



ANURAGAN

An e-Magazine of Science, Engineering & Technology



www.tnu.in

> School of Science & Technology

Diamond Harbour Road, Sarisha,

West Bengal 743368

FOREWARDS



Prof. Biswajit Ghosh
D.Sc. (Engg.),
Vice Chancellor,
The Neotia University

It is a great privilege for me to write an introductory note in the volume 4, first issue of the e-magazine of the School of Science & Technology 'ANURANAN' at the juncture of implementing the New Education Policy-2020 (NEP-20) and our university receives its recognition from UGC for its inclusion in sec. (2f) of UGC Act. 1956. The word ANURANAN has the special significance in the coming days to develop a resonance in between the totality of NEP-20 with the mind map of faculty members. The resonance will have to vibrate the students 'Mind Map' of the coming age for extracting the benefit of NEP-20. The NEP-20 introduced several dimensions of thought process on the use of science and technology as we are inclining more and more towards the virtual systems. In fact, there are three tangible dimensions and one intangible dimension in our life. Time is the intangible dimension and it represented as a virtual length. The past is hazy and the future is dark. Only the present is luminating us towards the positive thinking such that the darkness of future can be lighten. In the coming age the human civilization is going face four major problems and these are; i. Mobility, ii. Water, iii. Waste and iv. Energy. Among this energy is the integral parameters with i-iii.

The new researches are coming to address the above problems and science and technology will have a major role to play. The COVID-19 put lots of problem with miseries and sufferings but the human civilization overcome this and knowledge-based systems played a major role in this venture. We are more dependent on the virtual systems and are controlled by the technologies. This is major limitation of the virtual systems.

The ancient evolution of Newtonian theories is bringing revolution in string theory and quantum computation is knocking at the door in developing Artificial Intelligence (AI) and Machine Learning (ML) to empower the virtual systems. We expect that the present volume of 'ANURANAN' will bring exploration on many of the 'facts and principles', 'inquiry and discovery', 'predictions and speculations' where the knowledge of our faculty members and students will develop a 'Resonance' to enrich 'ANURANAN'. We believe on the term 'Vasudhaiva Kutumbakam', one Earth, one Family and one Future and to adhere this we have to develop the conception of one Home. We have to develop our student to be responsible global citizen such that they can develop themselves to participate in the humanitarian services of the globe. The present volume of e-magazine will not only contain the essence of exploration of knowledge-based systems but also some other articles those are the integral parts of our life. I like to congratulate the community of our university in general and School of Science & Technology in particular for their great initiatives in publishing this e-magazine 'ANURANAN' and it is expected that this will appear in every quarter of the year.

Prof. B. Ghosh, D.Sc. (Engg.)
Vice Chancellor,
The Neotia University



CHIEF-EDITOR'S NOTE

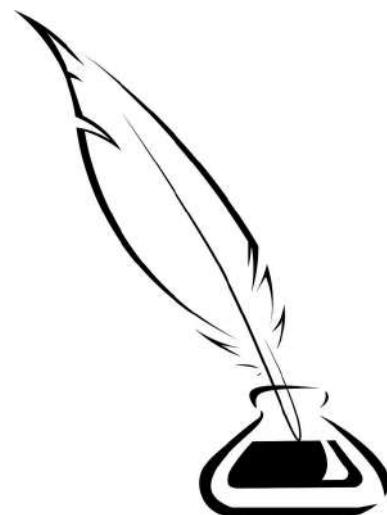


**Prof. (Dr.) Partha Kumar
Mukherjee**
Dean,
School of Science &
Technology,
The Neotia University

The School of Science and Technology (SST), The Neotia University (TNU), firmly believes in innovation and creativity molding into fresh ideas that can make changes. It gives me immense pleasure to ensure that the 4th release of "Anuranan" has successfully accomplished its vision and objectives. We are honored to announce the publication of the 1st issue of our e-magazine "Anuranan" and also for its mission to improve the quality of the contents. It is, indeed, heartwarming to note that students and the faculty members of SST are becoming increasingly successful in putting forth their sincere efforts in publishing this e-Magazine biannually. This 4th release is abound with wonderful 54 scientific articles that provide a wealth of knowledge and innovations to the readers. This magazine is an all-round report of the previous releases and some honorable movements. We wish to express our gratitude to the students, faculty members, research scholars, and thought leaders for their valuable submissions and to the ones who showed their interest for our e-Magazine. The submitted articles have been carefully reviewed by a professional editorial team within the School of Science and Technologies (SST) consisting of the Editors-in-Chief and the members of the Editorial Board.

It is well known that what is not measured cannot be improved. In this release, we have tried to make some more contributions to its improvement than the previous releases. The publication of this e-magazine is providing our students opportunity on a continuous basis to think on the new emerging areas of research as a whole / topic of their choice and apply their creative mind in developing / expressing it. I look forward to many such publications and events that would help in the holistic development of SST.

I wish a grand success of this e-magazine "Anuranan", Vol-4.



ARTISTRY EDIT & DESIGN TEAM



Members of Artistry Edit & Design Team

Biswamitra Das

**M.Sc. In Biotechnology,
The Neotia University**

Paramita Pramanik

**M.Sc. In Biotechnology,
The Neotia University**

Shahbaz Molla

**M.Sc. In Biotechnology,
The Neotia University**

Sujan Basak

**B.Sc. (H) In Biotechnology,
The Neotia University**

Photography

Avinandan Roy

**M.Sc. In Biotechnology,
The Neotia University**

Biswamitra Das

**M.Sc. In Biotechnology,
The Neotia University**

Heartfelt thanks to our respected Dean, Prof. Partha Kumar Mukherjee, and Dr. Ranojit Kumar Sarker for entrusting us with the opportunity to embark on this incredible journey of editing, designing & publishing our e-magazine. Special gratitude to our HOD, Dr. Prosun Tribedi, Dr. Diwakar Kumar Singh, and Dr. Poulomi Chakraborty for their unwavering guidance.

A sincere shoutout to my amazing team members whose dedication made this magazine a reality. Without your incredible efforts, this portrayal wouldn't have been possible.

To my fellow students and juniors, seize the pen and embark on a journey of continuous writing and research. The future lies in your articles, and your contribution will shape a greater tomorrow.

Cheers to collaboration, creativity, and a future filled with endless possibilities!

Warm regards,

Artistry Edit & Design Team

 editordesk.anuranan@tnu.in



TABLE OF CONTENTS

Biotechnology Breakthroughs 01

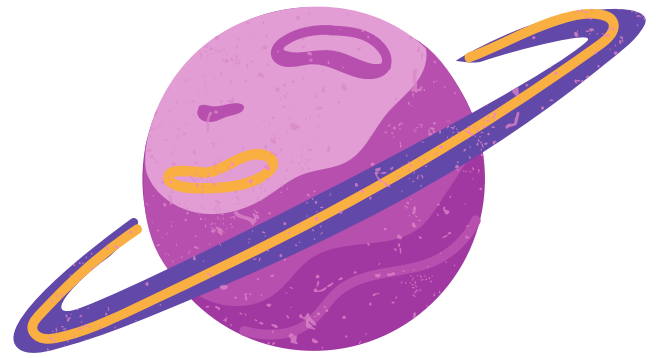
Biswamitra Das

Evolution of Cyborgs 05

Siddhartha Bera

CRISPR - A new approach 12

Ravi Shankar



Significance of Microbiology 14

Ankita Chakraborty

Mind Matters 22

Neha Singh

Soyahealth Drinks 24

Saptarshi Das

Development of Biotechnology 26

Sweety Das

Respirocytes & Nanobots 28

Parichaya Chowdhury

Applications of Nanotech 31

Puja Pradhan

CAR T-Cell in Cancer 37

Soumili Dhar

Genome editing 40

Rupsha Paul

Secrets of Biotechnology 43

Alakesh Maity

Klinefelter Syndrome 47

Swastika Mondal

Xenotransplantation 52

Sangita Nayek

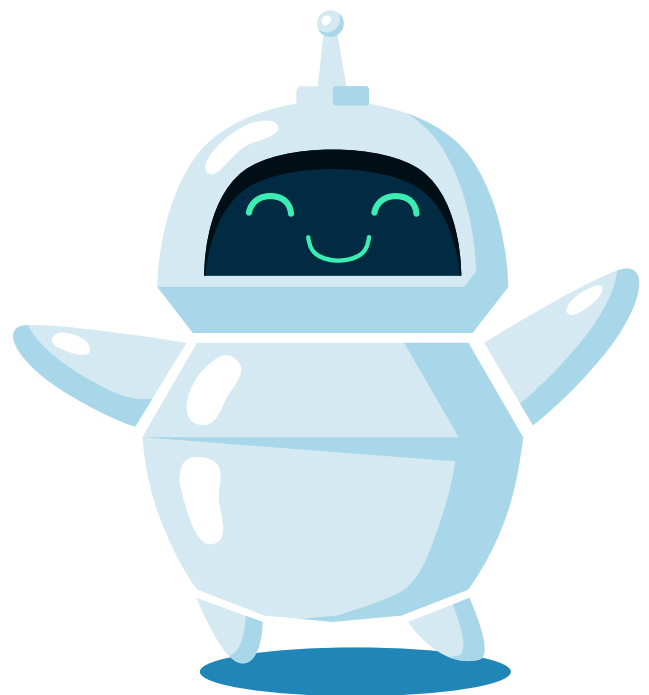
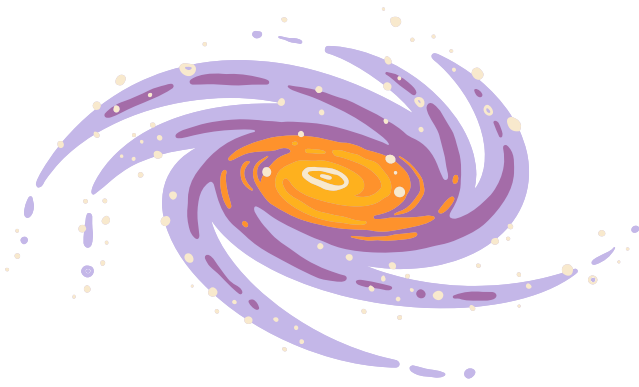
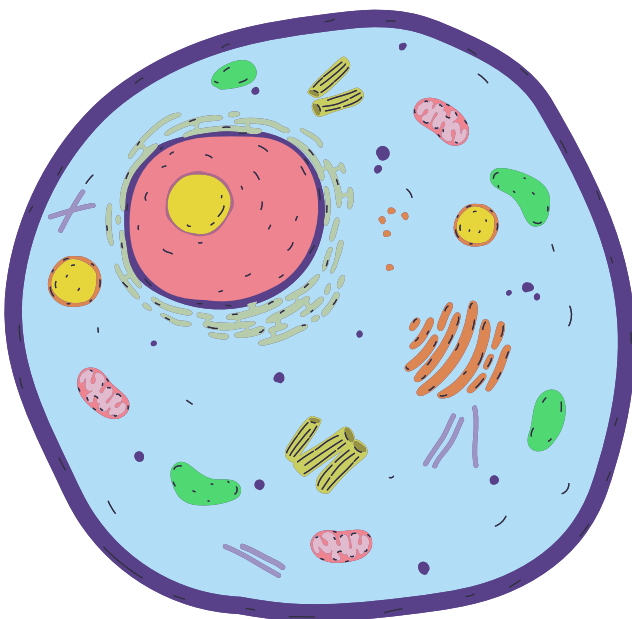


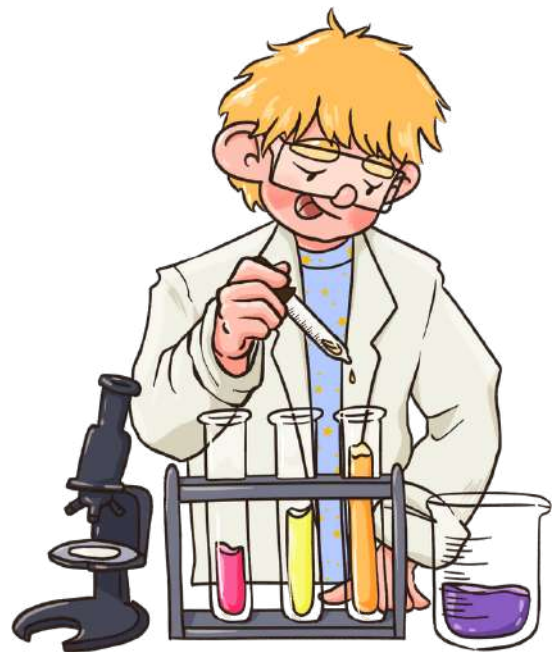
TABLE OF CONTENTS



Future of Technology	70
<i>Birju Mandal</i>	
Sentiment Analysis	77
<i>Wrishav Sett</i>	
Plant Disease Detection	81
<i>Subhodeep Ghosh, Dr. Usha Rani Gogoi</i>	
Predicting Future Stock	86
<i>Salman Faizi</i>	
Generative AI & LLMS	90
<i>Raja Chowdhury, Anangsha Halder</i>	



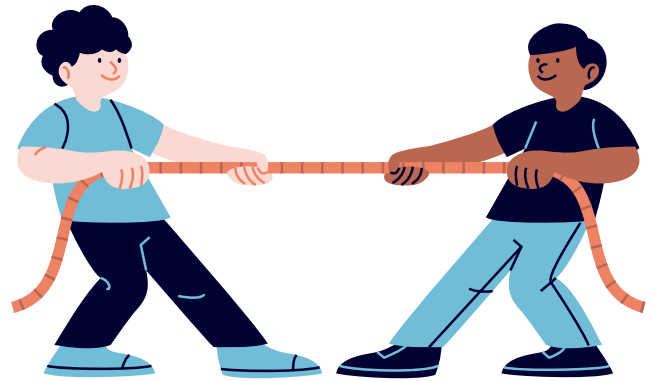
The Microbiome	56
<i>Sujan Basak</i>	
Venomous Cabbage	59
<i>Shrabani Mondal</i>	
Supply Chain Transparency	61
<i>Angshuman Nandi, Sandipan Chakravorty</i>	



Little Attention	95
<i>Subhajit Paul, Dr. Usha Rani Gogoi</i>	
Tears under Microscope	100
<i>Anwesha Das, Ritam Koley, Manan Maity</i>	
ML in Women's Health	103
<i>Yuvraj Singh Negi, Md Zunnurain</i>	
Stair Climbing Robot	107
<i>Anita Maity</i>	

TABLE OF CONTENTS

Sophia Robot	110
<i>Subhadeep Maity</i>	
AI & Data Privacy	113
<i>Rajib Mondal</i>	
Artificial Intelligence	115
<i>Srikanta Pramanik</i>	



AI In Business	117
<i>Debojyoti Paul</i>	
AI & Its Impact on Society	121
<i>Saifuddin Mollah</i>	
Adversarial Attacks	126
<i>Souvik Ghosh</i>	
Enhancing Credit Card Security	129
<i>Sarmin Ahmed</i>	

BIGBIRD	132
<i>Ayan Pramanik</i>	
Magnetic Energy Trains	137
<i>Suprime Mandal</i>	
AI & Biometric	142
<i>Aditi Chandra</i>	
Remote Controlled Staircase	144
<i>Nishant Rana, Sakshi Jha</i>	
Review of Nanorobotics	146
<i>Swagata Lakshmi Sadhukhan</i>	
AI in Chandrayaan-3	149
<i>Sayak Mandal</i>	
AI driven Smart Agriculture	152
<i>Subhraprakash Santra</i>	



TABLE OF CONTENTS



Deepfake 162

Ankita Saha

Anomaly Detection 167

*Anindya Mitra, Sudip Dhara,
Ripan Purkait*

Robotics in Medical Field 171

Snehendu Patra, Kushal Maity

Role of Data Science 174

Jit Mandal

Obstacle avoiding Robot 177

Promita Das

Atomic Energy 179

Ranit Debnath



Fire Fighting Robot 155

Agnik Das

Line Following Robot 157

Pratik Panda

Age Classification using CNN 160

Sumit Jana



AI driven Fashion Design 183

Nandana Mukherjee

The Blessings of Web 3.0 103

*Suprio Adhikari,
Harekrishna Adhikary,
Tufan Bera*

Unlocking The Cosmos 192

*Saptadeep Halder,
Swikriti Chandra*

Wearables & IoT 195

Swarnava Saha

Silicon based Alien Life 199

*Souhardya Sinha, Rajkumar Roy,
Rjkumar Maity*

BIOTECHNOLOGY BREAKTHROUGHS: REVOLUTIONIZING HEALTHCARE AND BEYOND

Biswamitra Das

M.Sc. in Biotechnology,
2023 - 2024,
The Neotia University

Abstract:

Biotechnology is a remarkable fusion of biology and technology that has propelled innovation across diverse fields. In this article, we explore the transformative impact of biotechnology on healthcare, agriculture, and environmental sustainability. From personalized medicine to revolutionary drug development and sustainable agriculture, we witness the power of biotechnology in shaping a brighter future. Additionally, biotechnology contributes to environmental remediation, recent discoveries in mRNA technology, and ethical considerations, ensuring that progress aligns with ethical values. We also highlight significant research contributions from the Department of Biotechnology at The Neotia University, showcasing their commitment to innovative solutions. The journey through biotechnology is guided by ethics, ensuring that the benefits of these scientific marvels are accessible to all. Through innovative sustainable approaches and a commitment to turning waste into resources, biotechnology offers the promise of a sustainable and equitable future.

Introduction:

In the grand tapestry of human progress, few threads shine as brightly as biotechnology. This fusion of biology and technology has ushered in an era of innovation that touches every facet of our lives, from healthcare to

agriculture and environmental sustainability. Let's embark on a journey through the realms of biotechnology, where science fiction meets reality, and the possibilities are boundless.

Personalized Medicine: Crafting Health, One Genome at a Time

Imagine a world where your medical treatment is as unique as your DNA. Welcome to the age of personalized medicine, where biotechnology becomes a tailor, fitting therapies to your genetic blueprint. This transformative approach not only enhances treatment efficacy but also minimizes side effects.

In personalized medicine, scientists delve into the intricate dance of genes and proteins within your body. By deciphering your unique genetic code, they create treatments precisely tuned to your needs. For example, cancer therapies are now customized based on the genetic makeup of a patient's tumor, resulting in more effective and comfortable treatments.

Revolutionizing Drug Development: The mRNA Marvel and CRISPR-Cas Revolution

In the race against diseases, biotechnology has become our secret weapon. mRNA technology, a star in this biotech arsenal, has revolutionized drug development. With its

power, scientists craft biopharmaceuticals like monoclonal antibodies and vaccines at unprecedented speeds.

Consider the rapid development of COVID-19 vaccines using mRNA. In mere months, researchers harnessed biotechnology to create vaccines that bolster our defenses against the virus. This breakthrough paves the way for future vaccine developments and quicker responses to emerging health threats.

But the biotechnological revolution doesn't stop there. Enter CRISPR-Cas, a groundbreaking gene-editing tool. This molecular scissor allows scientists to precisely modify genetic code, opening doors to treatments for genetic diseases and the potential to eradicate inherited conditions. CRISPR-Cas is the superhero of precision medicine, offering hope to millions worldwide.

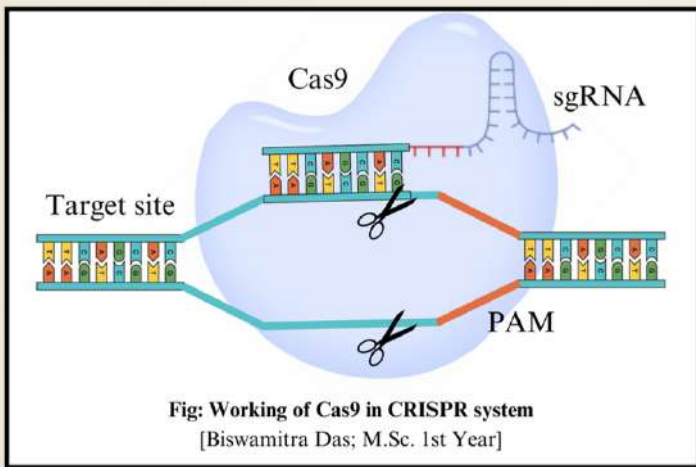


Fig. 1: Working of Cas9 in CRISPR system

Feeding the World Sustainably: The Promise of GM Crops

Amidst global challenges like climate change and food security, biotechnology extends its hand to agriculture. Genetically modified (GM) crops, engineered to withstand pests and harsh conditions, lead the charge. These crops not only bolster yields but also reduce reliance on chemical pesticides.

Picture drought-resistant crops thriving in arid lands, providing sustenance where water

is scarce. Biotechnology's magic wand makes it possible by fortifying plants against environmental challenges. Moreover, biotechnology is creating biofuels from renewable sources, offering a greener alternative to fossil fuels and curbing our carbon footprint.



Fig. 2: GM Crops at Stressed Condition

Healing Our Ailing Earth: Bioremediation and Nano-Adsorbents

Environmental woes find solace in the embrace of Biotechnology. Engineered microorganisms take center stage in bioremediation, a process akin to nature's janitors. These microorganisms digest pollutants, cleansing soil and water, and restoring the health of our planet.

Imagine oil spills transformed into ecological oases, thanks to bacteria that devour hydrocarbons. These biotech superheroes hold the key to efficient and eco-friendly environmental cleanup. Complementing this effort are nano-adsorbents, minuscule particles with exceptional pollutant-trapping abilities. They act as environmental sponges, absorbing toxins from water and air, offering innovative solutions to clean up our world.

Recent Discoveries from Biotechnology:

Biotechnology's journey is marked by continuous discovery. Recent breakthroughs include the development of mRNA-based

vaccines against not only COVID-19 but also other infectious diseases. These vaccines offer a glimpse into a future where we can rapidly respond to emerging threats.

In addition, biotechnology has paved the way for regenerative medicine, where scientists use stem cells to repair damaged tissues and organs. The possibilities are immense, from treating degenerative diseases to regrowing damaged organs.

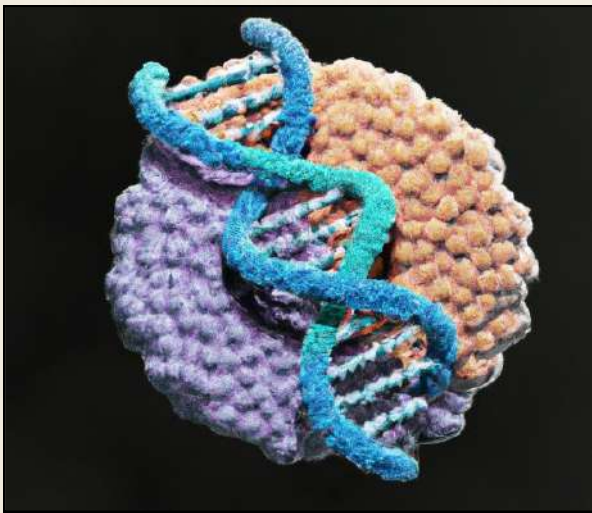


Fig. 3: Concept image

Contributions from the Department of Biotechnology, The Neotia University:

We must acknowledge the invaluable contributions of the **Department of Biotechnology at The Neotia University**. Their research has illuminated new pathways in the realm of biotechnology. Notable publications from their esteemed faculty include:

- **Tribedi P, Dey S** (2017) *Pre-oxidation of low-density polyethylene (LDPE) by ultraviolet light (UV) promotes enhanced degradation of LDPE in soil.* Environmental Monitoring and Assessment 189:1-8.
- **Goswami M, Bhattacharyya P, Tribedi P** (2017) *Addition of Rubber to soil damages the functional diversity of soil.* 3 Biotech 7:1-7.

- **Chakraborty P, Dastidar DG, Paul P, Dutta S, Basu D, Sharma SR, Basu S, Sarker RK, Sen A, Sarkar A, Tribedi P** (2019) *Inhibition of biofilm formation of Pseudomonas aeruginosa by caffeine: a potential approach for sustainable management of biofilm.* Archives of microbiology 202(3): 623-635.
- **Paul P, Ghorui S, Chakraborty P, Das S, Tribedi P, Dastidar DG** (2022) *Tryptophan: An Amino Acid to Manage Biofilm Threat Efficiently.* Advances in Health and Disease. Volume 57.
- **Sarkar S, Tribedi P, Bhadra K** (2022) *Structure-activity insights of harmine targeting DNA, ROS inducing cytotoxicity with PARP mediated apoptosis against cervical cancer, antibiofilm formation and in vivo therapeutic study.* Journal of Biomolecular Structure and Dynamics 40(13):5880-5902.
- **Das S, Roy R, Paul P, Chakraborty P, Chatterjee S, Malik M, Sarkar S, Das Gupta A, Maiti D, Tribedi P** (2023) *Piperine, a Plant Alkaloid, Exhibits Efficient Disintegration of the Pre-existing Biofilm of Staphylococcus aureus: a Step Towards Effective Management of Biofilm Threats.* Applied Biochemistry and Biotechnology 30:1-20.

These publications showcase the department's commitment to innovative research, exploring solutions for environmental challenges, the management of biofilms, and advancing our understanding of cancer treatment.

Ethical Considerations and a Fair Future:

Amidst the excitement, ethics must guide our path. Biotechnology raises important questions about genetic privacy and equitable

access. As we wield these scientific marvels, we must ensure they benefit all of humanity.

Regulations and ethical guidelines serve as our compass, ensuring responsible and fair usage of biotechnology. Balancing progress with ethics ensures our journey is one of compassion and justice.

Innovative Sustainable Approaches: Turning Waste into Gold

Biotechnology's reach extends to sustainability. Circular biotechnology transforms waste into valuable resources. Consider waste streams becoming sources of riches, thanks to biotechnology's alchemy. Bioplastics, derived from renewable sources, and biomimetic materials, imitating nature's genius, reduce our environmental footprint.

Highlights:

- **Personalized Medicine:** Tailored treatments for enhanced effectiveness.
- **mRNA and CRISPR-Cas Revolution:** Speedy drug development and precise gene editing.
- **Sustainable Agriculture:** Increased yields and reduced pesticide use.
- **Environmental Healing:** Eco-friendly bioremediation solutions.
- **Recent Discoveries:** Ongoing biotechnological innovations.
- **Ethical Considerations:** Balancing progress with ethics.
- **Innovative Sustainability:** Converting waste into valuable resources.

Conclusion: A Bright Biotechnological Future

Biotechnology, our modern Prometheus,

bestows upon us the power to shape a brighter future. Personalized medicine, rapid drug development, sustainable agriculture, environmental restoration, and ethical considerations are its guiding stars.

As we navigate this landscape, let us remember that innovation must harmonize with ethics. Only then can we fully embrace the blessings of biotechnology, ensuring a healthier, more sustainable, and equitable world for generations to come. Our biotechnological journey continues, promising discoveries yet unimagined and a brighter future yet to unfold. CRISPR-Cas, nano-adsorbents, and the latest discoveries are the heralds of this exciting future, ushering in an era of precision, sustainability, and hope.

References:

1. Eskandar, K. (2023). Revolutionizing biotechnology and bioengineering: unleashing the power of innovation. *J Appl Biotechnol Bioeng*, 10(3), 81-88.
2. Mozafari, M., Tariverdian, T., & Beynaghi, A. (2020). Trends in Biotechnology at the Turn of the Millennium. Recent patents on biotechnology, 14(1), 78-82.
3. Dogramatzis, D. (2011). *Healthcare biotechnology: a practical guide* (p. 689). Taylor & Francis.
4. Burrill, G. S. (2014). The biotechnology industry: An engine of innovation. In *Biotechnology Entrepreneurship* (pp. 21-44). Academic Press.

THE EVOLUTION OF CYBORGS: BLURRING THE LINES BETWEEN MAN AND MACHINE

Siddhartha Bera

B.Sc. (H) In Biotechnology,
2022 - 2023,
The Neotia University

Abstract:

Immersed in the world of biotechnology, my fervor revolves around the realm of robotics projects. This concise abstract encapsulates my impassioned commitment to the fusion of biotechnology and robotics. Navigating both academic studies and hands-on experiences, I've ventured into innovative avenues that intertwine these domains, relentlessly seeking to leverage biotechnology to augment the prowess of robots.

"The Evolution of Cyborgs: Blurring the Lines Between Man and Machine" serves as a thematic embodiment of the ongoing exploration into the integration of technology with the human body. This exploration delves deeply into the convergence of neural implants, prosthetics, and wearable devices, meticulously examining the dynamic relationship unfolding between humans and machines. Beyond the technical nuances, the abstract also probes the ethical and philosophical dimensions emerging from this integration, shedding light on the transformative impact on human capabilities and the potential redefinition of the delineations between humanity and machinery.

Keywords:

Biotechnology, Robotics, Encapsulate, Implication

Introduction:

The dynamic synergy between technology and the human body has undergone a remarkable evolution, paving the way for the emergence of cyborgs and pushing the boundaries of traditional distinctions between humanity and machinery. In delving into this intricate relationship, we navigate through a continuum of technological advancements, spanning from cutting-edge neural implants to sophisticated prosthetics and seamlessly integrated wearable devices. This journey unfolds against the backdrop of a society increasingly receptive to these innovations, prompting profound questions of ethics and philosophy.

The interplay of biology and technology raises a compelling discourse, challenging us to critically examine the implications for human identity, capabilities, and the very essence of what it means to be human. In this era, where the once-clear demarcation between man and machine becomes progressively obscured, the exploration of these ethical and philosophical dimensions becomes paramount. As we traverse this ever-evolving landscape of human augmentation, the integration of these technological marvels not only transforms our physicality but also sparks a contemplation of the profound changes shaping the core of our existence.

The Origin of Cyborgs:

In the rich tapestry of technological evolution, the term "cyborg" emerges as a captivating fusion of the words "cybernetic" and "organism." Originating in 1960, this visionary term was conceived by the brilliant minds of Manfred Clynes and Nathan S. Kline during their groundbreaking exploration of elevating human capabilities through the seamless integration of technology. At its core, the concept of a cyborg transcends conventional boundaries, describing a being that harmoniously merges biological and artificial components, thereby unlocking the potential for profound enhancements and augmentations of its inherent abilities.

The genesis of the cyborg concept stems from the idea of transcending the limitations of the human form through the symbiotic alliance with technology. Clynes and Kline envisioned a future where the synergy of biology and artificiality would birth entities capable of feats beyond the scope of unaltered organisms. This revolutionary concept paved the way for a paradigm shift, challenging traditional notions of what it means to be human.

In its essence, a cyborg represents the embodiment of a harmonious convergence between the organic and the technological, blurring the lines between nature and machine. The integration of artificial components isn't merely a superficial enhancement; rather, it is a profound leap into a realm where the boundaries of human potential are expanded through the incorporation of cutting-edge technology.

As we delve into the origins of cyborgs, we unravel a narrative that extends beyond scientific curiosity. It is a tale of human ingenuity seeking to transcend the constraints of the flesh and embrace a future where the marriage of biology and technology propels us into uncharted realms of possibility. The concept of cyborgs stands as a testament to

the ceaseless pursuit of innovation and the ever-present desire to redefine the limits of what it means to be human.

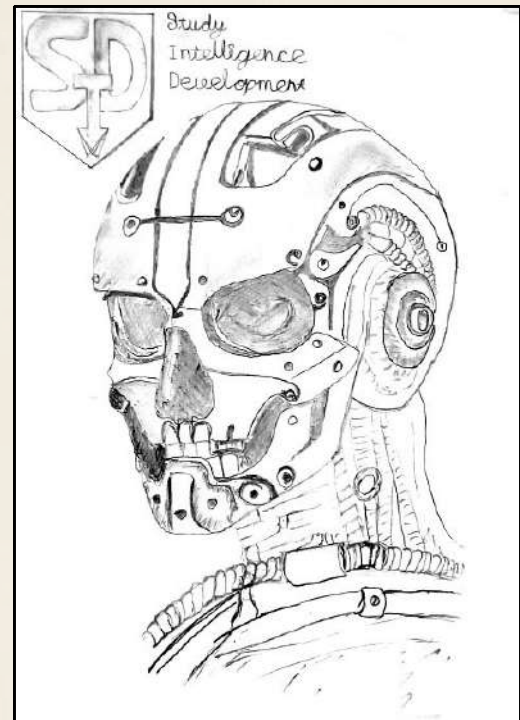


Fig. 1: Self drawn Cyborgs

The Evolution of Cyborg Technology: From Prosthetics to AI Integration

The landscape of cyborg technology has undergone a profound transformation since its inception, with a dynamic evolution that encompasses various fields of science and engineering. Initially, the focus was on medical applications, particularly in the development of advanced prosthetics aimed at enhancing mobility and functionality for amputees. However, as time progressed, the convergence of robotics, artificial intelligence (AI), and bioengineering has propelled cyborg technology into new and exciting realms.

1. Prosthetics: Bridging the Gap in Mobility

In its early stages, cyborg technology centered on the creation of sophisticated prosthetic limbs. These innovations sought to bridge the

gap for individuals with limb loss, providing them with enhanced mobility and functionality. The evolution of prosthetics laid the foundation for the broader exploration of merging human biology with technological enhancements.

2. Brain-Machine Interfaces (BMIs): Direct Communication with the Mind

Advancements in cyborg technology led to the development of Brain-Machine Interfaces (BMIs). These cutting-edge devices enable direct communication between the brain and external technologies, offering a lifeline for paralyzed individuals or amputees. The ability to interface with the human brain represents a significant leap forward, opening doors to unprecedented possibilities in neurotechnology.

3. Bionic Vision: Illuminating the World for the Visually Impaired

The progress in cyborg tech includes groundbreaking developments in bionic vision. Retinal implants and bionic eyes have emerged as transformative solutions, restoring vision for those with specific visual impairments. These advancements showcase the potential of cyborg technology to enhance not only mobility but also sensory perception.

4. Exoskeletons: Augmenting Human Strength and Endurance

Powered exoskeletons represent a fusion of biology and engineering designed to augment human strength and endurance. Originally conceived for medical rehabilitation, these exoskeletons have found applications in military contexts, showcasing the adaptability

and versatility of cyborg technology in addressing diverse human needs.

5. Neural Implants: Unlocking Cognitive Enhancements

Ongoing research in cyborg technology explores the realm of neural implants, aiming to unlock cognitive enhancements and treat neurological disorders. By interfacing directly with the brain, these implants hold the promise of revolutionizing our understanding of the mind and offering new avenues for therapeutic interventions.

6. Biohacking: DIY Cyborg Experiments

In a fascinating and sometimes controversial dimension, the evolution of cyborg technology has seen the rise of biohacking. This involves individuals undertaking do-it-yourself (DIY) cyborg experiments, implanting various technologies into their bodies for augmentation or functional improvements. Biohacking represents a grassroots movement pushing the boundaries of cyborg evolution beyond traditional institutional confines.

7. AI Integration: The Contemporary Aspect of Cyborg Evolution

A significant contemporary aspect of cyborg evolution lies in the seamless integration of artificial intelligence with human capabilities. This ranges from cognitive enhancements to AI-assisted decision-making, highlighting the synergy between human intuition and machine intelligence. The interplay between AI and human biology is shaping a new frontier in cyborg technology, bringing forth ethical and

societal considerations that continue to influence its trajectory.

Thus, the diverse applications and advancements in cyborg technology over the years underscore its transformative potential in reshaping the relationship between humans and machines. From the early focus on prosthetics to the integration of AI, the evolution of cyborg technology reflects a journey marked by innovation, ethical considerations, and the continual quest to enhance the human experience through technological augmentation.

Exploring the Diverse Horizons of Cyborg Technology: A Multifaceted Approach

- In the realm of technological advancements, cyborg technology has emerged as a transformative force with vast potential applications across various domains. From the intricacies of medical rehabilitation to the far reaches of space exploration, cyborg enhancements are paving the way for innovative solutions to complex challenges. In this article, we delve into the multifaceted landscape of cyborg technology, exploring its diverse applications that range from healthcare to entertainment.
- **Medical Rehabilitation:** One of the pivotal applications of cyborg technology lies in the domain of medical rehabilitation. The development of advanced prosthetics, exoskeletons, and neural interfaces holds the promise of significantly improving the lives of amputees and individuals with mobility impairments. By seamlessly integrating technology with the human body, cyborg advancements are contributing to a new era of personalized and adaptive healthcare solutions.

- **Healthcare:** In the medical field, cyborg technology is making significant strides in the realm of bioelectronic medicine. Neural implants designed for treating neurological disorders or managing chronic conditions showcase the potential for cyborg enhancements to revolutionize healthcare. These innovations highlight the intersection of biology and technology, opening new avenues for precise and targeted medical interventions.
- **Military and Defense:** Cyborg technology is not confined to the realm of healthcare alone; it extends its influence into military and defense applications. Exoskeletons and enhanced wearable technologies are poised to augment soldiers' physical capabilities, providing them with improved strength, endurance, and situational awareness. This convergence of human and machine amplifies the effectiveness of military personnel, enhancing their overall performance and safety.
- **Space Exploration:** The harsh conditions of space pose unique challenges to astronauts, and cyborg technology offers solutions to enhance their resilience. From advanced space suits to robotic assistance, cyborg advancements play a crucial role in ensuring the success of space exploration missions. By integrating technology with the human form, space agencies are pushing the boundaries of what is possible in the cosmos.
- **Assistive Technology:** Cyborg enhancements are instrumental in developing assistive technologies for individuals with disabilities, fostering independence and inclusivity. By seamlessly integrating technology with the human body, these advancements empower individuals to lead more autonomous lives, overcoming physical limitations with innovative solutions.

- **Communication and Accessibility:** The evolution of brain-machine interfaces introduces groundbreaking possibilities in communication for individuals with severe paralysis. These interfaces serve as a gateway for creating communication devices, allowing users to interact with the world in ways previously deemed impossible. Cyborg technology, in this context, becomes a bridge between human cognition and technological innovation.
- **Sports Performance:** In the realm of sports, wearable cyborg technologies are revolutionizing the way athletes train and perform. These technologies monitor and enhance athletic capabilities, providing valuable data for training regimes and injury prevention. By seamlessly integrating with the human body, cyborg enhancements contribute to pushing the boundaries of human physicality in the sporting arena.
- **Industrial Applications:** Cyborg technology finds practical applications in industries, particularly through the use of exoskeletons. These wearable enhancements reduce physical strain on workers, enhancing productivity in tasks that demand strength and endurance. The integration of cyborg technology in the industrial sector showcases its potential to revolutionize workplace ergonomics and safety.
- **Entertainment and Gaming:** Virtual reality, augmented reality, and brain-machine interfaces converge in the realm of entertainment and gaming. These technologies create immersive experiences that redefine user engagement. Cyborg enhancements, in this context, open new dimensions in interactive entertainment, blurring the lines between the virtual and physical worlds.

- **Research and Exploration:** Cyborg technology serves as an invaluable tool in scientific research, enabling remote sensing, data collection, and exploration in hazardous or inaccessible environments. The seamless integration of technology with the human form expands the possibilities of research and exploration, pushing the boundaries of what we can achieve in the pursuit of knowledge.

Navigating Ethical Waters: Considerations in the Integration of Cyborg Technology

The integration of cyborg technology into our lives heralds a new era of possibilities, but with these advancements come a host of ethical considerations that demand careful attention. As we navigate the evolving landscape of human-machine integration, a multifaceted approach to ethical considerations is imperative. This article explores key ethical dimensions, with a focus on privacy concerns, informed consent, inequality and access, security risks, autonomy and identity, long-term health impacts, unintended consequences, social acceptance and stigma, the dual-use dilemma, and the crucial role of regulatory frameworks.

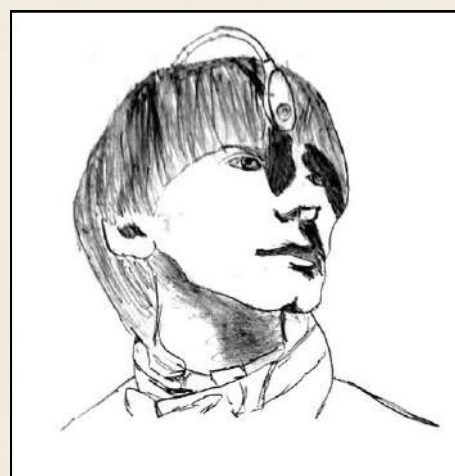


Fig. 2: Neil Harbisson (27 July)

- **Privacy Concerns:** The amalgamation of cyborg technology and personal data collection raises red flags surrounding privacy. As individuals' most intimate details become intertwined with technology, the potential for privacy breaches and unauthorized access looms large. Balancing technological innovation with the protection of personal information requires robust safeguards and ethical guidelines to prevent undue intrusion.
- **Informed Consent:** Central to ethical considerations is the principle of informed consent. Those undergoing cyborg enhancements must be fully aware of the potential risks, benefits, and long-term implications of integrating technology into their bodies. Ensuring individuals possess a comprehensive understanding empowers them to make autonomous decisions regarding their bodies and technological enhancements.
- **Inequality and Access:** The advent of cyborg enhancements introduces concerns about the emergence of a "cyborg divide." Socio-economic factors may influence access, potentially leading to disparities in who can benefit from these technologies. Ethical frameworks must address these concerns, promoting inclusivity and equitable access to prevent technology from exacerbating societal inequalities.
- **Security Risks:** As cyborg devices become increasingly interconnected, the specter of cyber threats and unauthorized control emerges. Ethical challenges arise in the realm of cybersecurity, demanding stringent measures to protect individuals from potential harm resulting from cyber attacks on their implants or devices.
- **Autonomy and Identity:** The integration of technology into the human body raises

profound questions about autonomy and personal identity. Individuals must grapple with defining the boundaries between the natural and the technological. Ethical discussions should empower individuals to shape their identity while respecting the symbiosis of human and machine.

- **Long-Term Health Impacts:** Careful consideration of the potential long-term health effects is crucial. Ethical frameworks must account for the risks of device malfunction, rejection, and unforeseen consequences on both physical and mental well-being. Striking a balance between innovation and the preservation of health is paramount.
- **Unintended Consequences:** Ethical frameworks should anticipate and mitigate potential unintended consequences of cyborg technology. This requires a comprehensive understanding of both individual and societal impacts, ensuring responsible innovation that prioritizes risk mitigation.
- **Social Acceptance and Stigma:** Society's acceptance of cyborg-enhanced individuals is a pivotal ethical concern. Varying degrees of acceptance may lead to social stigma and discrimination. Ethical discussions should address these societal dynamics, promoting inclusivity and understanding while safeguarding the psychological well-being of those integrating technology into their bodies.
- **Dual-Use Dilemma:** The dual-use potential of cyborg technology raises ethical dilemmas, especially when technologies designed for medical or beneficial purposes may be co-opted for military or malicious applications. Ethical considerations in research and development are essential to prevent unintended consequences and misuse.

- **Regulatory Frameworks:** Establishing comprehensive and adaptive regulatory frameworks is the linchpin of ethical considerations in the cyborg era. These frameworks should facilitate responsible development, deployment, and use of cyborg technology, striking a delicate balance between innovation, individual rights, and societal values.

Conclusion:

In summary, the unfolding landscape of cyborg technology presents a vast array of possibilities intertwined with intricate ethical considerations. The strides made in this field hold the potential to elevate human capabilities, address critical medical needs, and reshape entire industries. However, the ethical dimensions surrounding cyborg technology necessitate meticulous consideration.

Critical facets such as privacy, consent, equal access, and potential societal ramifications underscore the imperative need for robust regulatory frameworks. Establishing a delicate equilibrium between innovation and ethical responsibility stands as a pivotal challenge to ensure the conscientious advancement and broad acceptance of cyborg technology.

Fostering continuous dialogue and promoting interdisciplinary collaboration will be key in navigating the evolving terrain of human augmentation. A steadfast commitment to prioritizing individual rights and well-being becomes paramount as we collectively embark on this transformative journey. By striking this delicate balance, society can foster responsible development and foster widespread acceptance of cyborg technology, paving the way for a future where innovation and ethics seamlessly coexist.

References:

- Cyborg - Wikipedia
- What is a Cyborg? - Definition from Techopedia
- Who was the first cyborg? | Live Science
- How a Color-Blind Artist Became the World's First Cyborg (nationalgeographic.com)
- Cyborg: What is a Cyborg? (interestingengineering.com)
- Cyborg Definition & Meaning - Merriam-Webster



CRISPR- A NEW APPROACH FOR GENE EDITING

Ravi Shankar

B.Sc. (H) In Biotechnology,
2022 - 2023,
The Neotia University

Abstract:

The CRISPR system is derived from a natural defense mechanism found in bacteria, where it acts as an adaptive immune system to protect against viral infections. It consists of two main components: the Cas9 protein, which acts as a molecular scissor, and a guide RNA (gRNA), which directs Cas9 to the specific target DNA sequence.

Introduction:

When proved DNA was a genetic material and then its double helix model was provided by Watson & Crick in 1953; technologies were made for manipulating DNA sequences. In the starting days, the principle behind genome editing was based on site-specific recognition of DNA sequences. IN 1987, the Atsuo Nakato group at Osaka University, Japan found the CRISPR system which is part of prokaryotic adaptive immunity.

C- Clustered

R- Regularly

I- Interspaced

S- short

P- Palindromic

R- Repeats of 30- 34 nucleotide long

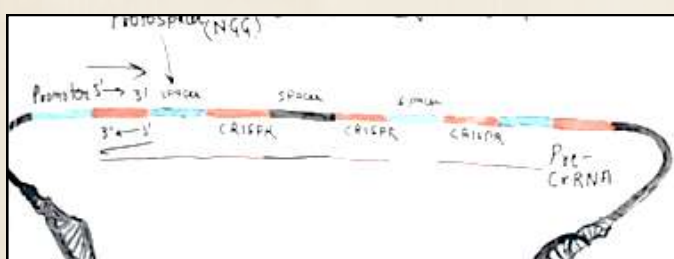


Fig. 1: Working of CRISPR System

CRISPR as an immune response:

When a bacteriophage infects the bacteria; the genome of the bacteriophage comes and ligates with the bacterial genome. To stop viral DNA replication prokaryotes, have CRISPR-cas9 as an immune response. When infection occurs; viral DNA inserts into the CRISPR array. Then this DNA transcript into crRNA's. there is a tracer RNA which is synthesized in bacteria that form complex with crRNA. Cas protein comes and binds with complex. the complex called guide RNA. Protospacer also called guide RNA. PAM (Protospacer Adjacent Motif) is found in viral DNA. In upstream of PAM, there is a protospacer. Cas9 protein recognizes the PAM site.

Then cas9 acts as the nucleus to cut that part. To repair the genome there are two methods non- homologous and joining (NHE) in which the removal of the selected gene sequence is removed but not added whereas in another one that is HDR (homology-directed repair) in which gene sequences are added.

CRISPR as a genome editing tool:

In 2012; Dr. Jennifer Doudna and Dr. Emmanuelle Charpentier proposed a genome editing method based on CRISPR cas9. CRISPR Cas 9 has triggered a revolution in genomic rearrangements (gene editing). CRISPR as it works on genome editing in prokaryotes is used to manipulate the gene sequence as

required in eukaryotes.

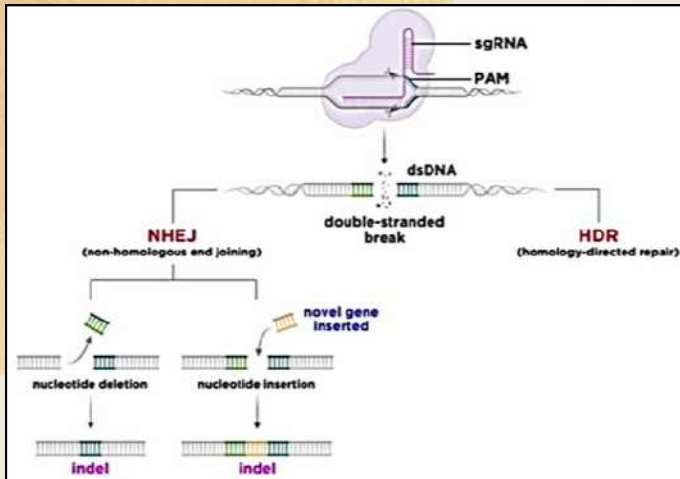


Fig. 1: Mechanism followed by CRISPR System

Protein application of CRISPR:

CRISPR acts as a genetic screening to identify genes. It may be used in cancer immune therapy via T-cell modification. As T-cells are modified for specialization in recognizing and killing cancer cells.

CRISPR has the potential to treat Aids. As it removes the viral DNA and stops their replication. CRISPR was used to determine SARS-COV2(Corona Virus). It ligates with specific gene sequences which helps in the identification of that genome and by this may particular virus is identified.

CRISPR is used in editing the genome in human embryos to cure various gene-linked diseases. It also be applied in genome editing on plant species.

Challenges:

CRISPR-cas9 has to face the same challenges as ethical implications such as germline editing and heritable change, informed consent, and patient autonomy. Some other challenges are it should be cost-effective and easy to use technology to precisely and efficiently target the desired gene sequence.

References:

- 1.Doudna, J. A., & Charpentier, E. (2014). The new frontier of genome engineering with CRISPR-Cas9. *Science*, 346(6213), 1258096.
- 2.Doudna, J. A., & Charpentier, E. GenCRISPR Services Make Genome Editing Easy



SIGNIFICANCE OF MICROBIOLOGY IN FORENSIC SCIENCE

Ankita Chakraborty

B.Sc. (H) In Biotechnology,
2021 - 2022,
The Neotia University

Abstract:

According to the latest research studies and the graphs it is discovered that science is currently trending in the path of forensic microbiology and more than 579 relevant documents were published between the time period of 1984 and 2023. Extensive use of microbiology in forensic replacing the cultivation theory (the theory that gives illusions between the real world and their imagination due to cultivation theory people try to align thoughts with reality). Microbial traces in the body that are the basic needs for identification of crimes are traces of Thanatomicrobiome (microorganisms found in organs and especially blood in dead bodies) and Epinecrotic community (microorganisms found in decaying corpse). The identification is done using isolation of the microorganisms found in the crime scenes and culturing them based on the metagenome analysis and 16s rRNA gene amplicon-based sequencing for fungi. The isolation of the human microbiome is very efficient in determining the DNA of the human origin, culture or if he/she has any sexually transmitted disease. Talking about microbes consider using of *Streptococcus phocae* a highly opportunistic pathogen although pathogenicity is poorly understood although it has high significance in forensic science and crime investigation.

Keywords:

Microbiome, metagenome, pathogenicity, polygraphs, Autopsy, cerebrospinal

Introduction:

Forensic science is a part of science that deals with techniques and methods for investigation of crimes and to provide relevant source of information to carry on further investigation. It ensures use of scientific techniques and scientific resources for its function. Microbiology itself is a part of science that deals with bacterial biology and its components. Examination of recovering a single microbial species also gives an overview of different kind of infection caused in the human body during he/ she was alive (Gunn and Pitt, 2012). Implementing microbiology in forensic science can enhance the investigation and far more relevant data can be presented. There are four ways a forensic investigation is carried out Chromatography, spectroscopy, hair and fiber analysis, and serology (such as DNA examination; Pathology, anthropology, odontology, toxicology, structural engineering, and examination of questionable documents; behavioral patterns revealed by tests such as polygraphs and psychological exams.

Significance & Applications:

There are different and various applications of microbiology in forensic science. Checking out certain case studies can give a brief idea about how microbiology is basically used in forensic science. A study was carried out using 36 corpse whose death reasons are different and unknown the blood cardiac muscles, spleen

liver and other body organs were taken during the autopsy and the sampling was done according to the rules issued by the European congress of clinical microbiology and infectious disease (ESCMID) and study group for forensic and postmortem microbiology (ESGFOR) (Ventura et al. 2019).

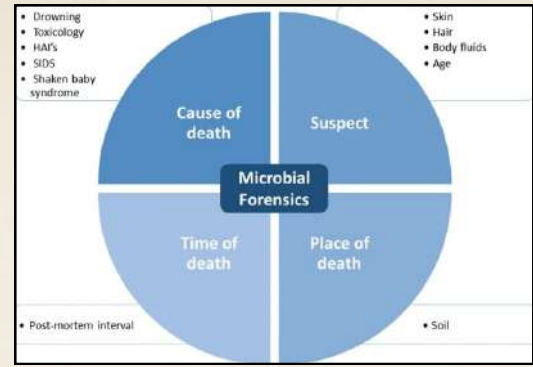


Fig. 1: Application of MF to answer criminal and legal questions

CASE n	CASE n	CASE n	CASE n	CASE n	CASE n	CASE n
1	F	54	HEALTH CARE	"FRESH"	Pos	Acinetobacter baumannii
2	F	66	ROAD ACCIDENT HOSPITALIZATION	"FRESH"	Pos	Proteus mirabilis
3	F	64	HEALTH CARE	"FRESH"	Pos	Acinetobacter baumannii
4	F	72	STRANGULATION – HOSPITALIZATION	"FRESH"	Pos	Pseudomonas aeruginosa
5	F	73	GASTROENTERITIS SEPSIS	"FRESH"	Pos	
6	F	59	SUDDEN DEATH AND ALCOHOLIC	"FRESH"	Pos	Pseudomonas aeruginosa

7	M	65	DROWNING	PUTRIFIED DISMEMBERED	Pos	Streptococcus spp, Bacillus spp, Pseudomonas spp
8	M	31	H2S INTOXICATION	"FRESH"	Neg	
9	M	39	H2S INTOXICATION	"FRESH"	Neg	
10	M	0	STILL BIRTH	"FRESH"	Neg	
11	M	35	SUICIDE	"FRESH"	Neg	
12	M	54	ROAD ACCIDENT	"FRESH"	Neg	
13	M	43	ROAD ACCIDENT	"FRESH"	Neg	
14	M	64	HYPOTHERMIA	"FRESH"	Neg	
15	M	55	HOMICIDE	"FRESH"	Neg	
16	M	36	ROAD ACCIDENT	"FRESH"	Neg	
17	M	61	SUICIDE(FIREARMS)	"FRESH"	Neg	

18	M	78	SUICIDE(BURNING)	CARBONIZED	Pos	Bacillus spp, E. coli, Staphylococcus spp, Enterobactor spp
19	M	32	SUDDEN CARDIAC ARREST	"FRESH"	Neg	
20	M	0	STILL BIRTH	"FRESH"	Neg	
21	M	63	ROAD ACCIDENT	"FRESH"	Neg	
22	M	55	SUDDEN CARDIAC ARREST	"FRESH"	Neg	
23	M	56	HEALTH CARE	"FRESH"	Neg	
24	M	79	ROAD ACCIDENT	"FRESH"	Neg	
25	M	46	HOMICIDE (BURNING ALIVE)	"FRESH"	Neg	
26	M	57	HEALTH CARE	"FRESH"	Pos	Staphylococcus aureus
27	M	69	HEALTH CARE	"FRESH"	Pos	Pseudomonas aeruginosa
28	M	39	HEALTH CARE	"FRESH"	Neg	

29	M	49	DRUG ADDICT	"FRESH"	Pos	Streptococcus pyogenus
30	M	29	HOMICIDE (FIREARMS)	"FRESH"	Neg	
31	M	75	ACCIDENT (BURNING)	"FRESH"	Neg	
32	M	33	ROAD ACCIDENT	"FRESH"	Neg	
33	M	35	HANGING	"FRESH"	Neg	

34	M	61	WORK ACCIDENT	"FRESH"	Neg	
35	M	82	HANGING	"FRESH"	Neg	
36	F	29	CAESERIAN SECTION	"FRESH"	Pos	Escherichia coli

The liquid portion of the body fluids were cultured in both aerobic & anaerobic conditions. And isolated using the Bactec FX blood culture system (it is an automated blood culture system that uses fluorescent technology for detecting growth of microorganisms in blood), Fig 1 shows the samples that had the presence of environmental bacteria *Bacillus* spp, *Enterobacter* spp and *Staphylococcus* spp are said that the cause of death is a natural

calamity flood whereas no traces of microorganism activity was found in the other corpses.

Figure 1: Showing The Results of The Microbial Traces Found in The 36 Human Dead Bodies

Another report presented in February 19, 2018

of a body found in Punjab claims to have presence of Entomofauna in the corpse and has traces of larvae of *Chrysomya rufifacies* and beetles belonging to the family Dermestida and Clerida i.e *Dermestes maculatus* and *Necrobia rufipes* (Sharma et al. 2018)

Presence of microbes in the blood or the organs of the corpse is said to be the evidence that helps during preparation of the postmortem report of the dead body. There are various mechanisms by which the presence of microbial traces can be found. Just before incision of the body the remains of blood traces on the surrounding including the body of the corpse are taken and culture in aerobic and anaerobic condition for maybe 13-14 days after which the culture is treated further to test the presence of gram-positive or gram-negative bacteria and its origin, with the help of forensic microbiology the location, origin even the culture region and DNA of the corpse can be detected. Bite marks if found in the body of the victims proves to be very important evidence in forensic investigation as dental arrangement is different for different individuals. It is considered that in the bite marks there can be traces of the DNA of the assaulter and therefore isolation of that DNA can prove to be important in most cases. Howsoever Forensic potential of salivary microbiome is another important aspect of investigation, according to 2011 studies it shows presence of certain enzymes (presence of 700 diverse bacterial species at a density of 1.4×10^8 organisms ml^{-1}) in saliva can degrade the DNA and therefore it becomes impossible to recover a full DNA profile. Viable bacteria can be recovered from the bite marks only if the samples are collected within 24 hours of the crime.

We can talk of a very well-known case published in the UK where a mother was accused of murder of two children when the doctor accused the presence of

Staphylococcus aureus present in the cerebrospinal fluid of the child which he recommends that came from the environment. Traces of bacterial infection in the white blood cell reports suggesting staphylococcal septicaemia and meningitis caused due to shaking baby syndrome was the cause of death.

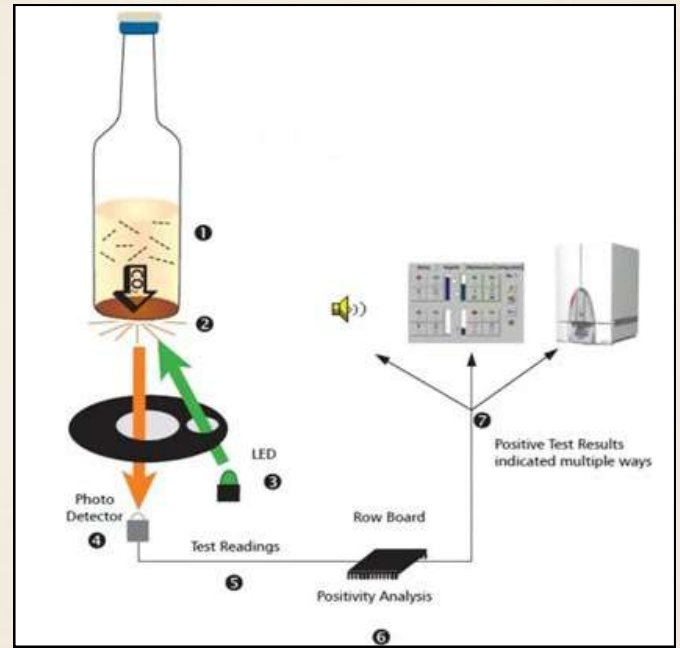


Fig. 2: Bactec Fx blood culture system followed in the isolation process

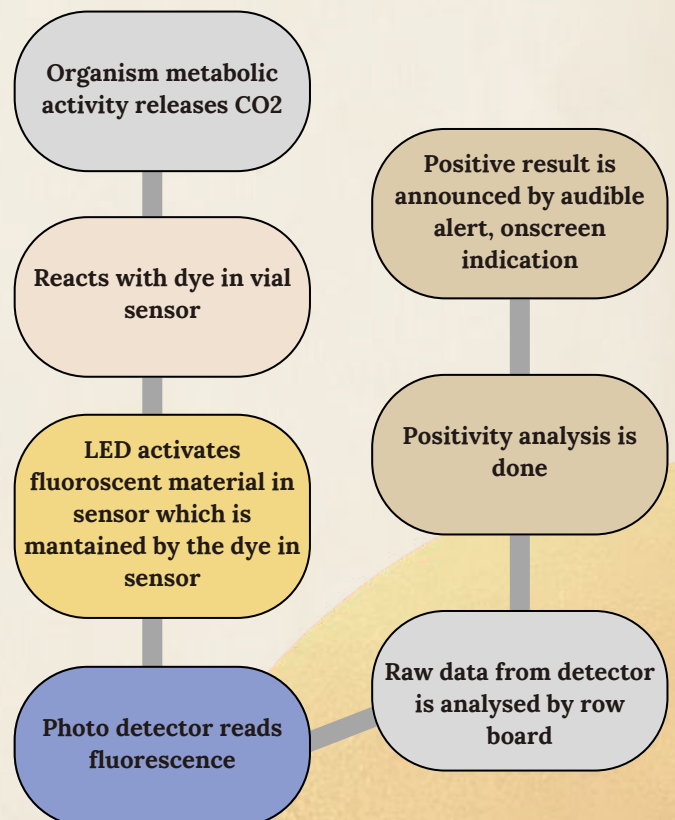


Fig. 2: Flow Chart for the same

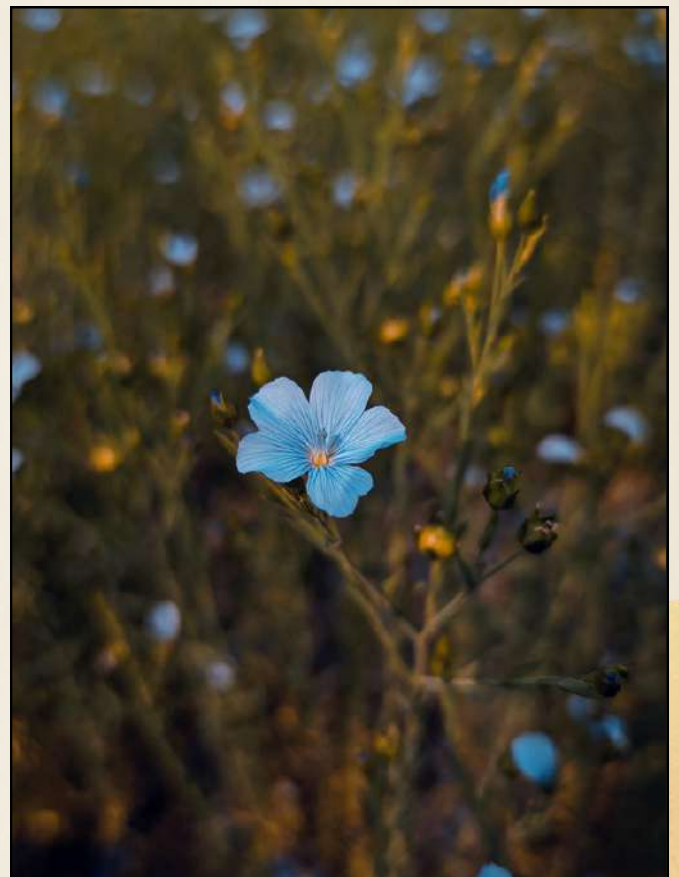
NO.	MICROBE	CONDITIONS	KIND	WORKS
1	Lactobacillus	Oxygen-tolerant anaerobes	Gram positive	Mops up oxygen after respiration stops
2	Escherichia coli	Facultatives anaerobes	Gram negative	Mops up oxygen after respiration stops
3	Clostridium strains	Anaerobic and aerotolerant	Gram positive	Attenuate inflammation and allergic diseases
4	C. botulinum	Anaerobic	Gram positive	Causes botulism
5	C. difficile	Anaerobic	Gram positive	Causes hospital infection
6	C. novyi	Obligate anaerobe	Gram positive	Causes rapid decomposition
7	Aspergillus	Obligate aerobe	Gram negative	Decomposition
8	Penicillium	Aerobic	Gram positive	Decomposition
9	Streptococcus	Aerobic	Gram positive	Decomposition

Conclusion:

This article is all about the various cases where microbiology has helped in finding deep evidence about certain cases in a more efficient way. Microbiology has helped to develop in the field of forensic science. Various crimes including bioterrorism incidents, analysis of diagnostic incidents, Identification of body fluids to tracing the source of a crime accident. It is mainly used in the estimation of post mortem interval (PMI) noticeable changes in the microbiome and the mycobiome can be detected by microbiology. The latest molecular techniques used for detecting genetic materials are next- generation sequencing, ultra deep PCR and whole-genome and exome sequencing.

Reference:

- 1.Gunn, A., & Pitt, S. J. (2012). Review paper microbes as forensic indicators. *Trop Biomed*, 29(3), 311-330.
- 2.Borzęcka, Justyna & Piecuch, Agata & Speruda, Mateusz & Ogórek, Rafał. (2021). Nietoperze jako rezerwuar grzybów mikroskopijnych (micromycetes) w podziemiach rezerwatu „Nietoperek” (obszaru Natura 2000, Polska).
- 3.Spagnolo, E. V., Mondello, C., Stassi, C., Baldino, G., D'Aleo, F., Conte, M., ... & Zerbo, S. (2019). FORENSIC MICROBIOLOGY: A CASE SERIES ANALYSIS. *Euromediterranean Biomedical Journal*, 14.
- 4.Sharma, A., Bala, M., & Singh, N. (2018). Five case studies associated with forensically important entomofauna recovered from human corpses from Punjab, India. *J. Forensic Sci. Crim. Inves*, 7.



MIND MATTERS: THE MENTAL MARVELS OF BIOTECHNOLOGY

Neha Singh

B.Sc. (H) In Biotechnology,
2022 - 2023,
The Neotia University

Abstract:

The discovery of efficacious medicines for neurological and behavioural illnesses is mostly propelled by biotech. Approximately 25% of people in the world have a mental illness that will last a lifetime. This essay delves into the fascinating and easily approachable realm of biotechnology and examines how it has revolutionised our comprehension and management of mental health concerns. We explore the ways in which genetics, brain imaging, and personalised medication might help to illuminate the intricate realm of mental health. Biotech innovation is dedicated to developing novel, potent technologies to address each of these ailments and reshaping the landscape of healthcare.

Keywords:

Biotechnology, Depression, Drug

Introduction:

Millions of people worldwide are impacted by mental health illnesses, which represent a substantial global health burden. The intricate and varied character of these disorders is frequently not adequately addressed by conventional methods of diagnosis and therapy. With its capacity to analyse complex genetic, neurological, and pharmacological

processes, biotechnology presents exciting opportunities to improve our comprehension and treatment of mental health conditions viz, Epilepsy, Schizophrenia, Depression etc.

A startlingly high 121 million individuals worldwide suffer from depression. High placebo responses in Phase II and III clinical studies for depression frequently result in study failure as reported in literature. Academics should take the lead as the primary obstacle appears to be a correct comprehension of its chemical underpinnings. However, with 50 million cases globally, epilepsy is the most prevalent brain illness. While antiepileptic medications allow the majority of patients to lead normal lives, 30% of individuals do not respond to standard care.

Biotechnology in Genomics:

Biotechnology has been essential in genetic research in recent years, especially in elucidating the connections between mental health and intellect. The common genetic variables impacting IQ-type tests and psychiatric diagnoses have been shown by genome-wide association studies (GWAS). These investigations help us identify shared genetic strands that support both psychological health and cognitive performance, providing insights into the intricate interactions between genetics and mental health.

Neuroimaging and Biomarkers:

The biological indicators found in the body, or biomarkers, are essential for the diagnosis of mental health conditions. These indicators may consist of particular chemicals in the blood or cerebrospinal fluid, genetic polymorphisms, or results from neuroimaging. Clinicians can learn important information about the biological basis of mental diseases through the analysis of these biomarkers, which can help them devise more accurate treatments and diagnosis.

Pharmacogenomics and Drug Development:

Drug development in the field of mental health treatment has been transformed by biotechnology. Pharmacogenomics allows psychotropic drugs to be tailored to a patient's genetic profile, minimising side effects and maximising the effectiveness of treatment. This strategy may reduce the need for trial and error while choosing a drug.

Challenges and Ethical consideration:

It is imperative that we face some ethical conundrums as we welcome the tremendous potential of biotechnology in the field of mental health. These include worries about data security, privacy protection, and the potential for stigmatisation. We must prioritise ethical usage and uphold patient rights if we are to fully realise the promise of biotechnological developments in mental health.

Conclusion:

Biotechnology has revolutionized the approach to comprehending and managing

mental health issues. Its application in genomics, neuroimaging, and pharmacogenomics promises a future where diagnoses may be more finely tuned, customized to each person's needs. This article can minimize the knowledge gap in population and define the therapeutic potential based on biotechnology approaches.

References:

1. Davidson, Laura, ed. *The Routledge handbook of international development, mental health and wellbeing*. Routledge, 2019.
2. Rucker, James JH, Jonathan Iliff, and David J. Nutt. "Psychiatry & psychedelic drugs. Past, present & future." *Neuropharmacology* 142 (2018): 200-218.
3. Patsalos, Philip N., et al. "Antiepileptic drugs –best practice guidelines for therapeutic drug monitoring: a position paper by the subcommission on therapeutic drug monitoring, ILAE Commission on Therapeutic Strategies." *Epilepsia* 49.7 (2008): 1239-1276.
4. Kong, Camillia, Michael Dunn, and Michael Parker. "Psychiatric genomics and mental health treatment: setting the ethical agenda." *The American Journal of Bioethics* 17.4 (2017): 3-12.
5. Fu, Cynthia HY, and Sergi G. Costafreda. "Neuroimaging-based biomarkers in psychiatry: clinical opportunities of a paradigm shift." *The Canadian Journal of Psychiatry* 58.9 (2013): 499-508.
6. Preskorn, Sheldon H. "Pharmacogenomics, informatics, and individual drug therapy in psychiatry: past, present and future." *Journal of Psychopharmacology* 20.4_suppl (2006): 85-94.
7. Koocher, Gerald P. "Ethical challenges in mental health services to children and families." *Journal of Clinical Psychology* 64.5 (2008): 601-612.

SOYAHEALTH DRINKS

Saptarshi Das

B.Sc. (H) In Biotechnology,
2022 - 2023,
The Neotia University

Abstract:

India is a country of huge population. Although our country has progressed a lot, it is still the same in some places, among them is malnutrition. There is a lot of propaganda in our country about this malnutrition. But unable to make up for this deficiency. So, this SOYA HEALTH POWDER has been created so that the deficiency can be filled to some extent. It uses high quality ingredients compared to other health drinks.

Keywords:

Fiber, food supplementation, health drink powder, protein, soy flour

Introduction:

India is a country of huge population. We are aware of many things but malnutrition can be called a disease. Moreover, another challenge for Indians at the present time is the population. Especially pregnant women, lactating women, primary school children provide this nutrition.

Source of protein: - About 70% of dietary protein and 80% of protein is provided by plants. A possible source of calories beyond regular consumption is food could be a possible solution. Soybean contains a lot of protein (43.2%), carbohydrates and sufficient amounts of minerals and vitamins.

Soybeans are excellent ingredients for a supplement.

Methodology:

Soybean and other ingredients collected from the local market. The wheat was soaked overnight, then washed, dried, milled and refrigerated at 40C. The powder of the grains mix together with water and put in an oven at 60-65C. Enzymes are active at this temperature.

INGREDIENTS	AMOUNT(%)
Wheat flour	20
Soy flour	20
Malt extract	25
Corn starch	5
Milk powder	30
Sodium benzoate	0.02
Salt	1.5

Experimental Results and Discussion:

The chemical composition of soy flour and locally available health powders have been found to be rich in moisture, protein, fiber and carbohydrates. Protein and fat were slightly higher. Soy health drinks with advanced chemical composition are superior and successful compared to other locally available health drinks.

Protein content:

Protein content ranging from 8.98% to 21.37% is the highest protein in this soy health drink.

Fat content:

The present study found the fat content to be 1.10% to 10.13% in this soy health drink. In this addition to soy flour, whole milk powder was included in the ingredients of the powder.

Fiber content:

Fiber content ranges from 0.04% to a maximum of 1.50%. The use of soy flour makes this health drink even better, consuming this fiber gives power to fight against diseases like cardiovascular, cancer, diabetes.

Carbohydrates content:

Carbohydrates amount is 59.95% to 81.58%. Due to the use of soy flour, this health drink can be considered high in carbohydrates.

Energy content:

The calorie content of this health drink is found to be 363.54 to 416.40 calories per 100 grams, which is more than other health drinks.

Conclusion:

Considering beyond the organic chemicals, it can be said that our soy health drink was high in calories, fiber, and protein. This health can provide daily nutrition.

Acknowledgments:

The authors would like to thank Dr. AnimeshKundu and Dr.Poulami Chakraborty for critically reading the manuscript. I am extremely grateful to Dr. Prosun Tribedi (HOD, Department of Biotechnology, The Neotia University, India) for sharing the information with me.

References:

- Farzana T, Mohajan S, Hossain MN, Ahmed MM. Formulation of a protein and fibre enriched soy-mushroom health drink powder compared to locally available health drink powders. Malaysian Journal of Nutrition. 2017 Jan 1;23(1).



DEVELOPMENT OF BIOTECHNOLOGY

Sweety Das

B.Sc. (H) In Biotechnology,
2022 - 2023,
The Neotia University

Abstract:

Biotechnology is an international index on biochemical, biomedical technology with applications in medicine, environmental science, agricultural science. Which helps in human development, plant development and also for the environment. This technology helps recycle the lightning by reusing it. This technology is used for sustainable development also.

Introduction:

Biotechnology is a technology that uses biological systems in living organisms to make technological advances and to apply those technologies to set up in different areas. The application of this technology is used in various areas from agriculture to medicine. Biotechnology plays a huge role in our daily lives, from the things we wear to the medicine we take, moreover, the contribution of Biotechnology to the fuel we use to drive our vehicle is undeniable.

Methodology:

Over the years valuable advances in Biotechnology have been supported by the development and application of various biotechnological methods. Some of the methods used in biotechnology include.

i) Recombinant DNA technology (Genetic Engineering):

It involves artificial gene synthesis , gene

repair, combining the DNA of two organisms, for the improvement of microbes, plants and humans manipulating artificial gene together with recombinant DNA.

ii) Structure-based molecular design(SBMD) and computer aided drug design:

This technology was invented in the 1980s. It often uses both r-DNA and bioprocess technology to produce it, so it is considered a biotechnology method. This method is based on the fact that “molecules lock and snap together”.

iii) Bioprocess technology:

It has a series of engineering technologies, which are genetically engineered cells. As well as using other types of cells to make medicine for humans.

iv) Cell Fusion:

This approach drives the development of monoclonal antibodies.

v) Bioinformatics:

Bioinformatics is an interdisciplinary field that mainly includes molecular biology, computer science, mathematics, and genetics. This topic is helped by biotechnology in many ways such as cell organization and analysis of drug targets.

vi) Bio analytical:

BIO ANALYTICAL Refers to the process of methods development by biological samples which includes sample preparation, separation. It helps to extract blood, plasma, serum and also urine.

These mentioned methods are able to detect diseases and take preventive measures. So, protecting humans from diseases, it is quite clear that biotechnology is a well developed science.

Discussion:

Biotechnology is considered the technological application of biological materials. Thinking about how biotechnology works is important. Generally, biotechnology works on agricultural, pharmaceutical, environment applications to develop new products. Biotechnology is mainly aimed that benefited mankind, such as resistant crops, vegetables, recombinant proteins, superior milk producing animals etc.

Conclusion:

- i) Biotechnology is a very diverse field.
- ii) Development helps to give higher diversity to many organisms.
- iii) Biotechnology Has applicants in fields such as agriculture, medicine and many other industries

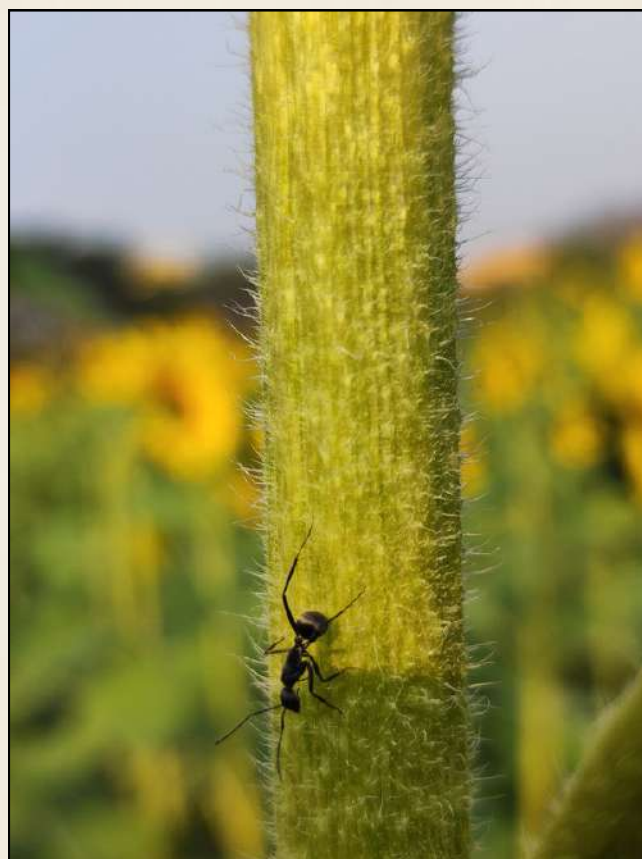
Acknowledgments:

The authors would like to thank Dr. Poulami Chakraborty and Dr. Diwakar Kumar Singh for critically reading the manuscript. We are extremely grateful to Dr. Prosun Tribedi(HOD, Department of Biotechnology, The Neotia University, India) for sharing the information with me.

References:

- a) <https://www.biotechnologyforums.com/forum-1.html>
- b) <https://aimst.edu.my/event-news/how-biotechnology-used-everyday-life/>
- c) Can T. Introduction to bioinformatics.

Methods Mol Biol. 2014;1107:51-71. doi: 10.1007/978-1-62703-748-8_4. PMID: 24272431.



REVOLUTIONIZING MEDICINE, BIOTECHNOLOGY, AND SPACE EXPLORATION: THE SYNERGY OF NANOTECHNOLOGY, RESPIROCYTES, AND NANOBOTS

Parichaya Chowdhury

M.Sc. In Biotechnology,
2023 - 2024,
The Neotia University

Abstract:

This text explores the fascinating realm of nanotechnology's synergy with biology and its potential to revolutionize various fields. It delves into the concept of Respirocytes, nano-engineered synthetic red blood cell counterparts, showcasing their remarkable capabilities in oxygen delivery and metabolic enhancement. The text also hints at their potential to serve as emergency blood substitutes. Moreover, it envisions the use of nanobots, similar to those involved in Respirocyte production, to create artificial atmospheres on planets, opening up new frontiers in space exploration and life sustenance. In essence, this text paints a picture of a future where the convergence of biology and technology promises groundbreaking advancements in medicine, biotechnology, and space research, pushing the boundaries of our understanding and potential.

Introduction:

The marvels achievable through the synergy of biology and technology are widely

acknowledged. Nanotechnology, in particular, is the art of crafting devices with a precision that operates within the scale of 1 to 100 nanometers. This scale grants us the ability to achieve perfection and precision at the molecular and even atomic levels, a concept often referred to as "molecular manufacturing." Nanotechnology harbours an array of potential applications spanning a multitude of fields, encompassing physics, biology, engineering, biochemistry, chemistry, and computer science. In our current context, this intriguing marvel emerges when biology entwines with technology, exemplifying the wonders of biotechnology.

Respirocyte: A nano-engineered wonder

Now, let's delve into the concept of Respirocytes. These synthetic red blood cell counterparts, aptly named "respirocytes," represent a groundbreaking feat of bioengineering. They exist as minute, blood-borne, spherical entities, measuring just 1 micron in size and constructed from diamondoid materials capable of withstanding pressures of up to 1000 atmospheres.

A pivotal nano-computed core and an array of chemical and pressure sensors govern these respirocytes. They are remotely programmed by medical professionals or physicians using externally applied acoustic signals. Through active pumping fueled by the body's own serum glucose, respirocytes excel at delivering a staggering 236 times more oxygen per unit volume to body tissues and cells compared to natural red blood cells, while also regulating carbonic acidity.

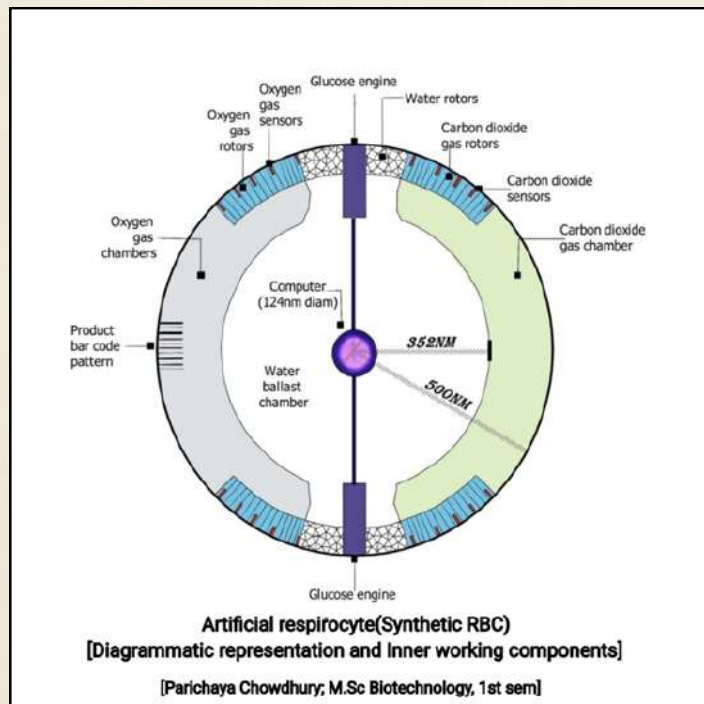


Fig. 1: Diagrammatic representation & Inner working components

These respirocytes boast three significant storage tanks: one for oxygen, another for carbon dioxide, and a third for water. An onboard chemo-mechanical turbine or fuel cell generates power by combining glucose from the bloodstream with oxygen drawn from internal storage. This power is then converted into mechanical energy, propelling molecular sorting rotors and other subsystems, akin to bacterial flagella.

The intricacies of this system encompass power plants, each generating 0.3pico watts of power. This energy suffices to refill the oxygen storage tank from empty in a mere 10 seconds, with a pumping rate of 100 million molecules per second.

To provide context, the average male human body contains 28.5 trillion red blood cells, each laden with 270 million haemoglobin molecules, binding four oxygen molecules per haemoglobin. However, since haemoglobin typically operates between 95% saturation (arterial) and 70% saturation (venous), only 25% of stored oxygen is accessible to tissues.

Conversely, each respirocyte can store up to 1.51 billion oxygen molecules, with 100% accessibility to tissues. Roughly, 5.36 trillion of these devices would be needed to replicate the full oxygen-carrying capacity of human blood. Imagine, one litre of a 50% respirocyte suspension, injecting a staggering 954 trillion of these devices into our bloodstream. This implies the astonishing ability to hold one's breath for 3.8 hours at the normal resting metabolic rate.

Respirocytes can serve as a temporary replacement for natural red blood cells in emergencies and act as an alternate source of oxygen supply.

In conclusion, respirocytes have the potential to revolutionize biotechnology. They offer a promising alternative, or perhaps a permanent solution, for treating anemia. These microscopic marvels deliver oxygen to muscle tissues more efficiently than our lungs, potentially transforming metabolism and enhancing overall human capacity. In essence, respirocytes have the power to reshape the future, ushering in a new era in medicine and biotechnology.

To infinity and beyond: Nanobots in Space:

Apart from the mind-bending biological applications in the field of biology, if we deviate a bit from the biological aspect of these nanobots involved in the process of making these respirocytes, they can also

theoretically seem to play a vital role in contributing to building an artificial atmosphere around any planet which can sustain life. Keeping in mind, their incredible capacity to withstand pressures up to 1000 atmospheres, both outside and inside, it won't implode and hence can be made to weave an artificial blanket of air surrounding any planet able to sustain life. However, it requires an immense number of modifications to achieve it, hence revolutionizing life sustenance in outer space.

In the captivating intersection of biology and space research, we uncover a scientific wonder that transcends our terrestrial boundaries and expands the horizons of our understanding. This awe-inspiring journey into the cosmos not only deepens our comprehension of the intricacies of life but also propels us into the uncharted realms of space, promising a future where biology becomes an integral part of our cosmic exploration. As we continue to unravel the mysteries of life beyond our planet, this remarkable fusion of biology and space research promises a future where our understanding of life's origins and its potential reach are truly boundless.

Acknowledgement:

I would like to express my heartfelt gratitude to the visionary authorities who conceived the brilliant idea of an e-magazine. Additionally, I extend my sincere appreciation to the dedicated members of my department's faculty, and especially to our esteemed Head of Department, Dr. Prosun Tribedi. Without their unwavering support and guidance, I would not have had the opportunity to present to you this exceptionally innovative and informative article.

References:

All information shown here are collected from the web with no violations to the respective terms of the owner.

Some of the websites are:

- <https://ts2.space/en/decoding-the-quantum-world-of-biology-with-artificial-intelligence/>
- www.azonano.com
- www.researchgate.net
- <https://www.thekurzweillibrary.com/respirocytes>
- <https://www.tandfonline.com/doi/pdf/10.3109/10731199809117682>



APPLICATIONS OF NANOTECHNOLOGY IN HIV TREATMENT

Puja Pradhan

B.Sc. (H) In Biotechnology,
2021 - 2022,
The Neotia University

Abstract:

In recent years, human immunodeficiency virus (HIV) infection has become extremely harmful. Every day, there are over 7400 new cases of infection. HIV-infected patients have had their lives extended by highly active antiretroviral therapy (HAART), which combines at least three antiretroviral (ARV) medications. In rich nations, HAART has significantly lowered mortality rates, but in developing nations, where millions of people are infected with the illness, the situation is still quite bad. Nanotechnology-based medication systems have-being investigated for HIV treatments to help the situation. When employed for HIV therapies, nano systems have several special benefits such improving the bioavailability, water solubility, stability, and targeting ability of ARV medicines. Main systems based on nanotechnology investigated for HIV. The development of effective HIV/AIDS treatments and prevention is challenging, with HAART improving life quality. Recent research suggests engineered nano systems could improve antiretroviral therapy and prevent HIV transmission. This chapter reviews recent advancements in nanotechnology-based systems for HIV/AIDS treatment and prevention.

Introduction:

“The lethal condition acquired immunodeficiency syndrome (AIDS), which is brought on by the human immunodeficiency virus (HIV), is a lentivirus that weakens the immune system of humans and makes them susceptible to life-threatening diseases.”

Nanotechnology involves the creation and manipulation of systems and materials with nanometre-sized features, which significantly impact their interaction with biological systems and other biological processes. Nanoscale medicines may offer therapeutic benefits over traditional treatments. For HIV treatment, over 30 years of research have focused on antiretroviral medications. The US Food and Drug Administration has authorized 25 drugs since 1987, but the advent of protease inhibitors and triple-drug therapy in the 1990s transformed treatment. Highly active antiretroviral treatment (HAART) has improved patients' lives, but requires permanent prescription and may have adverse effects. There is currently no comprehensive cure for HIV/AIDS. It noted in the late 20th century that two strains of HIV diverged from the SIV (Simian Immunodeficiency Virus), from which HIV-1 spread around the world and is more common in Africa [2]

Targeted nanoparticles with ligands such as mannose, galactose, tufts in, and FMLF, peptides have been utilised to attack macrophages which are important HIV viral reservoirs. Future treatment of viral reservoirs could be dramatically improved by tailored co-delivery of two or more antiviral medicines in a nano-particles technology. Human retroviruses can be divided into four main categories: human T cell leukaemia viruses (HTLV-1 and HTLV-2), human immunodeficiency viruses (HIV-1 and HIV-2), and others. The oncovirinae subclass of viruses that induce adult T cell leukaemia and spastic paraparesis includes HTLV-1 and HTLV-2. Acquired immunodeficiency syndrome (AIDS) is brought on by the lentivirinae subclass viruses HIV-1 and HIV-2. T cells that have CD4 receptors are all infected by these viruses. The global AIDS pandemic is mostly caused by the most dangerous of these four viral strains, HIV-1. HIV infection spreads through sexual contact, organ transplants, blood transfusions, and other 2 bodily fluid exchanges, as well as during pregnancy when a woman gives birth to her unborn child.

HIV Treatment Using Nanotechnology:

1. DRUG DELIVERY METHODS USING NANOTECHNOLOGY: Due to the scope of the Nanoscale process (1-100 nm), the discipline of Nanobiotechnology is emerging with excellent modern manufacturing for greater performance of drugs. Drug delivery in the pharmaceutical industry has been revolutionised by the development of nanotechnologies. The basic idea is to alter the pharmacokinetics of the chemical molecule that has earned the right to get rid of HIV in the body without harming it. Additionally, it improves the drug's biodistribution and bioavailability to expose the viral particle for a longer time with greater accuracy.

Because of their smaller size than traditional medications, nanoscale pharmaceuticals respond differently from them and have a healing effect on the surrounding environment.

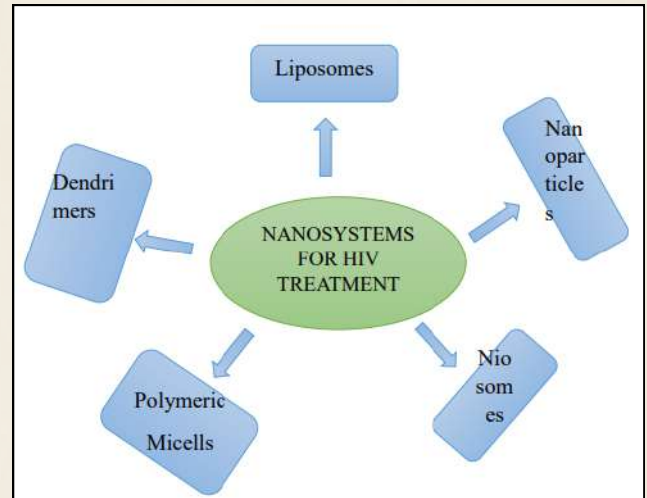


Fig. 1: Branches of Nanosystems

- LIPOSOMAL DRUG DELIVERY:** In 1976, liposomes were functionalized for use in medication delivery systems and became the first type of nanomaterial [26]. A liposome is a very small microscopic vesicle comprised of phospholipid bilayers, which are often surrounded by a watery core. While the hydrophobic drug is injected into the lipid bilayer, it is advantageous to trap the hydrophilic drug in the middle to hold it there. The liposomes' size ranges from 25 nm to several microns, providing the benefit of permeability. When liposomes enter the bloodstream, macrophages immediately phagocytose them. Liposomal surfaces are coated with hydrophilic polymers, such as PEG, to increase their bioavailability to infected cells and macrophages while extending their stay in circulation. To further enhance antiviral delivery, strategies including more precise liposome targeting were pursued. To specifically target HIV-infected cells, Flasher et al. employed liposomes attached to sCD4, a soluble version of the host ligand of gp120. Due to their relatively simple synthesis and lack of immunogenicity, CD4- derived peptides were

investigated in place of sCD4 for the targeted distribution of liposomes. Several researchers have looked on targeting molecules based on antibodies for antiretroviral liposomal delivery. These anti-HIV liposomes were proven to transport the antiretroviral protease inhibitor, PI1, a substituted benzimidazole sulphonamide, to HIV-infected cells only. The targeted PI1 had a higher inhibitory effect on viral replication than a comparable concentration of a free or nontargeted medication. Zidovudine, an amphiphilic reverse transcriptase inhibitor, can be loaded into liposomes, improving its pharmacokinetic properties, tissue distribution, and half-life, potentially reducing toxicity and improving HIV therapy efficacy.

- **NANOPARTICLE BASED ANTIRETROVIRAL THERAPY:** The cargo (ART) must be delivered by the majority of nanoparticulate drug delivery systems across the cell membrane in order to trigger an antiviral response. Therefore, it is essential to become familiar with the nanoparticle transport methodologies. Nanoparticles can pass through cell membranes in a variety of ways, principally through paracellular or transcellular channels. The majority, however, use an endogenous transporter or carrier-mediated route, which is decided by the concentration gradient of the substrates with the assistance of the right transporters, to reach the target cells.
- **DENDRIMERS: Dendrimers are vital in HIV:** treatment through nanotechnology. Their precision engineered structure allows them to combat the virus effectively. Dendrimers can serve as antiretroviral drug carriers, delivering medication directly to infected cells while minimizing systemic side effects. This targeted drug delivery enhances treatment efficacy and patient adherence.

Furthermore, dendrimers can block viral entry by binding to HIV's surface proteins, preventing it from infecting healthy cells. Their small size enables deep tissue penetration, reaching viral reservoirs. Dendrimers also find application in HIV prevention as microbicides, creating a protective barrier against viral transmission. In the fight against HIV, dendrimers harnessed by nanotechnology offer innovative strategies for therapy and prevention.

- **POLYMERIC NANOPARTICLES:**

Polymeric nanoparticles play a key role in the treatment of HIV via nanotechnology. They make it possible for focused drug delivery, increasing treatment effectiveness while reducing negative effects. Antiretroviral medications are encapsulated in these nanoparticles, which shield them from deterioration and enable their controlled release into the body. Additionally, due to their small size, drugs can enter HIV-infected cells more effectively. Additionally, the surface of polymeric nanoparticles can be altered to precisely attach to HIV-infected cells, boosting medication concentration at the site of infection. This strategy lessens toxicity and dosage frequency. Overall, polymeric nanoparticles offer a viable route for treating HIV, increasing the accuracy of drug distribution and perhaps even improving patient outcomes.

- **NIOSOMES:**

Niosomes, a byproduct of nanotechnology, are essential to the treatment of HIV. Antiretroviral medications are enclosed in these nanoscale vesicles, improving drug stability and targeted administration. Drug bioavailability is increased by niosomes, resulting in a more successful treatment outcome. Their lipid bilayer shape mimics cell membranes, making it easier for cells to absorb the drugs and less hazardous to cells. By reducing dose frequency, this customised drug delivery system improves patient compliance.

customised drug delivery system improves patient compliance. Niosomes can also be modified to release medications gradually, extending the duration of their therapeutic benefits. Overall, the use of niosomes in nanotechnology presents a promising means of enhancing antiretroviral medication, reducing adverse effects, and treating HIV.

Type of therapy	Therapeutic agent (drug or gene)	Nanotechnology delivery platform	Development stage	Refs.
Antiretroviral therapy	Rilpivirine (TMC278)	Potocarcer 338/TPGS 1000	Preclinical	[35]
	Indinavir	Liposome-laden macrophages	Preclinical	[36-38]
	Suivudine	Mannose- and galactose-targeted liposome	Preclinical	[39-41]
	Zidovudine	Mannose-targeted liposome	Preclinical	[42]
	Efavirenz	Mannose-targeted dendrimer	Preclinical	[43,45]
	Lamivudine	Mannose-targeted dendrimer	Preclinical	[46]
Nanomaterials	Fullerene derivatives	-	Preclinical	[49-55]
	Dendrimers	-	Preclinical	[56,57]
	Silver nanoparticles	-	Preclinical	[58,59]
	SDC-1721/gold nanoparticles	Gold nanoparticles	Preclinical	[60]
Gene therapy	siRNA	Peptide fusion proteins, protamine-antibody fusion proteins, dendrimers, single walled carbon nanotubes, peptide-antibody conjugates	Preclinical	[77-81]
Immunotherapy	P24 protein	Poly (DL-lactide) nanoparticles/dendritic cells	Preclinical	[98]
	Plasmid DNA	Mannose-targeted polyethyleneimine polymers	Phase II clinical trials	[99]

Table 1 :Nanotechnology based treatment approaches for HIV/AIDS

2. HIV TREATMENT VIA GENE THERAPY:

For treating HIV/AIDS, gene therapy based on siRNA has showed promise. Though new research has been welcomed with excitement, nanotechnology platforms for siRNA delivery for HIV/AIDS treatment are still in their early phases. siRNA has been delivered to HIV-specific cells using single-walled nanotubes, dendrimers, fusion proteins and peptide-antibody conjugates. Gene therapy via nanotechnology is a promising avenue for HIV treatment. Nanoparticles can deliver therapeutic genes to target cells, enhancing the body's ability to combat the virus. This approach offers precision, reducing side effects. CRISPR technology may also edit HIV genes within infected cells, rendering the virus harmless. Additionally, nano sensors can monitor viral load and immune response in real-time, aiding personalized treatment. While 5 challenges exist, such as safety and accessibility, this fusion of gene therapy and nanotechnology holds immense potential for more effective and tailored HIV treatment, potentially changing the landscape of HIV management in the future potentially changing the landscape of HIV management in the future.

3. HIV TREATMENT VIA IMMUNO THERAPY:

Risks are associated with ex vivo dendritic cell production and manipulation in ex vivo immunotherapy for HIV/AIDS based on viral agents. Clinical trials for an immunotherapy based on nanotechnology that delivers DNA plasmid using mannose-targeted polyetherimide have entered phase-II. Immunotherapy, which uses the immune system to treat HIV, has promising results. Therapeutic immunisations boost immunological defences against HIV, assisting in viral management. Monoclonal antibodies have the ability to neutralise viruses, hence lowering viral loads and defending healthy cells. Checkpoint inhibitors improve HIV-specific immune cell function. Through genetic engineering, adoptive T-cell therapy directs a patient's immune system to attack contaminated cells. These methods seek to sustain viral suppression without requiring antiretroviral medication for the rest of one's life. Immunotherapy presents a transformational horizon in HIV management, offering hope for long-term control and even functional cure, despite ongoing hurdles like HIV's capacity to escape the immune system.

4. VACCINES FOR HIV PREVENTION:

It has historically been challenging to develop an HIV/AIDS vaccine, and researchers are always looking for novel strategies. When delivering antigens more effectively to boost the immune response, nanoparticles have a number of benefits. They can be utilized to either absorb the antigens on their surfaces, allowing B cells to produce humoral responses, or they can encapsulate the antigens in their core, allowing antigen presentation cells to process and present and cross-present antigen to CD4+ and CD8+ T cells, respectively. Vaccines-made using nanoparticles can also be tailored for different delivery methods. To deliver DNA, protein, or peptide-based antigens in vivo and elicit potent cellular, humoral, and mucosal immune responses, a variety of polymeric and lipid-based nanoparticles have been utilized.

5. INTRAVAGINAL MICROBODIES:

Intravaginal microbicides are medications that are applied topically to the vagina to stop the spread of HIV/AIDS or other sexually transmitted illnesses. Dendrimers, siRNA, and nanoparticles are being used in the development of microbicidal methods based on nanotechnology. In Phase I clinical studies, the microbicide gel VivaGel, based on dendrimers, was demonstrated to be safe for use on people. PSC-RANTES, a CCR5 inhibitor, and HIV-specific siRNA, both utilised as microbicides, have been delivered via polymeric nanoparticles

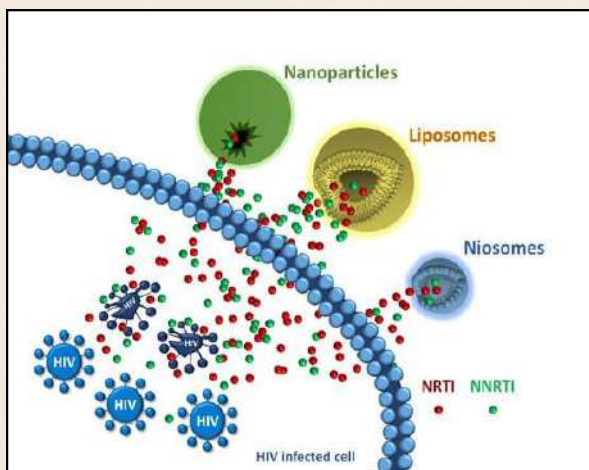


Fig 2: Nano-systems applied to HIV treatment

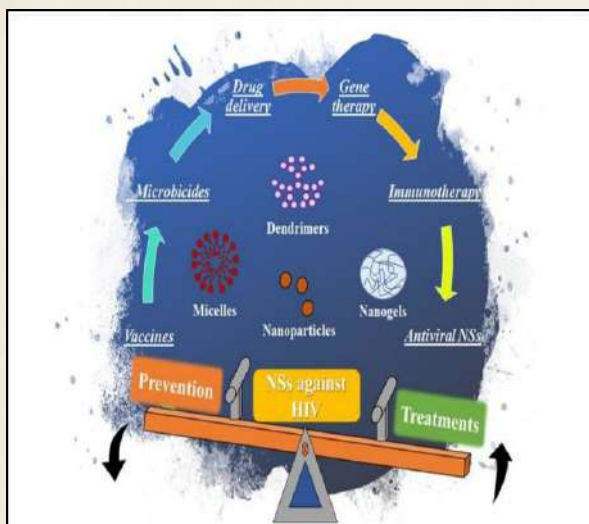


Fig 3: Pharmaceuticals

Future Development:

Nanotechnology, where tiny particles can revolutionise medicine delivery, holds the key to the future of HIV treatment.

Drug stability is improved by nano-based methods, which also precisely target infected cells to reduce adverse effects. Nanoparticle-encapsulated antiretroviral medications provide prolonged release, minimising the need for repeated dosages. Nanoscale sensors can instantly identify viral load and immunological response, enabling customised treatment regimens. Additionally, CRISPR-Cas9 gene editing delivered by nanoparticles may one day eliminate HIV from infected cells. HIV management could become more efficient, less invasive, and patient-friendly thanks to nano-enabled tests and medicines, bringing us one step closer to containing and perhaps even curing this worldwide health issue.

Conclusion:

The ability of systems based on nanotechnology to offer a logical strategy for anti-HIV therapy has been covered in this article. According to in vitro and animal in vivo research, nanotechnology-based devices may enhance medication therapy in infected individuals. By lowering their toxicity and streamlining drug regimens, they have increased the anti-HIV activity of various medications. By maintaining prolonged medication levels in areas that are known to be HIV reservoirs, these methods can result in superior viral suppression. Therefore, they may resemble a miracle bullet that only kills HIV. In addition to helping with the treatment of AIDS and other viral diseases, the development of drug delivery systems will hasten the development of methods for treating bacterial diseases, fungi, and mycobacteria. Because of this, there will be new challenges for drug delivery systems in the future, including the viability of scaling up processes to quickly introduce novel therapeutics to the market and the potential for obtaining multifunctional systems that can satisfy a variety of biological and therapeutic needs.

References:

1. Grande F, Ioele G, Occhiuzzi MA, De Luca M, Mazzotta E, Ragno G, Garofalo A, Muzzalupo R. Reverse transcriptase inhibitors nanosystems designed for drug stability and controlled delivery. *Pharmaceutics*. 2019 Apr 27;11(5):197.
2. Sailaja I, Baghel MK, Shaker IA. Nanotechnology Based Drug Delivery for HIV-AIDS Treatment. In *AIDS Updates-Recent Advances and New Perspectives* 2021 May 10. IntechOpen.
3. Mamo T, Moseman EA, Kolishetti N, Salvador-Morales C, Shi J, Kuritzkes DR, Langer R, Andrian UV, Farokhzad OC. Emerging nanotechnology approaches for HIV/AIDS treatment and prevention. *Nanomedicine*. 2010 Feb;5(2):269-85



CAR T-CELL IN CANCER THERAPY

Soumili Dhar

B.Sc. (H) In Biotechnology,
2021 - 2022,
The Neotia University

Abstract:

CAR T-cell is a innovative technology used since 2017 in United States for treating cancer. This technology is very useful for targeting cancer cells as the cells are identified specifically and killed efficiently. Though this technology shows side effects but are 100% reversible and can be cured using drugs and medications.

Introduction:

Treating cancer is way more difficult than we think of. Cancer causing cells are very difficult to identify due to their ability to escape the natural mechanisms of immune system. For this reason its very essential to develop a technology where the cancer cells will be specifically targeted and killed. This article comprises of a technology developed recently where cancer is treated using engineered T-cells .CAR T-cell therapy is the technology which has recently given hope to the cancer patients .

What is CAR T-CELL?

CAR T- cell or chimeric antigen receptor T-cell are genetically engineered natural T-cell isolated from patients. The natural T-cell are isolated from the patient body suffering from cancer specially blood cancer and then modified to produce CAR T-cell. To the natural T-cell a new receptor is bound which attacks a

specific cancer cell by binding to the antigen/specific proteins present on the cancer cell. Car T-cells combine three innovative technologies and they are a) Cellular therapy: Using the patient own cells as therapy b) Gene therapy: Inserting a gene to produce a therapeutic protein (Here it is CAR) c) Immunotherapy: Harvesting the patient own T-cells to treat his or her disease. As this technology involves all the three therapy used individually to treat cancer it is considered to be more efficient.

How are CAR T-CELLS made?

CAR T-cell therapy was found to be more efficient in patients suffering from B lineage lymphoma (in adults) and B lineage acute lymphoblastic leukemia(in children and young adults) Natural T-cell have the capability to fight against foreign invaders present in our body and can to some extent kill the cancer cells. But our cytotoxic T- cell are not efficient enough to eradicate the cancer cells as the cancer cells have mechanisms to escape our immune system. To identify the cancer cells and attack them a specific receptor was needed to bind to the surface protein present on the cancer cells and hence CAR t cells was developed. 1. Natural T-cells are isolated from patients suffering from lymphoma and leukemia and are harvested. 2. After harvesting they are infected by a virus vector in the lab (eg : lentivirus). 3. This causes the genetic material of the virus which carries the information for the production of CAR to incorporate into the harvested natural T-cell .

which results in the generation of CAR T-cell carrying both natural receptor and CAR. 4. These modified cells are then infused back to the patients body and allowed to work .

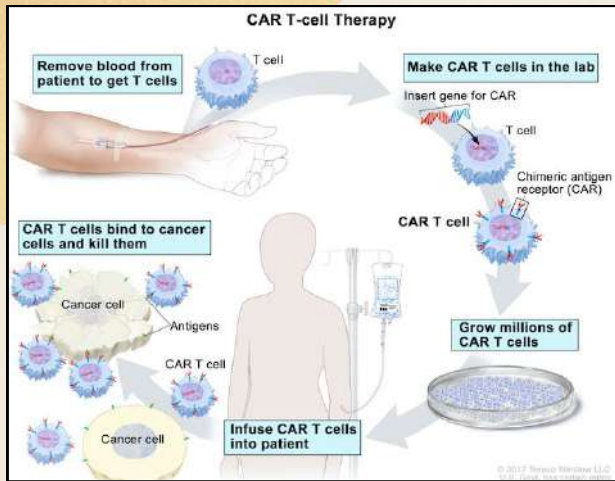


Fig. 1: CAR T-Cell Therapy

How CAR T-CELLS work inside the body and it's review:

The cancer cells have specific antigen present in their cell surface. CAR T-cells have the receptor molecule which identifies these antigen (CD19). After the CAR T- cells recognizes and binds to the CD19 the signaling domains present in the CAR T-cells beneath the membrane activates the CAR T-cell to produce cytotoxins which in turn kills the cancer cells.

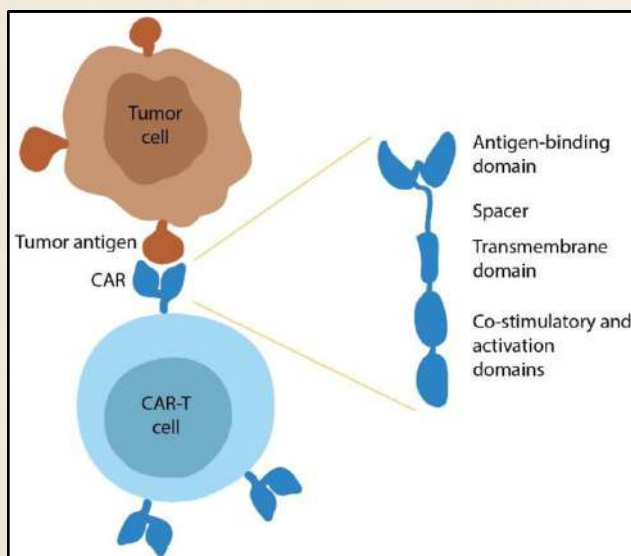
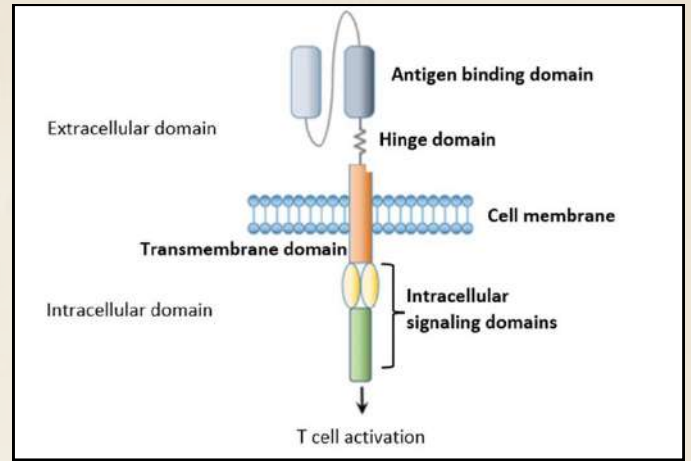


Fig. 3: Interaction between Tumor antigen & CAR



**Fig. 2: (1) Attachment of CAR T-cells to the target cancer cell
(2) Enlarged Image of CAR**

The initial development of the CAR T-cell therapy was to treat children suffering from ALL. More than 80% of children diagnosed with ALL that arises in B cells, the predominant type of pediatric ALL, was cured by intensive chemotherapy. But treatments were limited for cancers relapse, after chemotherapy or a stem-cell transplant. However, in 2017, a new option appeared, with FDA's approval of tisagenlecleucel (Kymriah), the first CAR T-cell therapy to be approved by the agency, based on clinical trials demonstrating it could eradicate cancer in children with relapsed ALL. An NCI-led research team found out that approximately 60% of the children were still alive 5 years later without their cancer coming back or the children experiencing any disease-related problems. The results in lymphoma to date "have been incredibly successful," Dr. Kochenderfer said, "and CAR T cells [have] become a frequently used therapy for several types of lymphoma."

Risk of CAR T-CELLS and measures taken to overcome it:

Every cancer treatment have some side effects this to have some. The following are the risks and its cure :

a) Cytokine Release Syndrome (CRS): As the T-cells remains in the body after treating the cancer cells it sometimes can get activated and produce the toxins in our body. It is an on target effect of CAR T-cell therapy which signifies that the treatment is successful. The symptoms may include fever, breathlessness and low blood pressure. It occurs after a day or week after taking the treatment. Cure: It can be managed by standard supportive therapies that include steroids. The drug tocilizumab (Actemra) which are used to treat inflammatory conditions like juvenile arthritis, blocks the activity of IL-6, a cytokine that is often secreted in large amounts by T cells and macrophages.

b) Neurotoxicity: The brain function is disrupted that is the neuro-signaling of the brain is hampered. Symptoms include confusion, not being able to speak properly and seizures. The symptoms can be seen a few weeks after the treatment is taken. Cure : Dexamethasone is used which is better at penetrating the CNS as explained by Jennifer Brudno M.D who is involved in several trials of CAR T-cell therapies in NCI's Center for Cancer Research. Anakinra used to treat rheumatoid arthritis can also prevent neurotoxicity. All of these side effect are 100% reversible as said by Dr. Patrick Brown, M.D(John Hopkins University) .

and its side effects the only problem remains is the cost . Efforts are still been made to reduce the cost as it takes nearly 4-5 crore in the United States (the technology is available since 2017) and in India if the technology is available then it might costs up to 20-30 lakhs.

References:

1. Castillo G, Lalu MM, Asad S, Foster M, Kekre N, Fergusson DA, Hawrysh T, Atkins H, Thavorn K, Montroy J, Schwartz S. Navigating choice in the face of uncertainty: using a theory informed qualitative approach to identifying potential patient barriers and enablers to participating in an early phase chimeric antigen receptor T (CAR-T) cell therapy trial. *BMJ open.* 2021 Mar 1; 11(3):e043929.
2. National Cancer Institute. CAR T Cells: Engineering Patients' Immune Cells to Treat Their Cancers.
3. Ahmed MM. CAR-T cell therapy: current advances and future research possibilities. *Journal of Scientific Research in Medical and Biological Sciences.* 2021 May 26;2(2):86- 116 .

Generic Name	Brand Name	Target Antigen	Targeted Disease	Patient Population
Tisagenlecleucel	Kymriah	CD19	B-cell acute lymphoblastic leukemia (ALL) B-cell non-Hodgkin lymphoma (NHL)	Children and young adults with refractory or relapsed B-cell ALL Adults with relapsed or refractory B-cell NHL
Axicabtagene ciloleucel	Yescarta	CD19	B-cell non-Hodgkin lymphoma (NHL) Follicular lymphoma	Adults with relapsed or refractory B-cell NHL Adults with relapsed or refractory follicular lymphoma
Brexucabtagene autoleucel	Tecartus	CD19	Mantle cell lymphoma (MCL) B-cell acute lymphoblastic leukemia (ALL)	Adults with relapsed or refractory MCL Adults with refractory or relapsed B-cell ALL
Lisocabtagene maraleucel	Breyanzi	CD19	B-cell non-Hodgkin lymphoma (NHL)	Adults with relapsed or refractory B-cell NHL
Idecabtagene vicleucel	Abecma	BCMA	Multiple myeloma	Adults with relapsed or refractory multiple myeloma
Ciltacabtagene autoleucel	Carvykti	BCMA	Multiple myeloma	Adults with relapsed or refractory multiple myeloma

Table 1: FOOD AND DRUGS ADMINISTRATION APPROVED CAR T-CELL

Conclusion:

This CAR T-cell is a blessing to the patients suffering from cancer. There will be side effects but it still holds a cure for both cancer

UNLOCKING THE POTENTIAL OF GENOME EDITING: FROM CRISPR-CAS9 TO PRIME EDITING AND BEYOND

Rupsha Paul

M.Sc. in Biotechnology,
2023-2024,
The Neotia University

Abstract:

CRISPR-Cas9, a game-changing gene editing tool, allows scientists to precisely alter DNA with molecular scissors guided by RNA. This opens doors to a vast range of possibilities, from controlling genes to eliminating disease-carrying insects and even bringing extinct species back from the brink. Recent triumphs include using CRISPR to treat a corneal disease in mice and speed up COVID-19 diagnosis. Beyond Cas9, Prime Editing promises a safer method for modifying genes. This transformative technology has the power to tackle global challenges and revolutionize healthcare.

Introduction:

DNA manipulation enters a new era with genome editing, a ground-breaking technology empowering scientist to rewrite the genetic blueprint of life. This revolutionary approach allows for precise alteration of an organism's DNA, letting us add, remove, or swap genetic material like building blocks. From CRISPR-Cas9, the latest star of the show, to a diverse toolbox of editing techniques, the possibilities

are endless. With the advent of genome editing, scientists have cracked the code of life, gaining the remarkable ability to surgically modify an organism's DNA.

The CRISPR-Cas9 Revolution: Rewriting the Code of Life:

Cracking the DNA code : For decades, scientists dreamed of precisely editing the genomes of living cells. Then came CRISPR-Cas9, a revolutionary technology that redefined genetic manipulation. This powerful tool allows us to add, delete, or change genetic material with unrivaled accuracy, opening doors to a realm of possibilities.

Molecular Scissors and Guiding Stars: At the heart of CRISPR-Cas9 lies Cas9, a "molecular scissor" enzyme that snips specific DNA strands at chosen locations. But how does it know where to cut? Enter guide RNA (gRNA), a crucial navigation system. Designed to match a specific DNA sequence, gRNA guides Cas9 to its target, ensuring precise edits.

Nature's Inspiration: This ingenious system wasn't invented from scratch. It was inspired

by bacteria's natural defense against viruses. Cas9 naturally cuts invading viral DNA. Scientists cleverly repurposed this mechanism, not only to target and cut specific DNA, but also to control gene activity without permanently altering the code.

From Labs to Living Beings: While a powerful tool for gene regulation in lab models, CRISPR Cas9 faced hurdles in treating adult animals. However, advancements like prime editing, built upon the CRISPR foundation, are overcoming these challenges. Prime editing avoids collateral damage to the target DNA, paving the way for revolutionary applications like gene therapy.

The Future Unfolds:

CRISPR-Cas9 and its evolving family are transforming medicine, agriculture, and our understanding of life itself. From treating genetic diseases to engineering crops or even reviving extinct species, the possibilities are boundless. The DNA revolution has begun, and with each new advancement, we rewrite the code of life, shaping a future filled with unimaginable possibilities.

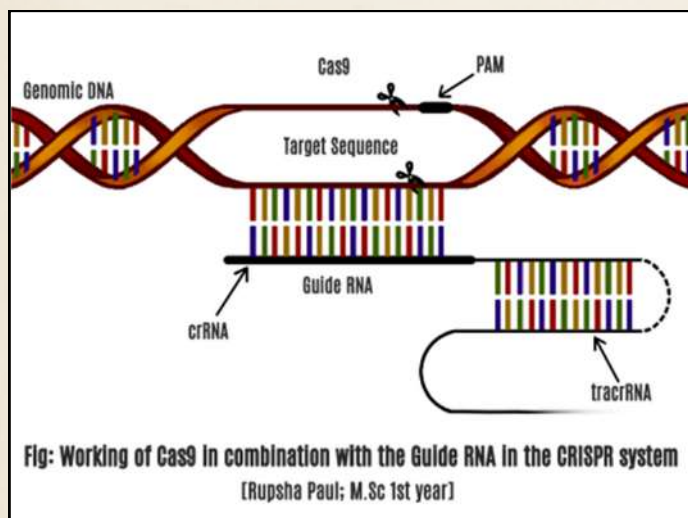


Fig1: Working of Cas9 in combination with the guide RNA in the CRISPR system

Diverse Applications of CRISPR-Cas9:

The versatility of CRISPR-Cas9 is reflected in its numerous successful applications across

various domains, including :

1. Regulating Endogenous Gene Expression
2. Epigenome Editing
3. Live-Cell Labelling of Chromosomal Loci
4. Editing Single-Stranded RNA
5. High-Throughput Gene Screening
6. Eradicating Infectious Insects
7. Developing Organ Resources
8. Reviving Extinct Animals
9. Animal Modelling
10. Enhancing Food Production

CRISPR-Cas9: Cutting-Edge Tools for Health and Beyond:

1.Eye-Opening Advance : CRISPR Prevents Corneal Dystrophy in Mice Scientists at the University of Oregon have made a groundbreaking breakthrough in treating Fuchs' corneal dystrophy, a blinding disease. Using CRISPR-Cas9's "start codon disruption," they prevented the disease in mice, paving the way for a potential cure without the need for corneal transplants. This first-of-its-kind application opens doors for treating other genetic diseases, even in non-dividing cells.

2. CRISPR-Cas9 Detects COVID-19 in a Flash: A team at UC Berkeley, including Nobel laureate Jennifer Doudna, has developed a faster and more portable COVID-19 diagnostic test using two types of CRISPR enzymes. This innovative approach can detect viral RNA in under an hour, offering a valuable tool for population surveillance and controlling the spread of the virus, even though it may not yet match the sensitivity of traditional methods.

3. Prime Editing: A Safer Way to Edit Genes:

Prime Editing, a new and safer alternative to CRISPR-Cas9. Unlike its predecessor, Prime Editing doesn't cut DNA before making changes. Instead, it seamlessly inserts new sequences, minimizing the risk of collateral damage. This makes it a more precise and

promising tool for genetic modifications. by bacteria's natural defense against viruses. . Cas9 naturally cuts invading viral DNA. Scientists cleverly repurposed this mechanism, not only to target and cut specific DNA, but also to control gene activity without permanently altering the code.

CRISPR-Cas9: A Revolution in Progress:

These breakthroughs highlight the transformative power of CRISPR-Cas9. From treating genetic diseases to developing rapid diagnostics, its applications are vast and hold immense potential for improving human health and addressing global challenges. With ongoing research and innovations like Prime Editing, the future of genome editing is brighter than ever, promising even more groundbreaking advancements in the years to come.

Acknowledgement:

I want to take a moment to extend my gratitude to the individuals behind the conception of this remarkable e-magazine. Furthermore, I would like to acknowledge and thank the faculty members of my department, as well as our Head of Department, Dr. Prosun Tribedi. Their unwavering support and encouragement have played a pivotal role in enabling me to deliver this article.

References:

The above text has sought references from various websites with no conflict with the respective terms of the owner.

- <https://www.news-medical.net/news/20210803/Start-codon-disruption-with-CRISPR-Cas9-gene-editing->

[prevents-Fuchse28099-corneal-dystrophy-in-mice.aspx](https://www.news-medical.net/news/20210803/Start-codon-disruption-with-CRISPR-Cas9-gene-editing-prevents-Fuchse28099-corneal-dystrophy-in-mice.aspx)

- <https://www.eurekalert.org/news-releases/924338>
- <https://publichealth.berkeley.edu/news-media/research-highlights/using-two-crispr-enzymes-a-covid-diagnostic-in-only-20-minutes/>
- <https://news.berkeley.edu/2021/08/05/using-two-crispr-enzymes-a-covid-diagnostic-in-only-20-minutes/>
- <https://medicalxpress.com/news/2021-08-scientists-crispr-cas9-fuchs-corneal-dystrophy.html/>



UNLOCKING THE SECRETS OF BIOTECHNOLOGY: REVOLUTIONIZING HUMAN HEALTH

Mr. Alakesh Maity
Research Scholar,
Department of Biotechnology,
2023-2024,
The Neotia University

Introduction:

Biotechnology, with its immense potential and groundbreaking advancements, has become a driving force in revolutionizing human health. This dynamic field encompasses a range of scientific disciplines and technologies, all geared toward improving diagnostics, treatments, and preventive measures for various diseases (Greenwood et al. 2006). The remarkable growth of biotechnology has paved the way for precision medicine, personalized therapies, regenerative medicine, and the utilization of big data in healthcare, known as bioinformatics. In recent years, biotechnology has had a significant impact on human health.



Fig. 1: Laboratory And Scientist: Image by sindhu digital from Pixabay

Biotechnology-derived vaccinations, for example, have contributed to the eradication

eradication of smallpox and polio, as well as a considerable reduction in the prevalence of measles, mumps, and rubella. Drugs produced by biotechnology have also had an enormous impact on explaining how cancer, HIV/AIDS, and other diseases are treated. In this article, we'll delve into the world of biotechnology and look at how it positively impacts human health and well-being (Mason and Dunhill 2008).

The Role of Biotechnology in Disease Diagnosis and Prevention:

One of the core pillars of biotechnology lies in its contribution to disease diagnosis and prevention. We can now detect diseases with exceptional accuracy and at earlier stages thanks to sophisticated diagnostic instruments and techniques developed through biotechnological applications. With the development of precision medicine, medical experts are now able to personalized treatments for particular individuals based on their unique genetic make-up and health characteristics. For instance, liquid biopsies, a cutting-edge technique enabled by biotechnology, have revolutionized the early detection of cancer by analyzing trace amounts of tumor DNA circulating in the blood (Kemp 2006).

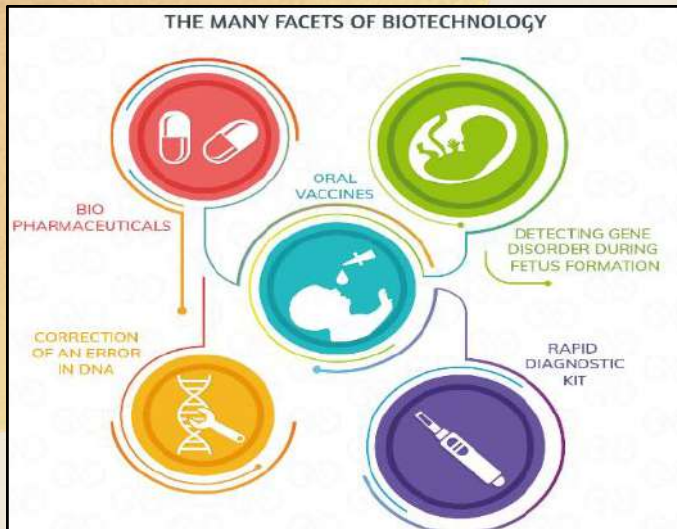


Fig. 2: Sources from: www.heyzindagi.com

Additionally, biotechnology has been crucial in the prevention and treatment of many diseases. Effective vaccines against infectious diseases have been developed by researchers using biotechnological techniques, as in the case of current attempts concerning the global COVID-19 epidemic. Scientists may develop vaccinations more quickly and effectively by taking advantage of the power of biotechnology, potentially saving countless lives (Basiri et al. 2021).



**Fig. 3: "Covid-19 Vaccine Ampoules and Syringe"-
By nataliya-vaitkevich-from pexels**

Biotechnology Revolutionizing Therapy and Treatment:

The impact of biotechnology on therapy and treatment is profound. Advancements in drug discovery and development have been

accelerated through biotechnological innovation. By harnessing the tools of biotechnology, researchers can produce targeted therapies, biologics, and gene therapies for a wide range of diseases. In the realm of gene editing, the groundbreaking CRISPR-Cas9 technology has brought new hope for treating previously incurable genetic disorders. By "DNA genetics molecule" Image by Furiosa-L from Pixabay "Covid-19 Vaccine Ampoules and Syringe"- By nataliya-vaitkevich-from pexels Sources from: www.heyzindagi.com precisely modifying a patient's DNA, it is now possible to correct genetic defects and potentially cure diseases that were once considered untreatable (Jehan 2022).



Fig. 4: "DNA genetics molecule" Image by Furiosa-L from Pixabay

The use of biotechnological innovations in therapy and treatment has resulted in remarkable outcomes. Patients with rare disorders, such as multiple sclerosis, hemophilia, and many others, now have access to life-changing medical treatments. These breakthroughs highlight biotechnology's transformative potential towards improving patients' lives and decreasing the burden of several healthcare issues.

Advancements in Regenerative Medicine:

Regenerative medicine, an intriguing field at the convergence of biotechnology and healthcare, holds enormous potential for the

future. Biotechnology has opened up novel approaches for repairing and replacing damaged tissues and organs through the use of stem cell treatment and tissue engineering. Transplantation of regenerated tissues and organs is already a reality, with the potential to solve the organ-limited availability problem (Zeman 2001).

Bio-printing, a cutting-edge biotechnological technique, enables scientists to develop sophisticated 3-D structures using living cells. This technology holds the potential to transform organ transplantation through the creation of functional organs that are compatible with the patient's unique biology, eliminating the need for donors and minimizing the danger of organ rejection (Yagi et al. 2013).



Fig. 5: Organ Transplant: Source iStock

Bioinformatics: Revolutionizing Healthcare with Big Data:

The exponential growth of biological data has paved the way for the integration of biotechnology and computer science into healthcare, giving rise to the field of bioinformatics.

Bioinformatics enables researchers to extract valuable insights, predict disease outcomes, and develop personalized treatment plans by employing the power of big data and artificial intelligence (AI). Precision genomics, a specialized branch of bioinformatics, is concerned with analyzing an individual's

genome in order to personalised treatments and medications to their genetic make-up. This strategy has enormous potential for enhancing treatment outcomes and reducing undesirable reactions (Ho et al. 2021).

While the benefits of bioinformatics are significant it is critical to address the ethical concerns related to healthcare big data management. To safeguard patient information from misuse or unauthorised access, it is critical to protect privacy and data security.

Ethical Considerations and a Future Perspective:

Organ Transplant: Source iStock As we witness biotechnology's profound impact on human health, it is crucial to address the ethical implications of these innovations. The use of genetic alteration and gene editing raises concerns about the limits of medical intervention, while the ethical use of large data must involve careful thought to protect patient privacy.

Embracing the potential of biotechnology while dealing with these ethical obstacles, on the other hand, can pave the path for a future in which human health attains new heights. Collaboration among scientists, politicians, and individuals is critical to ensuring that biotechnological advancement is carried out properly and ethically, benefiting society as a whole.

Conclusion:

Biotechnology, a blossoming field, is developing with life-altering possibilities for human health. From pinpointing and preventing diseases to crafting groundbreaking therapies, it's reshaping medicine. Regenerative medicine, bioinformatics, and mindful technology use all hold immense promise for a healthier future.

But to harness this power fully, we must invest in research, foster responsible innovation, and address ethical concerns head-on. By embracing biotechnology's potential while prioritizing patient well-being and ethical rigor, we can unlock a future where countless lives are improved and saved, one groundbreaking discovery at a time.

References:

1. Basiri, A., Pazhouhnia, Z., Beheshtizadeh, N., Hoseinpour, M., Saghazadeh, A., & Rezaei, N. (2021). Regenerative medicine in COVID-19 treatment: real opportunities and range of promises. *Stem cell reviews and reports*, 17, 163-175.

2. Greenwood, H. L., Thorsteinsdóttir, H., Perry, G., Renihan, J., Singer, P., & Daar, A. (2006). Regenerative medicine: new opportunities for developing countries. *International journal of biotechnology*, 8(1-2), 60-77

3. Ho, D., Quake, S. R., McCabe, E. R., Chng, W. J., Chow, E. K., Ding, X., ... & Zarrinpar, A. (2020). Enabling technologies for personalized and precision medicine. *Trends in biotechnology*, 38(5), 497-518.

4. Jehan, Z. (2022). Biotechnology applications in regenerative medicine. In *Biotechnology in Healthcare* (pp. 131-142). Academic Press.

5. Kemp, P. (2006). History of regenerative medicine: looking backwards to move forwards.

6. Mason, C., & Dunnill, P. (2008). A brief definition of regenerative medicine.

7. Petit-Zeman, S. (2001). Regenerative medicine. *Nature biotechnology*, 19(3), 201-206.

8. Yagi, H., Fukumitsu, K., Fukuda, K., Kitago, M., Shinoda, M., Obara, H., ... & Kitagawa, Y. (2013). Human-scale whole-organ bioengineering for liver transplantation: a regenerative medicine approach. *Cell transplantation*, 22(2), 231- 242



KLINEFELTER SYNDROME: A GENETIC- DISORDER (CHROMOSOMAL ABNORMALITIES)

Swastika Mondal

B.Sc. (H) Biotechnology,
2022-2023 ,
The Neotia University

Abstract:

Genetic disorder occurs when inherited medical conditions caused by DNA abnormalities. Klinefelter syndrome is most genetic condition in which a male is born with an extra copy of X Chromosome. Some of the most seen chromosomal aberrations are deletion, translocation, inversion, duplication. Typically, a male has one X and one Y chromosome. People with Klinefelter syndrome can experience breast growth, breast cancer, osteoporosis, infertility and learning difficulties. Klinefelter syndrome is a congenital condition which means its present from the time of birth. There are certain tests that can be done during pregnancy that can diagnose it before birth. Treatment involves physical and emotional therapy as well as hormone replacement. Testosterone replacement corrects symptoms of androgen deficiency but has no positive effect on infertility. However, nowadays patients with Klinefelter's syndrome This syndrome is fairly common, happening in about 1 in 600 people, but (70-80)% people don't have knowledge about this genetic condition. Women who have pregnancies after age 35 have slightly high chances of having a boy with this syndrome. Henry Klinefelter, who identified the condition in the 1940s.

Keywords:

Klinefelter syndrome ,Testosterone,
Chromosome abnormalities, infertility.

Introduction:

Klinefelter syndrome occurs randomly which means it's not hereditary. Klinefelter syndrome also known as 47XXY is an aneuploid genetic condition. A typical man or person assigned male at birth (AMAB) has a total of 46 chromosome (packages of DNA): one copy of an X chromosome and one copy of the Y chromosome (46,XY) .A typical woman or person assigned female at birth (AFAB) has two copies of the X chromosome (46,XX). There are a number of different genetic conditions where an individual may have more or less than the expected X or Y chromosomes. Klinefelter syndrome (KS) is a genetic condition where an extra X chromosome is present in a male's genetic code. Instead of having 46 Chromosomes , they have 47-with two copies of the X chromosome and one copy of the Y chromosome (47,XXY) . Klinefelter syndrome is found in about 1 out of every 500-1000 new born males. This extra X chromosome can either come from the father's sperm or mother's egg .The clinical

phenotype of KS was first described in males with tall structure, small testes, gynecomastia and azoospermia with the genetic etiology of supernumerary X chromosomes identified in 1959.

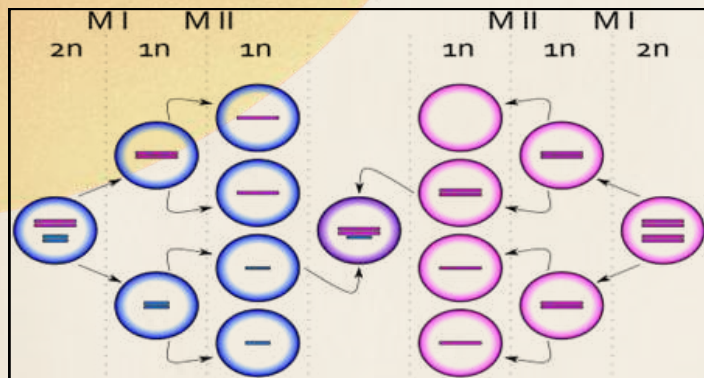


Figure: 1

Methodology:

Blood or urine samples can reveal abnormal hormone levels that are sign of Klinefelter. Karyotyping analysis is done to diagnose Klinefelter syndrome. A blood sample is sent to the lab to check the shape and number of chromosomes. Klinefelter syndrome can be caused by: one extra copy of the X chromosome in each cell. (XXY), an extra X chromosome in some of the cells (mosaic Klinefelter Syndrome), with fewer symptoms. Klinefelter syndrome, (47,XXY) is a chromosomal variation inhales in which one extra X chromosome is present.

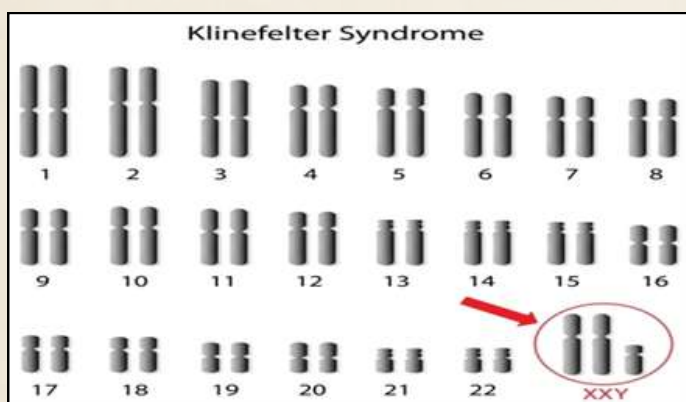


Figure: 3

Physical And Psychological Symptoms:

- Low Sperm Count or No sperm.
- Small testicles and penis.
- Low sex drive.
- Taller than average height.

- Weak bones.
- Decreased facial and body hair.
- Less muscular compared with other men.
- Enlarged breast tissue.
- Quite personalities.
- Gynaecomastia.

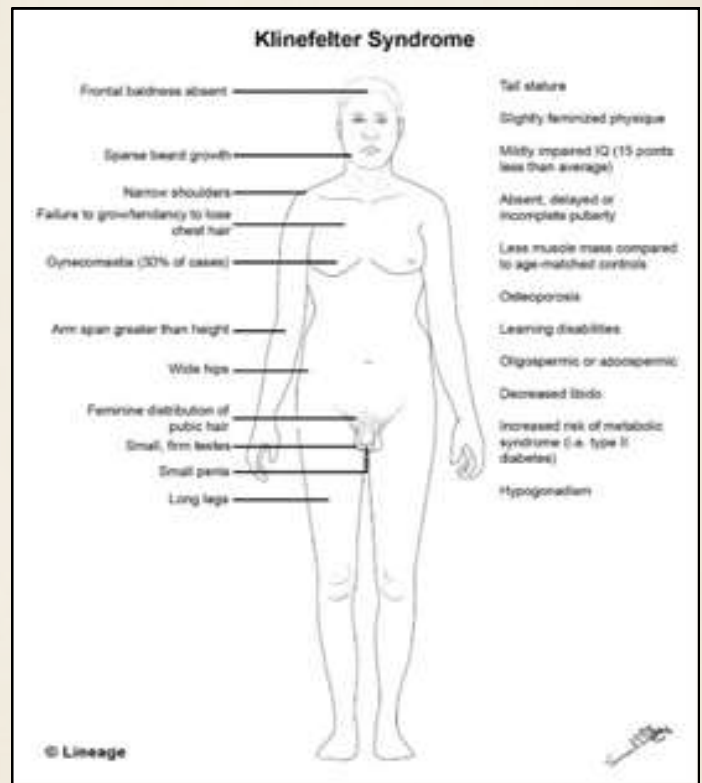


Figure: 2

Discussion:

There are Some Conditions that are caused by the presence of one extra sex chromosome in each cell are described as variants of Klinefelter syndrome . These conditions include 48,XXXYY syndrome , 48,XXYY syndrome , and 49,XXXXYY syndrome. Klinefelter Syndrome may adversely affect testicular growth ,resulting in smaller than normal testicles, which can lead to lower production of testosterone. The syndrome may also cause reduced muscle mass, reduced body and facial hair, and enlarged breast tissue.

Diagnosis and Screening:

Klinefelter Syndrome is typically diagnosed in one of the following ways:

- Prenatal screening .
- Testing after a healthcare provider notices abnormal growth during childhood , puberty or throughout the teen years.
- Testing for fertility issues and /or low testosterone in adulthood.

The doctor will look at the chromosomes to check for an extra X chromosome and the process is known as karyotyping .This testing can be done in children , adults and even in a foetus before birth.

It isn't standard to test foetuses for Klinefelter syndrome, but certain tests that gather genetic material from tissue or fluid (Chorionic Villus sampling or Amniocentesis) can detect it. Chorionic villus Sampling involves taking a sample from the placenta (food source for the foetus in the uterus). Amniocentesis involves taking a sample from the amniotic fluid that the foetus is in with in the uterus.

In people with very mild cases of Klinefelter Syndrome – those without symptoms – the condition may never be diagnose or treated. Some people believe that only 20 to 30% of all people with Klinefelter Syndrome ever know about their diagnosis. For others, it's only discovered when they're tested for infertility.

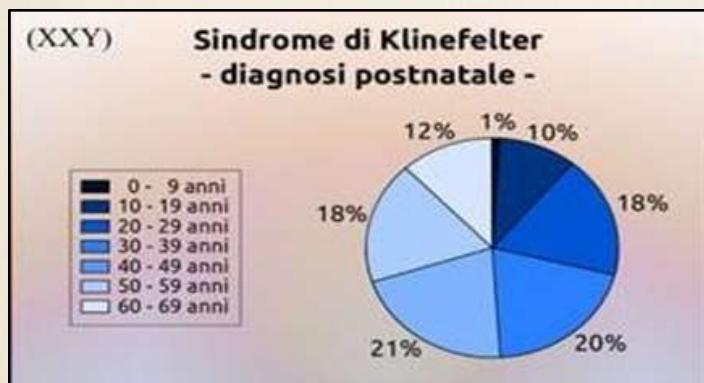


Figure: 4

Klinefelter Syndrome Treated Many Ways.....

1) Hormone Replacement

2) Therapy

3) Surgery

1.HORMONE REPLACEMENT :

People with Klinefelter Syndrome often have less testosterone than typical males. Some boys and children AMAB won't start puberty at all, whereas other all start but then stop or regress. This happens because the testicles usually "fail" in Klinefelter Syndrome, which makes them unable to make testosterone and sperm.

When the level of testosterone in the body shop goes up with treatment , the person with Klinefelter syndrome may have :

- An increased Sexual desire.
- More body and facial hair.
- A deeper voice .
- Stronger muscle .

This type of treatment can also help improve a person's mental state ,including their self - image and mood.

2.THERAPY:

Those with Klinefelter Syndrome may need help from a number of different therapists, including :

- Speech and language therapists(SLPs)
- Physical and /or occupational therapists
- Emotional, behavioural and family therapists.

Children with Klinefelter Syndrome may also need changes in the classroom to help them learn. Many children with this condition will qualify for special help in school to adapt the lessons in a way that works for them. It's recommended that children be tested. Therapy can really help limit the impact of certain symptoms of Klinefelter Syndrome.



Figure: 4

For example , physical therapy can help with muscle tone, while a speech and language therapist may be able to address speech issue.

3.Surgery :

Extra breast tissue can be a normal finding in all teenagers AMAB (Occurring in approximately half), but it usually goes away on its own. However, in Klinefelter syndrome ,the extra breast tissue is more likely to stay . In some cases -mostly if it's very bothersome to the person-the healthcare provider may decide to surgically remove extra breast tissue. This removal or reduction surgery can help with self-image and confidence, but is usually delayed until adult age.

Can Klinefelter Syndrome Be Prevented?

Unfortunately, Klinefelter Syndrome is a genetic condition that can't be prevented . It's a random error in the genetic code that happens before birth. This condition isn't passed down through a family (inherited) and there's nothing a parent can do to prevent their child from having Klinefelter Syndrome. Some of the problems associated with the condition can be treated if necessary.

No special diet is required for KS although a well-balanced diet is important. It is important to ask the parents about the medical issues in their child and what medical management challenges they may face at school. Many boys with Klinefelter are followed by an endocrinologist and are followed by an endocrinologist when they reach the age of puberty.

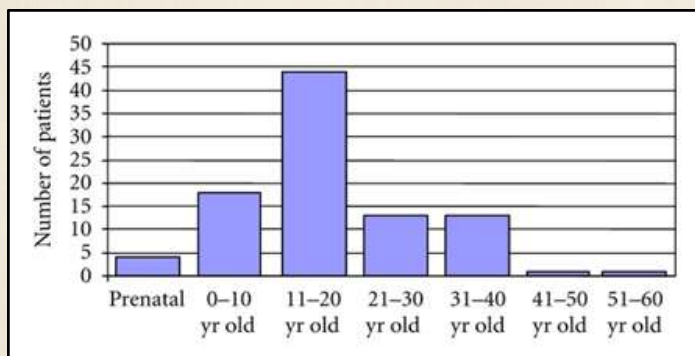


Figure: 5

There's no cure for Klinefelter Syndrome, but some of the problems associated with the condition can be treated if necessary. Possible treatments include: testosterone replacement therapy. Speech and language therapy during childhood to help with speech development.

Treatment for Klinefelter Syndrome:

Males with Klinefelter syndrome can given testosterone , a hormone needed for sexual development. If treatment is started around the age of puberty , it can help boys with the sexual development of their bodies. Testosterone is given by injection or through a skin patch or gel. And also as the genetic variation is irreversible, no causal therapy is available . From the onset of puberty , the existing testosterone deficiency can be compensated by appropriate hormone-replacement therapy. If gynecomastia is present the surgical removal of the breast my be considered for both the psychological reasons and to reduce the risk of breast cancer.



Figure: 6

Conclusion:

Klinefelter Syndrome is a genetic condition affecting mainly males and it's often isn't diagnosed until adulthood. Klinefelter Syndrome is associated with a significant high morbidity rate compared to the male

population as a whole. The main associated disorders are varicose veins, thrombosis, embolism type 2 diabetes, bone fractures, epilepsy, and other neurological and mental disorders. Hypogonadism in Klinefelter Syndrome begins as a mild dysfunction of the germ and Leydig cell populations and ends up as a severe dysfunction mainly affecting germ cells.

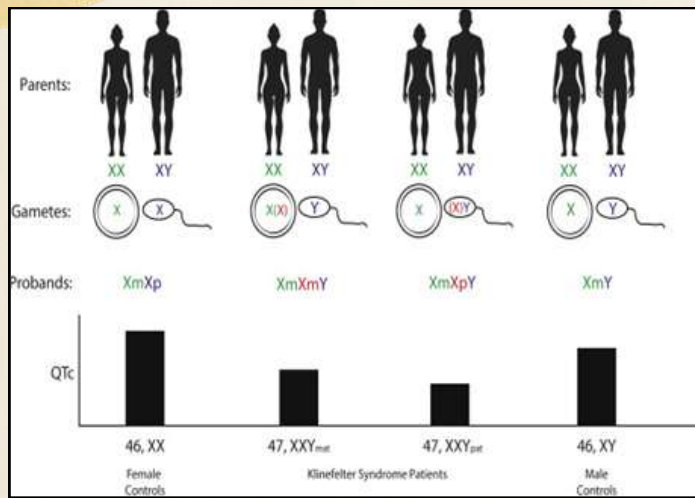


Figure: 7

References:

- ❖ <https://en.m.wikipedia.org/wiki>
- ❖ <https://www.google.co.in>
- ❖ <https://scholar.google.com>
- ❖ <https://byjus.com>
- ❖ <https://medineplus.gov/condition>
- ❖ <https://kidshealth.org/parents/kii>
- ❖ <https://www.healthdirect.gov.au/kl...>
- ❖ <https://www.sciencedirect.com/kl...>
- ❖ <https://my.clevelandclinic.org/health/21116>



XENOTRANSPLANTATION: A NEW CLINICAL ERA

Sangita Nayek

B.Sc. (H) in Biotechnology,
2021-2022,
The Neotia University

Abstract:

Blood from different animal species was transfused between the 17th and 20th centuries into patients with having a range of different clinical conditions. In the 19th century, skin grafts from a number of animals were used and for example it was started from frogs and today's it's being the most common. Voronoff promoted the transplanting of chimpanzee testis slices into elderly men in the 1920s because he thought that the hormones released by the testis would revive his patients. Thirteen individuals had been transplanted with chimpanzee's kidneys from Reemtsma in 1963-1964. During that time dialysis was not yet widely used and human organs were not yet available. One patient went back to work for nearly nine months before passing away due to electrolyte problem. Hardy used a chimpanzee heart to perform the first human heart transplant ever, but the patient passed away two hours later. Starzl performed the first liver transplant from a chimpanzee to a human in 1966. In 1992, he achieved patient survival for 70 days after a baboon liver transplant. Groth performed the first clinical pig islet transplant in 1993. Today, genetically altered pigs give individuals in need of a transplant hope for an endless supply of organs and cells.

Introduction:

When a 57-year-old man with fatal heart disease underwent the first-ever transplant of

a genetically altered pig heart in January 2022, xenotransplantation—the technique of implanting an organ from one animal species into another—took a significant step forward. The patient had a 61-day lifespan. Using xenografts from genetically modified pigs is one of the most promising solutions to the lack of transplantable human organs. In this context, hyper acute rejection has proven to be challenging. This has been avoided by creating pigs with the alpha-1,3-galactosyltransferase gene deletion and sub capsular autologous thymic tissue. Since the middle of the 1980s, xenotransplantation (cross-species transplantation) has been my main field of research interest. It intends to address the pressing need for organs from deceased human donors by providing an alternative source of organs from genetically engineered pigs. We have now travelled an intriguing and thrilling, if occasionally difficult, road and appear to be very close to the beginning of official clinical research.

Genetically Modified Pigs For Xenotransplantation:

Numerous genetically engineered pigs have been produced, according to studies on immunological rejection and coagulation dysregulation, to overcome interspecies molecular incompatibilities. The majority of the advancements in the field of xenotransplantation since 2009 have been made possible by the generation of Hoof pigs that have undergone genetic engineering.

Abbreviations	Gene Name	Function
GTKO	1.3-galactoferase KO (GGTA1 KO)	Deletion of Gal epitope
CMAH KO	CMP-N-acetylneuraminic acid hydroxylase KO	Deletion of NeugC epitope
B4GalNT2 KO	B-1,4N-galactosaminyltransferase KO	Deletion of Soa epitope
hCD46(MCP)	Human membrane collector protein transgene	Inactivation complement factors C3b and Cb
hCD55(DAF)	Human decay accelerating factor gene	Acceleration of complement decay
hCD59(MAC-IP)	Human membrane attack complex C5b-9 Inhibitory protein transgene	Inhibition of the complement membrane attack complex C5b-9
hTBM	Human thrombomodulin	Anticoagulation activates protein C)
hTFPI	Human tissue factor pathway inhibitor	Antagonize the function of tissue factor
hCD39(hENTPD1)	Human ectonucleoside triphosphate diphosphohydrolase-1 transgene	Anticoagulation and anti-inflammatory
hA20	Human tumor necrosis factor alpha-induced protein-3 transgene	Inhibition of NF-kappaB activation and TNF-mediated apoptosis
hCD47	Human integrin associated protein transgene	Regulation of macrophage activation and phagocytosis
CTLA4- Ig	Cytotoxic T lymphocyte-associated protein 4-immunoglobulin transgene	Cellular immune response inhibition of T-cell costimulation via CD86/CTLA4
CIITA-DN	MHC class transactivator dominant negative	Suppression of T-cell activation
hHO1	Human hemo oxygenase 1 transgene	Antiapoptosis; cytoprotection; anti-inflammatory
ASGR1 KO	Asialoglycoprotein receptor 1	Decreases human platelet phagocytosis by pig Sinusoidal endothelial cells
PERV Inactivation	Porcine endogenous retrovirus innovation	Xenozoonosis

Table 1: Summary of gene knockouts and human transgenes, thought to be most relevant for xeno-organ transplantation. KO indicates gene inactivation

A wide range of genetically modified pigs have been created as a result of advancements in gene-editing tools, particularly clustered regularly interspaced short palindromic repeats-Cas9 (CRISPR/Cas9), and the generation of source pigs with multiple edited genes has gotten simpler and quicker. We include the genetically altered pigs that are currently accessible for xenotransplantation in this section.

Expression of Human Anti-inflammatory Proteins:

A possible method to improve the success and safety of the surgery is the production of human anti-inflammatory proteins in xenotransplantation. These proteins, like TGF- β or Interleukin-10 (IL-10), are essential for controlling immune responses and minimizing inflammation. It is now possible to reduce the danger of hyperacute rejection and acute inflammatory reactions when these organs are transplanted into humans by genetically altering donor animals, especially pigs, to manufacture and express human anti-inflammatory proteins within their organs. By reducing the recipient's immune system's harsh reaction to the foreign tissue, this genetic modification increases the likelihood that the graft will survive. This strategy marks a significant development in xenotransplantation, potentially addressing the long-standing immunological difficulties linked to the transplanting of organs from different species while improving patient outcomes. This strategy is a significant advancement in xenotransplantation because it may provide a solution to the long-standing immunological problems brought on by interspecies organ transplantation, improve patient outcomes, and expand the supply of organs available to those in need.

First pig-to-human heart transplantation:

At the University of Maryland School of Medicine (Baltimore, MD, USA), a genetically altered pig heart was successfully transplanted into a 57-year-old man who was in the latter stages of cardiac disease, making it the first porcine-to-human heart transplantation ever conducted. The patient was able to move around without the aid of cardiopulmonary bypass following a very experimental procedure. The historic procedure surmounted the biggest impediment posed by hyper acute immunological rejection and produced positive short-term outcomes.

CRISPR/Cas Technology in Pig-to-Human Xenotransplantation:

Pig-to-human xenotransplantation has been transformed by CRISPR/Cas technology, which also addresses major challenges in this area. CRISPR allows researchers to accurately modify pig genomes, preventing problems like hyper acute rejection. For instance, disrupting genes like alpha-1,3-galactosyltransferase that cause pig-to-human immunological incompatibility can lower the chance of organ rejection. Additionally, CRISPR makes it possible to splice human genes into pig organs, giving them more human-like traits. By reducing the possibility of interspecies infections and enhancing organ performance, this method makes xenotransplants safer and more efficient. Nevertheless, there are still issues with ethics and regulations, which call for careful monitoring and evaluation of possible hazards. However, CRISPR/Cas technology continues to be a valuable tool for improving the viability of pig-to-human xenotransplantation and perhaps addressing the ongoing organ donor scarcity.

Safety:

Transferring animal organs to people through xenotransplantation raises safety issues by nature. The possibility of diseases spreading across species borders is foremost among these. Critical measures include constant surveillance and stringent screening of donor animals. A further difficulty is the probable rejection of animal organs by the human immune system, which has prompted research into genetic alterations to address this problem. The importance of ethical issues calls for open procedures and public awareness initiatives. Furthermore, continued research is necessary due to the potential problems and long-term health implications. To assure the safety of xenotransplantation and strike a balance between relieving organ shortages and reducing hazards to human health, robust regulatory frameworks and oversight are essential.

Conclusion:

In conclusion, xenotransplantation offers hope to innumerable people in need of life-saving transplants and shows enormous promise as a potential solution to the organ scarcity dilemma. Despite the field's substantial scientific advancements, obstacles, including immunological barriers and the threat of zoonotic illnesses, must be overcome by continued research and stringent safety procedures. To protect the wellbeing of both recipients and animals, ethical issues must continue to be at the forefront of xenotransplantation research. The future of xenotransplantation provides a glimpse into a society in which organ scarcity is no longer a limiting factor in healthcare as research advances. The future of organ transplantation may be changed by this creative strategy with ongoing commitment, cooperation, and moral vigilance.

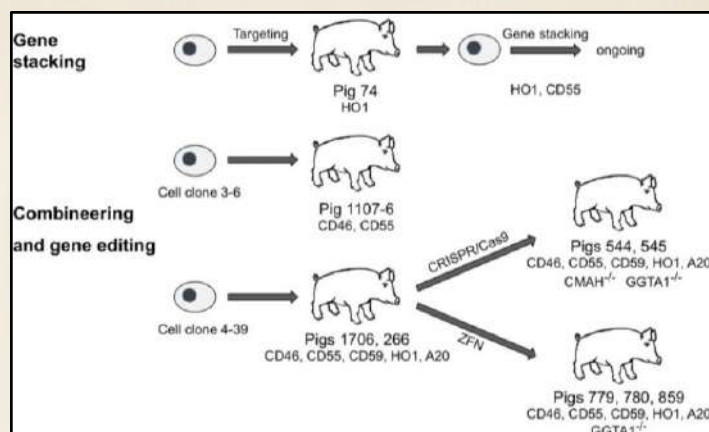


Fig. 1: Genetic modification schemes

References:

- <https://www.frontiersin.org/files/Articles/504994/fimmu-10-03060->
- HTML/image_m/fimmu-10-03060-t001.jpg
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4684730/>
- <https://www.nature.com/articles/srep29081/figures/1>

THE MICROBIOME AND HUMAN HEALTH

Sujan Basak

B.Sc. (H) in Biotechnology,
2021-2022,
The Neotia University

Abstract:

Human health is significantly shaped by the human microbiome, a varied collection of microbes that live inside the human body. The complicated connection between the human microbiome and numerous elements of health and disease is examined in this study report. This study attempts to clarify the crucial function of the microbiome in preserving health and its potential as a therapeutic target for the prevention and treatment of illnesses via a thorough assessment of recent developments in microbiome research and the scientific literature.

Keywords:

Microbiome, Human health, Gut microbiome, Microbial diversity, Immune system, Metabolic health,

Introduction:

The human microbiome is the aggregate name for the billions of bacteria that live inside the human body. The skin, mouth cavity, gastrointestinal system, and reproductive organs are just a few of the bodily sections inhabited by these microorganisms, including bacteria, viruses, fungi, and archaea. The human microbiome participates actively in numerous physiological processes, affecting

health and happiness, rather than acting as a passive bystander. This article is about the microbiome present in humans and its importance in human health.

Microbiome composition and dynamics in humans:

The ecosystem of the human microbiome is intricate and ever-changing. It consists of countless species, each with a specific purpose and function. Each person's microbiome is unique and depends on their genetics, environment, nutrition, and lifestyle. To understand how this variation affects human health, it is essential to comprehend it.

The Microbiome's Purposes:

The microbiome is engaged in a wide range of essential processes, such as:

Microbes assist in the digestion of complex carbohydrates, the synthesis of vitamins, and the enhancement of nutrient absorption.

Immune System Modulation: The microbiome affects the growth and operation of the immune system, defending against infections and autoimmune diseases. Bioactive chemicals, such as short-chain fatty acids, are created by microbes and play a part in metabolism and inflammation.

The Microbiome and Digestive Health:

In particular, the gut microbiota is crucial for digestion and nutritional absorption.

Gastrointestinal illnesses, including irritable bowel syndrome (IBS) and inflammatory bowel disease (IBD), have been related to imbalances in the gut microbiota. The gut-brain axis has recently received attention in studies showing how gut microbiota influences neurological and mental health issues.

Studies on gut microbiota and metabolic health have shown a clear connection between the two. Obesity, type 2 diabetes, and metabolic syndrome are all correlated with dysbiosis, an imbalance in the gut microbiota. Inflammation and energy metabolism are impacted by gut microbes, which have an influence on metabolic health overall.

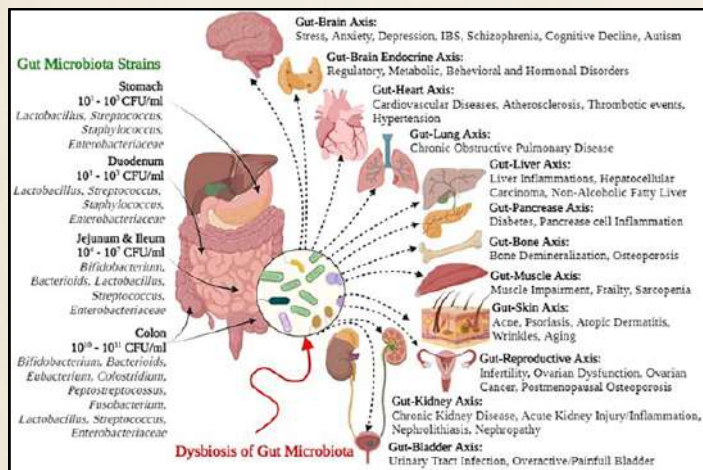


Figure-1: Gut microbial strains

Gastrointestinal illnesses, including irritable bowel syndrome (IBS) and inflammatory bowel disease (IBD), have been related to imbalances in the gut microbiota. The gut-brain axis has recently received attention in studies showing how gut microbiota influences neurological and mental health issues.

Studies on gut microbiota and metabolic health have shown a clear connection between the two. Obesity, type 2 diabetes, and metabolic syndrome are all correlated with dysbiosis, an imbalance in the gut microbiota. Inflammation and energy metabolism are impacted by gut microbes, which have an influence on metabolic health overall. health and happiness, rather than acting as a passive bystander.

This article is about the microbiome present in humans and its importance in human health.

Microbiome composition and dynamics in humans:

The ecosystem of the human microbiome is intricate and ever-changing. It consists of countless species, each with a specific purpose and function. Each person's microbiome is unique and depends on their genetics, environment, nutrition, and lifestyle. To understand how this variation affects human health, it is essential to comprehend it.

The Microbiome's Purposes :

The microbiome is engaged in a wide range of essential processes, such as :

Microbes assist in the digestion of complex carbohydrates, the synthesis of vitamins, and the enhancement of nutrient absorption.

Immune System Modulation: The microbiome affects the growth and operation of the immune system, defending against infections and autoimmune diseases. Bioactive chemicals, such as short-chain fatty acids, are created by microbes and play a part in metabolism and inflammation.

The Microbiome and Digestive Health :

In particular, the gut microbiota is crucial for digestion and nutritional absorption.

Discussion:

Immunity and Microbiome:

Gut microbiota is particularly important for the growth and operation of the immune system. The immune system is strengthened by early exposure to a variety of microorganisms, which lowers the likelihood of allergies and autoimmune conditions. Microbiome imbalances can interfere with immunological homeostasis.

Therapeutic Consequences:

Promising approaches to illness prevention and treatment include microbiome-targeted therapies. Live beneficial bacteria known as probiotics have demonstrated promise in reducing gastrointestinal discomfort and boosting immune response. Prebiotics are another method for enhancing the health of the microbiome since they feed advantageous microorganisms. Faecal microbiota transplantation (FMT), a process that involves transferring healthy donor microbiota to a patient, has shown promising results in the treatment of severe gut infections.

Conclusion:

In conclusion, the human microbiome is an active and crucial part of human health. It has an impact on immunological response, metabolism, and even mental health in addition to the stomach. Innovative treatments and preventative measures are made possible by an understanding of the microbiome's involvement in health and illness. Research in the future will continue to reveal the complex ways by which the microbiome affects human health.

Acknowledgements:

I would like to express my heartfelt gratitude to our esteemed Dean sir of the School of Science and Technology, as well as our HOD sir and dedicated faculty members of the Biotechnology Department. Your guidance, support, and expertise have been invaluable throughout my academic journey. Thank you for your unwavering commitment to our education and growth.

References:

1. Sender, R., Fuchs, S., & Milo, R. (2016). Revised Estimates for the Number of Human and Bacteria Cells in the Body. *PLOS Biology*, 14(8), e1002533.
2. Cho, I., & Blaser, M. J. (2012). The Human Microbiome: At the Interface of Health and Disease. *Nature Reviews Genetics*, 13(4), 260-270.
3. Afzaal M, Saeed F, Shah YA, Hussain M, Rabail R, Socol CT, Hassoun A, Pateiro M, Lorenzo JM, Rusu AV & Aadil RM (2022) Human gut microbiota in health and disease: Unveiling the relationship. *Front. Microbiol.* 13:999001.



VENOMOUS CABBAGE

Shrabani Mondal

B.Sc. (H) in Biotechnology,
2022-2023,
The Neotia University

Abstract:

Venomous Cabbages, like regular cabbages, undergo modification to produce scorpion poison, harmful to caterpillars and other insects when they bite the leaves. Despite being toxic to certain insects, these cabbages remain safe for human consumption. They are essentially normal cabbages, but rather than being treated with pesticides, scorpion venom from the tail is infused into them, causing the cabbage to develop venomous properties. This unique feature not only makes them harmful to pests but also helps decrease the reliance on conventional pesticides.

Introduction:

Venomous Cabbages are a result of genetic modification, where cabbages are infused with scorpion poison to deter caterpillars from consuming the crops. The scorpion poison, derived from the genetically modified genes of *Androctonus australis hector*, known as "AaIT," contains 70 amino acids and induces necrosis, causing the death of cells in an organ or tissue. This modified scorpion poison is carefully engineered to ensure it poses no harm to humans while effectively preventing caterpillars from feeding on the cabbage. The genetic material extracted from scorpions releases a nerve poison, paralyzing the caterpillar and swiftly halting its consumption, allowing the modified cabbage to resist pests efficiently.

Why make the scorpion venom infused virus?

The primary motive for incorporating a potentially lethal poison into food is to keep insects, caterpillars, and other animals away from cabbage gardens. This genetically modified cabbage requires significantly less pesticide than conventionally grown cabbage. When pesticides are introduced into plants, every cell in the plant begins to produce the pesticide.

Role of enzymes in these processes:

The AaT strand was created by cloning the full-length coding sequence into a pBluescript II SK phagemid, resulting in the vector pBS-AaIT. This phagemid boasts an extensive multiple cloning site housing 21 unique restriction enzyme recognition sites. Adjacent to this site, T7 and T3 RNA polymerase promoters are present, facilitating in vitro RNA synthesis.

Subsequently, the synthesized coding sequence was introduced into the cabbage embryo, leading to the formation of the new gene. As the new gene took shape, the cabbage began to grow with the venom already encoded into its DNA.

What are the Pros and Cons of it ?

Pros:

- By reducing the amount of pesticide usage, the price of crops is significantly lower compared to conventionally grown cabbage.
- This reduction in pesticide usage also diminishes pest attacks and minimizes damage caused by pests.
- The scorpion venom used is carefully selected to ensure it does not harm humans. The genome chosen, known as AAiT, is specifically targeted to be toxic to insects while posing no harm to humans.

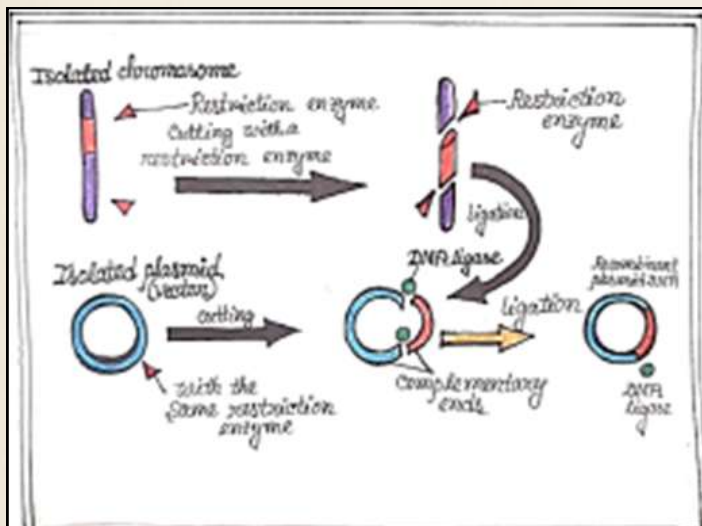


Fig. 1: Role Of Enzymes In These Processes

Cons:

- It will reduce the insect population, as a result, the entire ecosystem will be altered. Predatory animal will go hungry, and their populations will also decrease slowly. The biodiversity or the balance of nature will be destroyed.
- It interrupt the food web of the enclosure environment.

References:

- <https://www.thealternativedaily.com/scorpion-poison-in-this-vegetable/>

- <https://explorebiotech.com/venomous-cabbage-cabbage-with-scorpion-poison-engineered-in-every-cell>
- <https://www.nature.com/articles/7290120>
- <https://prezi.com/-vrfhdduino2/venomous-cabbage>
- <https://www.pnas.org/content/100/3/922>



SUPPLY CHAIN TRANSPARENCY IN PHARMACEUTICALS: A BLOCKCHAIN SOLUTION

Angshuman Nandi

Computer Science and Engineering,
2020-2021,
The Neotia University

Mr. Sandipan Chakravorty

Assistant Professor,
CSE, School of Science & Technology,
The Neotia University

Abstract:

The pharmaceutical industry is one of the most critical sectors for public health, yet it faces significant challenges related to supply chain transparency, traceability, and counterfeiting. With increasing globalization and complexity in the pharmaceutical supply chain, ensuring the integrity and safety of medicines has become a paramount concern. Blockchain technology offers a promising solution to these challenges. This research article delves into the issues surrounding pharmaceutical supply chains, the potential benefits of implementing blockchain technology, and the challenges and considerations associated with its adoption.

Keywords:

Pharmaceutical Supply Chain, Blockchain Technology, Drug Traceability

Introduction:

The pharmaceutical supply chain is a complex web of manufacturers, distributors, wholesalers, pharmacies, and healthcare institutions. It plays a crucial role in delivering safe and effective medications to patients

worldwide. However, this complexity also opens the door to various issues such as counterfeit drugs, substandard products, and inefficient tracking of pharmaceuticals. These problems not only jeopardize patient safety but also lead to economic losses for the industry.

Blockchain technology, which gained prominence as the underlying technology for cryptocurrencies, has emerged as a potential solution to enhance supply chain transparency and security. Blockchain offers a decentralized and immutable ledger where data is recorded in a tamper-resistant manner, making it an ideal tool for tracking pharmaceutical products throughout their journey from manufacturing facilities to patients.

The Current Landscape of Pharmaceutical Supply Chains

Before we delve into the potential solutions offered by blockchain technology, it is crucial to understand the existing intricacies and challenges that characterize pharmaceutical supply chains. The current state of affairs in this industry, while essential for delivering life-saving medications, is marked by several noteworthy aspects:

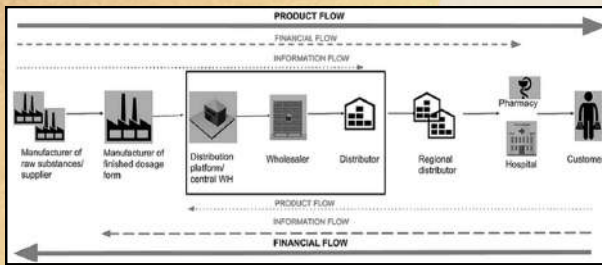


Fig. 1: Existing Pharmaceutical Supply Chains

1. Complexity and Fragmentation

The pharmaceutical supply chain is intricate, comprising a multitude of stakeholders and touchpoints. It commences with the manufacturing of active pharmaceutical ingredients (APIs) and progresses through the assembly, packaging, distribution, and dispensing phases. These complex networks often involve multiple intermediaries, including contract manufacturers, distributors, wholesalers, and retail pharmacies. The labyrinthine nature of these supply chains can obscure transparency and complicate traceability efforts.

2. Lack of End-to-End Visibility

End-to-end visibility is a challenge in the pharmaceutical industry. At times, certain supply chain segments operate in isolation, leading to information silos. This lack of visibility hampers real-time tracking, making it difficult to ascertain the precise location, condition, and authenticity of pharmaceutical products as they traverse the supply chain.

3. Counterfeit and Substandard Drugs-not just a “DEVELOPING” WORLD Problem:

Even the WHO frames this issue as a third-world worry, and web searches reflect this viewpoint, although it is a truly global dilemma encompassing both richer and poorer parts of the world. Data from the Pharmaceutical Security Institute on counterfeiting

occurrences suggest that unlawful trafficking of medications in 137 countries grew by 38%, from 3146 in 2016 to 4344 in 2020. The 2020 data set includes 2451 distinct medications from various therapeutic areas. North America ranked first (32% of all regions) in terms of counterfeit pharmaceutical seizures in 2020, followed by Asia Pacific (23%), Latin America, Eurasia, the Near East, Europe, and Africa (3%), in that order..[5]

Pharmaceutical counterfeiting is a serious hazard to public health. The World Health Organization (WHO) reports that more than 10% of the worldwide pharmaceutical industry contains counterfeit medications, which contributes to hundreds of thousands of fatalities annually. Blockchain's capacity to offer an open and unchangeable record of medicine transactions can aid in preventing the introduction of fake medications into the supply chain.

Counterfeit and substandard drugs pose a significant threat to patient safety and industry integrity. These illicit products often infiltrate the supply chain due to gaps in oversight and tracing mechanisms. Patients, expecting genuine medication, may unknowingly receive counterfeit or substandard drugs, leading to health risks and eroded trust in pharmaceutical brands.[5]

4. Regulatory Compliance Challenges

The pharmaceutical industry operates under stringent regulations to ensure the quality and safety of medications. Regulatory compliance encompasses diverse areas, including Good Manufacturing Practices (GMP), Good Distribution Practices (GDP), and controlled temperature storage and transportation. Meeting these requirements demands meticulous record-keeping, reporting, and adherence to guidelines. Non-compliance can lead to regulatory actions, product recalls, and

reputational damage.

5. Product Recalls

Efficient and precise product recalls are essential for patient safety. However, the current mechanisms for initiating and executing recalls are often time-consuming and error-prone. The lack of real-time data and comprehensive traceability can hinder the swift identification and removal of defective or unsafe products from the market.

6. Data Privacy and Security

Sensitive patient and product data traverse the pharmaceutical supply chain, necessitating stringent data privacy and security measures. Existing systems may fall short in safeguarding this information, potentially exposing it to breaches and unauthorized access.

In summary, the pharmaceutical supply chain, while indispensable, grapples with challenges related to complexity, transparency, counterfeit drugs, regulatory compliance, and data security. These challenges not only jeopardize patient safety but also impose substantial financial burdens on the industry. Blockchain technology, with its capacity to address these issues, emerges as a promising solution.

In the subsequent sections of this article, we will explore how blockchain can revolutionize the pharmaceutical supply chain by enhancing transparency, traceability, and security while mitigating the existing challenges.

Methodology:

The successful implementation of blockchain technology in the pharmaceutical supply chain requires a systematic approach that considers various technical, organizational, and regulatory aspects. Below, we outline a methodology that pharmaceutical companies

and stakeholders can follow to harness the benefits of blockchain while addressing the challenges:

1. Needs Assessment and Stakeholder Mapping

Identify Stakeholders: Begin by identifying all the stakeholders in the pharmaceutical supply chain, including manufacturers, distributors, wholesalers, pharmacies, and regulatory bodies.

Assess Needs: Conduct a thorough assessment of the specific pain points and challenges faced by each stakeholder. This step is essential for tailoring the blockchain solution to address the unique requirements of the industry.[1]

2. Selecting the Appropriate Blockchain Platform

Private vs. Public Blockchain: Decide whether to opt for a private (permissioned) or public (permissionless) blockchain. In the pharmaceutical industry, a private blockchain is often preferred to maintain control over data and access.

Choose the Technology Stack: Select the appropriate blockchain platform and technology stack based on factors such as scalability, security, and compatibility with existing systems.

3. Designing Smart Contracts and Data Structures

Smart Contracts: Define and develop smart contracts that automate various processes within the supply chain. These contracts should be in line with regulatory requirements and industry standards.

Data Structure: Create a standardized data

structure that ensures consistency and compatibility across the supply chain network.

4. Pilot Testing and Proof of Concept

Conduct a Pilot: Implement a pilot project involving a limited segment of the supply chain to test the blockchain solution's functionality and efficiency.

Gather Feedback: Solicit feedback from participants during the pilot phase to identify any issues or improvements needed.

5. Scalable Infrastructure Development

Infrastructure Planning: Based on the results of the pilot project, design a scalable and robust infrastructure to support the full-scale implementation of blockchain across the entire supply chain.

Security Measures: Implement robust security measures, including encryption and access controls, to protect sensitive data.

6. Integration with Existing Systems

Seamless Integration: Ensure that the blockchain system seamlessly integrates with existing supply chain management systems, databases, and IoT devices.

7. Data Migration and Legacy System Decommissioning

Data Migration: Migrate relevant data from legacy systems to the blockchain ledger. This step is critical for ensuring a complete and accurate historical record.

Decommission Legacy Systems: Safely

decommission obsolete legacy systems to avoid redundancy and reduce maintenance costs.[2]

8. Regulatory Compliance and Reporting

Compliance Framework: Establish a compliance framework that aligns with industry regulations and guidelines.

Real-time Reporting: Leverage blockchain's real-time reporting capabilities to streamline regulatory reporting processes.

9. Training and Education

Training Programs: Provide comprehensive training to all stakeholders on how to use and interact with the blockchain system.

Awareness Campaigns: Raise awareness about the benefits of blockchain technology in enhancing supply chain transparency.

10. Continuous Monitoring and Improvement

Monitoring and Auditing: Continuously monitor the blockchain network for anomalies and conduct regular audits to ensure data integrity.

Feedback Mechanism: Establish a feedback mechanism to gather insights from stakeholders and make continuous improvements to the system.

By following this methodology, pharmaceutical companies can systematically adopt blockchain technology, addressing the challenges of supply chain transparency while enhancing overall efficiency and security.

Experimental Findings:

Examining the results of these experiments provides insights into the practical advantages and possible obstacles related to the adoption of blockchain technology to improve transparency in the pharmaceutical supply chain. The implementation of blockchain technology in a pharmaceutical supply chain can significantly enhance transparency, traceability, and security.

Below is an explanation of how the flow of a pharmaceutical supply chain can be improved with blockchain:

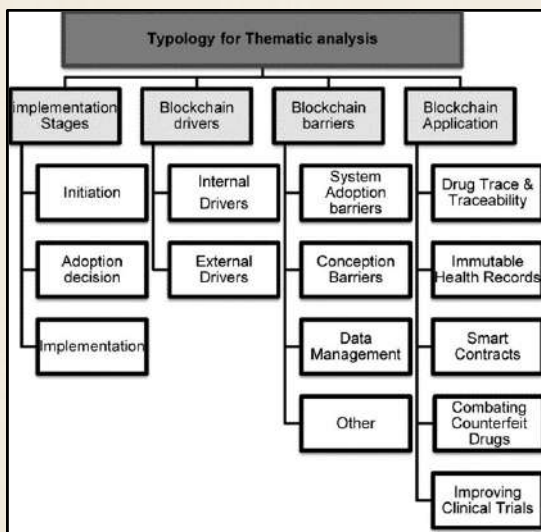


Fig. 2: Typology for Thematic Analysis

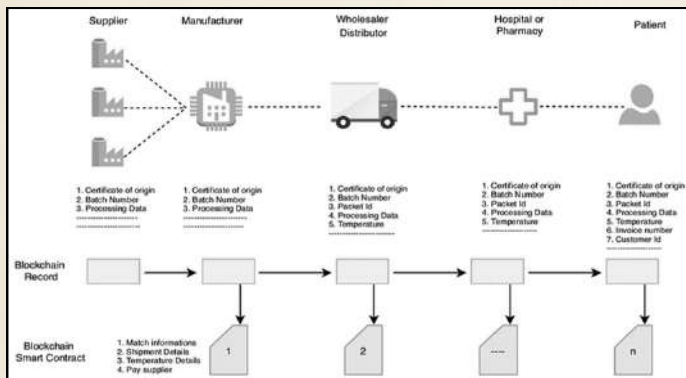


Fig.3: Flow of Blockchain based pharmaceutical supply chain

1. Manufacturing Phase:

Blockchain Implementation: The process begins at the manufacturing phase, where pharmaceutical companies produce drugs and active pharmaceutical ingredients (APIs). Each batch of drugs or APIs is assigned a unique identifier, often in the form of a QR code or barcode, which is recorded on the blockchain.

Data Entry and Smart Contracts: Manufacturers input crucial information about the production process, including manufacturing dates, quality control results, and storage conditions. Smart contracts within the blockchain network can automate quality control checks and trigger alerts if any discrepancies are detected.

2. Distribution Phase:

Tracking Batches: As the pharmaceutical products leave the manufacturing facility, blockchain technology ensures real-time tracking. At each distribution point, the blockchain records the movement of batches, including the time and location of transfer.

Authentication and Verification: When pharmaceutical products change hands, authorized participants, such as distributors and wholesalers, can use their access to the blockchain to verify the authenticity and integrity of the products. This significantly reduces the risk of counterfeit drugs infiltrating the supply chain.

3. Pharmacy and Retail Phase:

Receipt and Verification: Pharmacies and retail outlets receive pharmaceutical products and verify their authenticity by scanning the unique identifiers (QR codes or barcodes) on the packaging. The blockchain instantly confirms whether the product matches the recorded data from the manufacturing phase.

Patient Dispensing: When patients purchase medication, their transactions can also be recorded on the blockchain, creating a complete and tamper-resistant history of the product's journey.

4. Recall and Compliance:

Swift Recalls: In the event of a product recall, blockchain technology enables rapid

and precise identification of affected batches. Smart contracts can automate recall processes, notifying relevant parties and preventing the sale of recalled products.

Regulatory Reporting: Blockchain facilitates real-time reporting of compliance data to regulatory authorities. This ensures that pharmaceutical companies can easily demonstrate adherence to regulatory requirements, reducing compliance-related issues.

5. Data Privacy and Security:

Data Encryption: Sensitive data related to patients and product information is encrypted and stored securely on the blockchain. Access controls ensure that only authorized parties, such as regulators and healthcare providers, can access specific data.

Immutable Ledger: The blockchain ledger is tamper-resistant, meaning that once data is recorded, it cannot be altered or deleted. This immutable record enhances data integrity and accountability.

6. End-to-End Transparency:

Real-time Visibility: All stakeholders in the supply chain, including manufacturers, distributors, pharmacies, healthcare providers, and patients, have real-time access to the blockchain ledger. This transparency enhances trust and accountability throughout the supply chain.

7. Data Analytics and Continuous Improvement:

Data Analytics: Pharmaceutical companies can leverage the wealth of data stored on the blockchain for analytics and insights. This data-driven approach can help optimize supply chain operations, predict demand, and

identify areas for improvement.

Continuous Improvement: The transparency and traceability provided by blockchain technology enable continuous improvement in supply chain processes, helping pharmaceutical companies refine their operations and reduce costs over time.

By implementing blockchain technology in the pharmaceutical supply chain, the flow of products becomes more transparent, secure, and efficient. This not only safeguards patient safety but also helps the industry address issues such as counterfeit drugs, compliance challenges, and product recalls with greater speed and accuracy.

Discussions:

The discussion section delves into the implications and considerations surrounding the adoption of blockchain technology in pharmaceutical supply chains, focusing on the benefits, challenges, and future prospects.

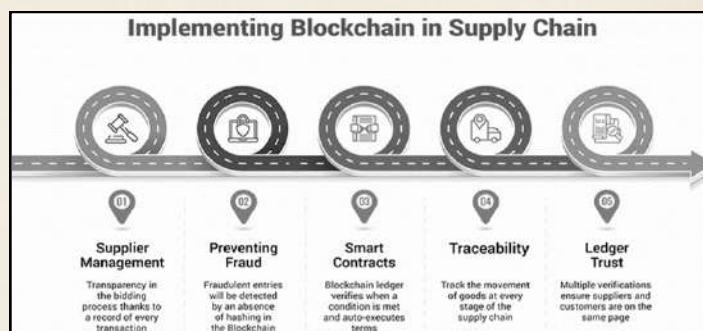


Fig. 4: Implementing Blockchain in Supply Chain

1. Benefits of Blockchain in Pharmaceuticals

The implementation of blockchain technology offers several significant advantages for the pharmaceutical industry. Firstly, it enhances supply chain transparency by providing a secure and immutable ledger that records every transaction, ensuring that the provenance of each pharmaceutical product can be tracked from manufacturing to distribution. This not only reduces the risk of

counterfeit drugs but also increases overall product authenticity.

Furthermore, blockchain's immutability ensures the integrity of data. Once data is recorded, it cannot be altered or deleted, preventing unauthorized tampering. This is paramount in an industry where data accuracy is critical to ensuring patient safety.[3]

The introduction of smart contracts also plays a pivotal role in streamlining operations within the pharmaceutical supply chain. These self-executing agreements automate various tasks, such as verifying product authenticity and ensuring compliance with regulatory standards. The result is a reduction in the need for intermediaries, decreased administrative costs, and improved efficiency.[4]

Finally, the enhanced transparency that blockchain offers is a catalyst for improved coordination among supply chain stakeholders. By providing all parties with equal access to the same data, trust is fostered, disputes are minimized, and communication between different stakeholders becomes more efficient.

2. Challenges and Considerations:

While blockchain holds great promise for improving pharmaceutical supply chain transparency, its adoption is not without challenges:

Integration Complexity:

Integrating blockchain into existing supply chain systems can be complex and costly. Pharmaceutical companies must carefully plan and invest in the necessary infrastructure and partnerships.

Standardization:

A lack of industry-wide standards for

blockchain implementation can hinder interoperability between different stakeholders in the supply chain. Establishing common protocols and standards is essential for the technology's widespread adoption.

Scalability:

Blockchain networks must handle a vast amount of data in real-time. Scalability remains a concern, and selecting the right blockchain platform is crucial to ensure it can handle the demands of the pharmaceutical supply chain.

Regulatory Framework:

Regulators need to adapt to blockchain technology. Clear guidelines and regulations regarding its use in the pharmaceutical industry are essential to ensure compliance.

3. Future Prospects:

The future of blockchain technology in pharmaceutical supply chains is promising. As regulatory bodies and industry stakeholders continue to recognize its potential, we can expect to see more widespread adoption and further innovation in this space.

Collaboration among industry players, including pharmaceutical companies, regulatory agencies, and technology providers, will be essential to overcoming current challenges. The development of industry-wide standards and best practices will facilitate a smoother transition to blockchain-based supply chains.

Moreover, as blockchain technology evolves, it may offer solutions to additional challenges, such as temperature monitoring for biopharmaceuticals and ensuring the authenticity of clinical trial data.

In conclusion, blockchain technology holds the potential to transform pharmaceutical supply chains by addressing issues related to transparency, security, and efficiency. While challenges exist, collaborative efforts and ongoing advancements in blockchain technology are poised to revolutionize the pharmaceutical industry, ultimately benefiting patient safety and the integrity of the global healthcare ecosystem.

Conclusion:

Blockchain technology offers a transformative solution to the challenges of supply chain transparency in the pharmaceutical industry. Its ability to provide an immutable ledger, real-time tracking, and automated compliance processes can enhance patient safety, reduce the prevalence of counterfeit drugs, and streamline supply chain operations. While challenges exist, the potential benefits far outweigh the obstacles. As pharmaceutical companies continue to explore and invest in blockchain solutions, we can expect a safer, more transparent, and efficient pharmaceutical supply chain in the near future.

In the realm of pharmaceuticals, where every pill, vial, or dose carries with it the promise of health and well-being, the imperative for a transparent, secure, and efficient supply chain is paramount. The pharmaceutical industry has stood as a stalwart guardian of public health, but it grapples with challenges that can only be surmounted through innovation. In this pursuit, blockchain technology shines as a beacon of transformation, offering the potential to revolutionize how medicines are produced, distributed, and safeguarded.

Our journey through the labyrinthine landscape of pharmaceutical supply chains has unveiled a poignant narrative—a story of complexity, fragmentation, and, at times, vulnerabilities. The existing system, while

resilient, is not immune to the perils of counterfeit drugs, substandard products, and regulatory mazes that obscure transparency. These challenges not only jeopardize patient safety but also cast shadows over the industry's reputation.

Enter blockchain—a technology that transcends its origins as the backbone of cryptocurrencies to redefine how pharmaceutical supply chains operate. It does so by weaving a tapestry of attributes, including transparency, traceability, security, and automation, into the very fabric of the supply chain. Our exploration has revealed that blockchain can deliver:

Real-Time Transparency: Blockchain brings unparalleled visibility to every step of the pharmaceutical journey, from manufacturing facilities to the hands of patients. This transparency fosters trust among stakeholders and safeguards patient well-being.

Efficient Traceability: The immutable nature of blockchain ledgers ensures that every product's history is indelibly etched. This is a formidable deterrent to counterfeit drugs, as unauthorized entries and alterations become virtually impossible.

Streamlined Compliance: Through smart contracts, regulatory compliance becomes an automated, error-reducing process, aligning the industry with stringent standards and requirements.

Swift Recalls: In the event of a product recall, blockchain technology facilitates precise, rapid action—shielding patients from harm and minimizing financial losses.

Data Fortification: Sensitive patient and product data find refuge in blockchain's secure confines, protected by encryption and access controls.

Operational Excellence: Blockchain unlocks the power of data analytics, enabling pharmaceutical companies to optimize operations, predict demand, and continually refine the supply chain.

This journey reflects an unwavering commitment—a promise—of an industry determined to prioritize patient safety and well-being. Blockchain stands as a powerful catalyst in realizing this commitment.

In conclusion, the pharmaceutical industry is poised at the precipice of transformation—a juncture where the promise of life-saving medications is fortified by the assurance of a transparent, secure, and efficient supply chain. As we embrace this technological evolution, we are not merely revolutionizing an industry; we are ensuring that every dose of medicine administered holds the trust, transparency, and authenticity that patients around the world rightfully deserve.

Acknowledgment:

The completion of this article on "Supply Chain Transparency in Pharmaceuticals: A Blockchain Solution" has been a collaborative effort, and we wish to express our gratitude to the individuals and organizations who have contributed to its realization.

First and foremost, I extend our heartfelt thanks to the pharmaceutical experts, industry professionals, and researchers who generously shared their knowledge, insights, and experiences in the field of pharmaceutical supply chains and blockchain technology. Your valuable contributions have enriched this article and provided a solid foundation for understanding the complexities and potential solutions within the pharmaceutical industry.

I would like to acknowledge the support and guidance provided by our academic advisors and mentors who played a pivotal role in shaping the direction of this research. Your mentorship has been invaluable in navigating

the intricate landscape of blockchain technology and its applications in healthcare.

I am also grateful to our Department of Computer Science and Engineering for providing me this opportunity and motivating me to complete the article on time.

Lastly, we extend our appreciation to our families and loved ones for their unwavering support and encouragement throughout this research endeavor. Your understanding and patience have been a constant source of motivation.

In conclusion, the successful completion of this article stands as a testament to the collective efforts, collaboration, and support of numerous individuals and organizations. We are truly thankful for your contributions, and this article would not have been possible without your involvement.

References:

[1] FDA. (2022). Drug Supply Chain Security Act (DSCSA). Retrieved from <https://www.fda.gov/drugs/drug-supply-chain-security-act-dscsa>

[2] World Health Organization. (2021). Substandard and Falsified (SF) Medical Products. Retrieved from [https://www.who.int/news-room/fact-sheets/detail/substandard-and-falsified-\(sf\)-medical-products](https://www.who.int/news-room/fact-sheets/detail/substandard-and-falsified-(sf)-medical-products)

[3] Kim, S. et al. (2020). Blockchain-Based Pharmaceutical Supply Chain Traceability and Drug Traceability in South Korea. *Journal of Pharmaceutical Sciences*, 110(5), 1853-1859.

[4] Blockchain based Supply Chain: A review and conceptual framework -fig1,2 <https://www.tandfonline.com/doi/full/10.1080/00207543.2022.2125595>

[5] National Library of Medicine <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9031510/>

SYNERGIZING AI AND PIEZOELECTRIC AND TRIBOELECTRIC MATERIALS: SHAPING THE FUTURE OF TECHNOLOGY

Birju Mandal

B. Tech Cyber Security Dept. CSE,
2020-2021,
The Neotia University

Abstract:

If you've ever used a cigarette lighter, experienced a medical ultrasound in a doctor's office or turned on a gas burner, you've used piezoelectricity. Piezoelectric materials are materials that have the ability to generate internal electrical charge from applied mechanical stress. The term piezo is Greek for "push." Several naturally occurring substances demonstrate the piezoelectric effect, such as: Bone, Crystals, Certain ceramics, DNA, Enamel, Silk, Dentin, etc. Flexible piezoelectric acoustic sensors have been developed to generate multiple sound signals with high sensitivity, shifting the paradigm of future voice technologies. Speech recognition based on advanced acoustic sensors and optimized machine learning software will play an innovative interface for artificial intelligence (AI) services. Collaboration and novel approaches between smart sensors and speech algorithms should be attempted to realize a hyperconnected society, which can offer personalized services such as biometric authentication, AI secretaries, and home appliances. In this article, representative developments in speech recognition are reviewed in terms of flexible piezoelectric materials, self-powered sensors, machine learning algorithms, and speaker recognition.

Introduction:

The first technological application of a piezoelectric material was the ultrasonic submarine detector created during World War I. The detector plate was made from a transducer (a device that transforms from one type of energy into another) and a type of detector called a hydrophone. The transducer was made of thin quartz crystals glued between two steel plates. The resounding success of the ultrasonic submarine detector during the war stimulated intense technological development of piezoelectric devices. After World War I, piezoelectric ceramics were used in the cartridges of phonographs. Applications of piezoelectric materials advanced significantly during World War II due to independent research by Japan, Russia and the United States. In particular, advancements in the understanding of the relationship between crystal structure and electromechanical activity along with other developments in research shifted the approach toward piezoelectric technology entirely. For the first time, engineers were able to manipulate piezoelectric materials for a specific device application, rather than observing properties of the materials and then searching for suitable applications of the observed properties. This development created many war-related applications of piezoelectric materials such as super-sensitive microphones, powerful sonar devices, sonobuoys (small buoys with hydrophone listening and radio-transmitting capabilities for monitoring movement of ocean vessels)

and piezo ignition systems for single cylinder ignitions.

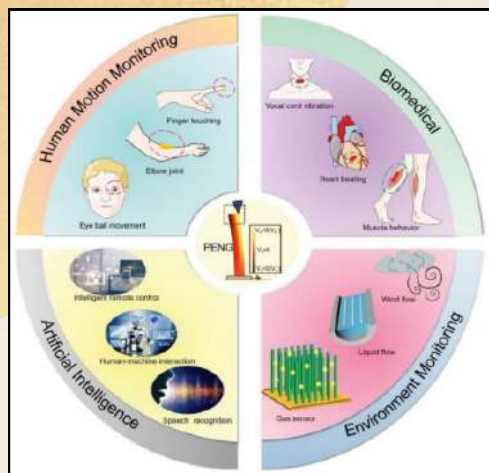


Figure No: 1

Piezoelectric materials and related piezoelectricity have attracted extensive attention from modern science and technology worldwide. Many natural piezoelectric materials have been found and a lot of artificial piezoelectric materials with excellent performance have been synthesized to meet various application requirements during the last 140 years. Biopiezoelectric materials potentially offer a simple and environmentally friendly approach to energy generation, smart sensing, and artificial intelligence. In this review recent research progress in piezoelectric materials is emphasized which can be divided into three types: common inorganic materials, polymer materials, and biomaterials.

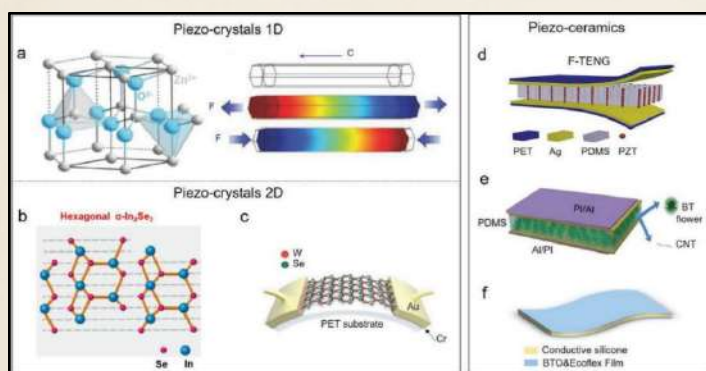


Fig: a) Atomic model of the wurtzite-structured ZnO, 3D views, and numerical calculation of the piezoelectric potential distribution in a ZnO NW under axial strain. Reproduced with permission. Copyright 2009, American Institute of Physics. **b)** The side view for atomistic arrangement structure models of

α -In₂Se₃. Reproduced with permission. Copyright 2018, American Chemical Society. **c)** Schematic of the PEH based on monolayer WSe₂. Reproduced with permission. Copyright 2017, Wiley-VCH GmbH. **d)** Oriented particle structure of F-PENG. Reproduced with permission. Copyright 2020, John Wiley & Sons Ltd. **e)** Schematic of the composition of BTFs-CNTs/PDMS composites and the structure of the corresponding energy harvester. Reproduced with permission. Copyright 2020, Wiley-VCH GmbH. **f)** Schematic diagram of BPNG. Adapted with permission. Copyright 2020, Elsevier B.V. (<https://www.advancedsciencenews.com/>)

Mechanism of Piezoelectricity:

As mentioned above, piezoelectricity is the property of a substance to generate electricity if a stress such as squeezing, bending or twisting is applied to it. When placed under stress, the piezoelectric crystal produces a polarization, P , proportional to the stress that produced it. The main equation of piezoelectricity is $\mathbf{P} = \mathbf{d} \times \text{stress}$ where d is the piezoelectric coefficient, a factor unique to each type of piezoelectric material. The piezoelectric coefficient for quartz is 3×10^{-12} . The piezoelectric coefficient for lead zirconate titanate (PZT) is 3×10^{-10} . Small displacements of ions in the crystal lattice create the polarization observed in piezoelectricity. This only occurs in crystals that do not have a center of symmetry.

Methodology:

Developing algorithms for the application of artificial intelligence (AI) in energy harvesting using piezoelectric nanogenerators (PENG) and triboelectric nanogenerators (TENG), it's essential to select specific algorithms that best suit the task at hand. A wide range of AI algorithms is available for creating prediction models in energy harvesting. These models

can be employed for tasks such as predicting energy output based on datasets, which can be discrete (requiring data classification) or continuous (requiring data regression).

AI prediction models in energy harvesting can vary in complexity, from simple and rigid models, such as classic statistical linear regression, to complex and flexible models like deep neural networks. These AI algorithms aim to mimic human learning processes by extracting knowledge and insights from large datasets. However, raw big data alone is insufficient; AI models must be able to infer meaningful information from these datasets.

AI makes certain assumptions and incorporates them into the models to effectively fill in missing data. The general approach of AI involves using various techniques to uncover inherent rules and dependencies between observed data and hidden patterns or features in materials and structures.

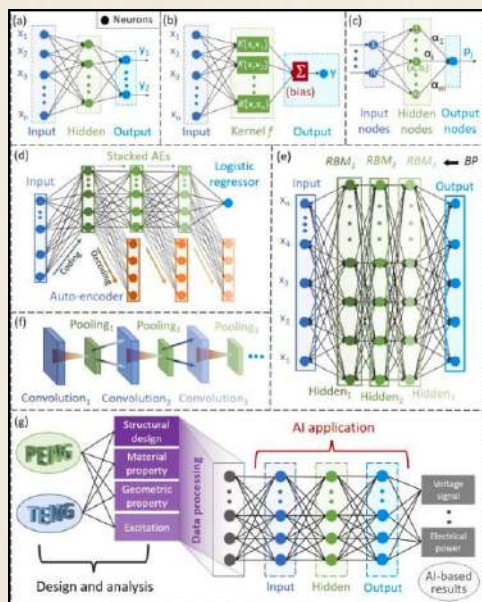


Figure No: 2

In the context of PENG and TENG, classification algorithms can be employed to analyze data, regression algorithms can address design and fabrication challenges, and probability algorithms can handle application related challenges.

It is essential to assess and optimize trial models to identify the most suitable AI model

for energy harvesting. Techniques like cross validation can help evaluate model accuracy, but they may encounter challenges with small datasets.

Proper rules and indices, such as RMSE, MAPE, CA, R2, etc., are used to assess model performance. Model bias and variance are two primary factors contributing to model errors in energy harvesting. Model bias results from inappropriate assumptions in algorithms, leading to the omission of underlying relationships between raw input data and energy performance prediction. On the other hand, model variance is sensitive to small fluctuations in input data due to data noise, calculation uncertainties, and measurement limitations. High bias or variance can result in poor model performance.

The complexity of AI models can impact their performance, with high bias leading to underfitting and high variance leading to overfitting. Underfitting occurs when AI models are not flexible enough to capture complex relationships in the input data, while overfitting happens when models become overly complex, typically by increasing input parameters.

Various AI algorithms can be applied to PENG and TENG applications, including:

Artificial Neural Networks (ANN): ANN models consist of interconnected nodes that process data. The output of an ANN depends on factors like node functions and connections, making it suitable for nonlinear approximation.

Support Vector Machine (SVM): SVM employs supervised learning to classify input data. It identifies support vectors to create optimal classification hyperplanes in the training dataset.

Extreme Learning Machine (ELM): ELM generates network parameters randomly, such

as thresholds and weights, for feedforward neural networks with a single hidden layer. ELM is known for its fast learning speed and generalization capabilities.

Stacked Auto-Encoder (SAE): SAE is a deep neural network algorithm in deep learning (DL). It involves coding and decoding processes to transform input data with minimal error.

Deep Belief Network (DBN): DBN, an unsupervised learning algorithm, consists of three restricted Boltzmann machine (RBM) layers. RBM has visible and hidden layers, and DBN excels in feature extraction.

Convolutional Neural Network (CNN): CNN, used for supervised and unsupervised learning, is inspired by human visual perception. It employs convolutional kernels and parameter sharing for efficient feature representation. PENG and TENG applications, AI plays a crucial role in designing, analyzing, and optimizing nanogenerators. AI algorithms process initial data related to structural design, material properties, geometric properties, and external excitation to generate PENG and TENG inputs. These inputs are then analyzed by AI, such as the ML or DL algorithms discussed earlier, to produce optimized voltage signals or electrical power generated by the nanogenerators. AI also contributes to the investigation of the triboelectric mechanism in TENG, allowing for the expansion of theoretical models to accommodate complex real-world scenarios.

Result of experiment/Applications:

Active Sensors for Biomedical Applications:

Flexible piezoelectric sensors have great potential for wearable biomedical applications due to their fast response and self-powered characteristics. In recent years, a large number of piezoelectric nanogenerator (PENG)-based biosensors have been reported for physiological signal monitoring. Here are some examples of PENG-based biosensors for monitoring human physiological signals:

- A self-powered hydrogel sensor based on polyacrylonitrile-poly(vinylidene fluoride) can be attached to the wrist and throat to monitor body pulse signal and spoken words, respectively.
- A highly sensitive self-powered PENG sensor based on nanocomposite micropillar array can be used to detect air pressure/flow and human breathing in a noncontact mode.
- A self-powered sensor made of PVDF nanogenerator (PVDF NG) integrated on a respirator can be used to monitor human breathing and ambient temperature.
- A self-powered ultrathin piezoelectric pulse sensor based on PZT thin film can be conformally attached to the human epidermis to detect the radial/carotid artery pulse, respiratory activities, and trachea movements. The pulse signal can be transmitted to the smartphone wirelessly via a microcontroller unit and Bluetooth transmitter, realizing the self-powered real-time pulse monitoring system.
- A piezoelectric sensor constructed from 3D layered PVDF/ZnO nanofibers can be used for human physiological monitoring such as respiration, heart rate, and gait recognition. The sensor is flexible, mechanically stable, and has high gas permeability. When attached to the chest, it can clearly differentiate breathing modes among normal breathing, deep

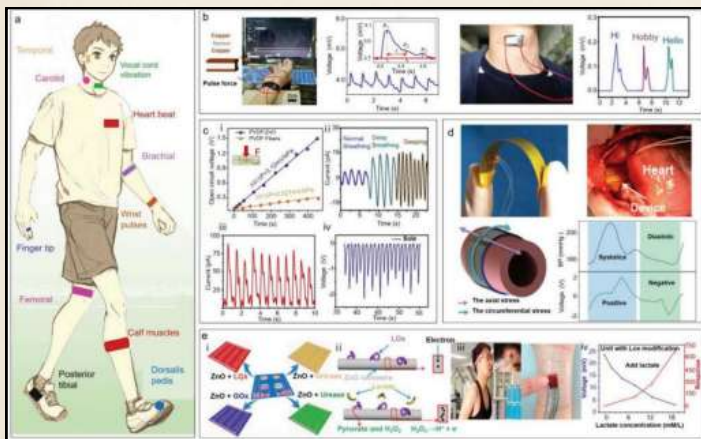


Figure No: 3

breathing, and gasping. When mounted on the wrist, it can clearly indicate the pulse signals. When attached to the epidermis of the calf muscle, it can be used for gait recognition.

These examples demonstrate the potential of self-powered piezoelectric sensors for real-time monitoring of human physiological signals. These sensors could be used to develop new wearable devices for disease diagnosis, therapy, rehabilitation, and health assessment.

Active Sensors for Artificial Intelligence:

As artificial intelligence (AI) continues its rapid advancement, the development of intelligent devices has grown exponentially. These devices often rely on sensory networks comprising numerous sensing nodes. However, the conventional commercial batteries in widespread use have limited lifecycles and pose environmental concerns, which hinder their practicality in Internet of Things (IoT) applications. Therefore, there is a growing interest in self-powered piezoelectric sensors that eliminate the need for batteries in wireless sensor networks. This innovation is particularly attractive as it aligns with the increasing availability of energy harvesting devices and power management electronics, enabling the creation of self-powered wireless intelligent systems for standalone, mobile, and ubiquitous sensory networks.

Researchers have explored the use of self-powered piezoelectric sensors for intelligent applications, such as remote control and human-machine interaction (HMI). One notable example involves a flexible piezoelectric sensor constructed from a cowpea-structured PVDF/ZnO nanofiber composite. This sensor, designed for recognizing gestures, allows for remote control within an HMI system. Its flexibility, owing to the polymer material and the

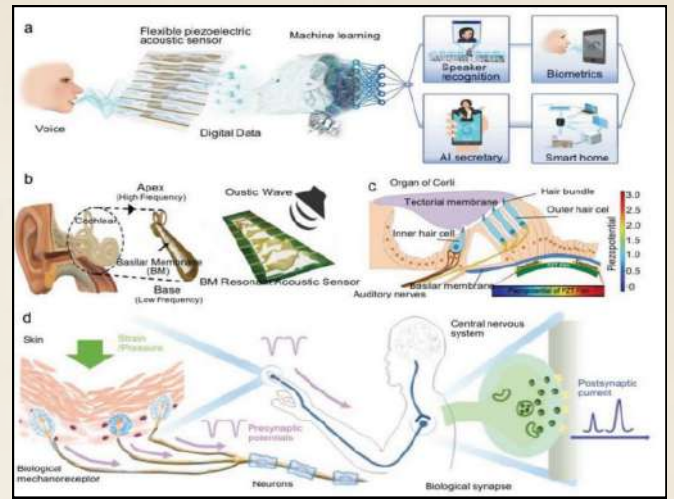


Figure No: 4

synergistic piezoelectric effect of hybrid PVDF/ZnO, enables it to accurately record bending angles and facilitate fast recognition. This innovation has practical implications for applications like robotic hands for remote control. A novel piezoelectric material, optimized PZN0.25C ceramics, was used to create smart-home sensors. These sensors could be affixed to floor tiles, generating voltage and current through the piezoelectric effect when someone stepped on the floor. This energy was then used for real-time control of home appliances via a microcontroller unit. Additionally, researchers explored the potential of 2D SnS₂-based piezoelectric nanogenerators (PENGs) for human-robot control in an intelligent HMI system. This technology allowed for the generation of distinctive voltages corresponding to various human forefinger bending states, enabling real-time human-robot control to mimic human gestures. Such advancements hold promise for active-sensing technology and HMI. Furthermore, the development of dynamic piezoelectric tactile sensors interfaced with metal oxide semiconductor field-effect transistors (MOSFETs) has shown great potential. These sensors, when used in conjunction with intelligent robotic arms, can detect tactile signals and classify them through a spiking neural network (SNN) tempotron classifier system. Achieving a high classification accuracy of 99.45%, these sensors have

applications in prosthetics, robotics, medical devices, and wearable sensors.

In the realm of artificial intelligence, flexible acoustic sensors for speech recognition and artificial synapses have gained attention. Piezoelectric acoustic sensors, with their excellent inherent properties, offer improved sensitivity and speech recognition accuracy. For instance, a self-powered flexible piezoelectric acoustic sensor inspired by the human cochlear's basilar membrane was developed. This sensor, based on a PZT membrane, generated distinct voltages in response to minute acoustic stimuli, offering potential applications in speech recognition systems. Moreover, innovative inorganic-based piezoelectric acoustic nanosensors (iPANS) based on PZT thin films were designed to mimic the functions of the natural basilar membrane. These iPANS devices demonstrated highly efficient sensitivity and the ability to respond to speech stimuli in the audible frequency range. The article also discussed the development of piezoelectric graphene artificial sensory synapses, which use piezoelectric potential from piezoelectric nanogenerators (PENGs) to power synaptic devices. These devices simulate sensory input, neurotransmitter release, and postsynaptic output in biological sensory synapses, enabling external stimulus perception and synaptic transmission in neuromorphic systems. In the field of soft robotics, researchers have integrated multiple sensors into smart, thin-film composite-based somatosensory light-driven robots (SLiRs). These robots combine actuation with various sensors, including piezoresistive strain sensors and pyro/piezoelectric sensors, enabling them to detect actuation deformation states and body temperature concurrently. SLiRs can navigate different surfaces, provide feedback on terrain textures, and exhibit multifunctional sensing capabilities, making them valuable for multiple sensory systems with diverse intelligent behaviors.

In conclusion, the integration of self-powered piezoelectric sensors and AI has paved the way for innovative applications in remote control, HMI, speech recognition, artificial synapses, and soft robotics. These developments hold great promise for advancing technology in various domains, including IoT, robotics, and human-machine interaction.

Conclusion:

AI has been applied to address those challenges in PENG and TENG such as the classification algorithms to solve the challenge of analysis, regression algorithms for the challenges in design and fabrication, and probability algorithms for the challenge in application. The application paradigms of AI in PENG and TENG can be categorized into the environment layer, the hardware layer, the software layer, and the application layer. Therefore, AI is able to address the challenges of PENG and TENG in analysis, design, fabrication, and application. AI-enhanced energy harvesting is categorized from the structural perspectives such as designing the geometric properties of the microstructures to addresses the uncertainties in the structural design, and the material perspective such as discovering new piezoelectric and triboelectric materials. AIPENG and AI-TENG can be used to efficiently power the advanced multiscale devices in the domains of engineering and life science. The AI-enabled nanogenerators are envisioned as the reliable green energy supplies to enable next-generation applications in smart cities.

References:

- Emerging artificial intelligence in piezoelectric and triboelectric nanogenerators (<https://www.sciencedirect.com/science/article>)

- Comprehensive Piezoelectric Material Application Issues on Energy Harvesting for Artificial Intelligence Systems (<https://www.researchgate.com>)
- Piezoelectric Nanogenerators Derived Self-Powered Sensors for Multifunctional Applications and Artificial Intelligence (www.afm-journal.de)



SENTIMENT ANALYSIS USING NLP

Wrishav Sett

Bachelors in Computer Science Engineering,
2020-2021,
The Neotia University

Abstract:

This paper presents the process of sentiment analysis in Natural Language Processing (NLP) using the Naive Bayes classifier algorithm to classify restaurant reviews as either positive or negative. This classification utilizes a tab-separated (.tsv) dataset containing positive and negative reviews including sarcasm.

Introduction:

1. What is natural language processing?

Natural language processing (NLP) refers to the branch of computer science—and more specifically, the branch of artificial intelligence or AI—concerned with giving computers the ability to understand text and spoken words in much the same way human beings can.

NLP combines computational linguistics—rule-based modeling of human language—with statistical, machine learning, and deep learning models. Together, these technologies enable computers to process human language in the form of text or voice data and to ‘understand’ its full meaning, complete with the speaker or writer’s intent and sentiment.

NLP drives computer programs that translate text from one language to another, respond to spoken commands, and summarize large volumes of text rapidly—even in real time. There’s a good chance you’ve interacted with NLP in the form of voice-operated GPS systems, digital assistants, speech-to-text dictation software, customer service chatbots, and other consumer conveniences. But NLP

also plays a growing role in enterprise solutions that help streamline business operations, increase employee productivity, and simplify mission-critical business processes.

2. What is sentiment analysis?

Sentiment analysis, or opinion mining, is the process of analyzing large volumes of text to determine whether it expresses a positive sentiment, a negative sentiment or a neutral sentiment.

At its core, sentiment analysis is a computational study of opinions, sentiments, evaluations, and emotions expressed in text. It seeks to determine whether a given piece of text expresses a positive, negative, or neutral sentiment.

Companies now have access to more data about their customers than ever before, presenting both an opportunity and a challenge: analyzing the vast amounts of textual data available and extracting meaningful insights to guide their business decisions.

From emails and tweets to online survey responses, chats with customer service representatives and reviews, the sources available to gauge customer sentiment are seemingly endless. Sentiment analysis systems help companies better understand their customers, deliver stronger customer experiences and improve their brand reputation.

3. What are Naïve Bayes classifiers?

The Naïve Bayes classifier is a supervised machine learning algorithm, which is used for classification tasks, like text classification. It is also part of a family of generative learning algorithms, meaning that it seeks to model the distribution of inputs of a given class or category. Unlike discriminative classifiers, like logistic regression, it does not learn which features are most important to differentiate between classes.

The Naïve Bayes theorem is given by:

$$p(x|y) = p(y|x) * p(x) p(y)$$

$p(x|y)$ is the posterior probability of class A given predictor B.

$p(y|x)$ is the likelihood which is the probability of predictor B given class A.

$p(x)$ is the prior probability or marginal probability of class A.

$p(y)$ is the prior probability of predictor B.

In machine learning, the Naive Bayes classifier is predominantly employed in text classification, which includes spam filtering and sentiment analysis due to its simplicity, efficiency, and effectiveness in high dimensional datasets

2. Methodology:

1. Data Preprocessing The dataset, named "Restaurant-Reviews", contains 1,000 reviews. The preprocessing steps include:

Cleaning: Using regex, we removed all characters that are not alphabets.

Lowercasing: All characters in the reviews are converted to lowercase.

Tokenization: The cleaned reviews are then split into individual words.

Stemming: The Porter stemming algorithm is applied to reduce words to their root form.

Stop words Removal: Common words that don't carry meaningful information for our task are removed, with an exception for the word "not" due to its significance in sentiment. The preprocessed reviews are then stored in the `corpus` list, which is the collection of the processed text.

2. Feature Extraction The Bag-of-Words (BoW) model is applied, converting the `corpus` into a numerical format. This representation limits the features to 1,500 most frequent words.

Bag of Words (BoW) is a natural language processing (NLP) strategy for converting a text document into numbers that can be used by a computer program

3. Model Training The dataset is then split into training and testing sets in a ratio of 8:2. The Naive Bayes classifier is then applied, specifically the GaussianNB variant, and trained on the training dataset.

Gaussian Naive Bayes (GaussianNB) is a classification technique used in Machine Learning (ML) based on the probabilistic approach and Gaussian distribution. Gaussian Naive Bayes assumes that each parameter (also called features or predictors) has an independent capacity of predicting the output variable.

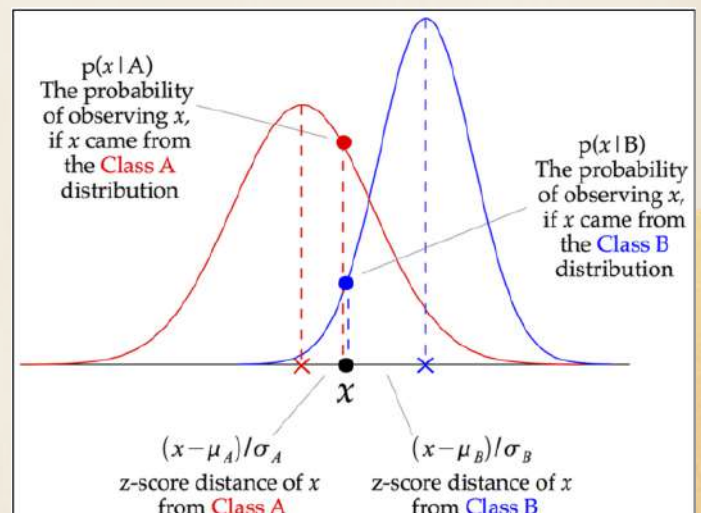


Figure No.: 1

Real World application of Sentiment Analysis in NLP

- Business Analytics: Understanding the customer feedback on various products.
- Market Research: Analyzing the sentiment of the buyer/public towards brands, offers, sales and the like.
- Politics: Politicians and governments can determine public sentiment towards policies or political events or even the politicians themselves.
- Financial Markets: Traders can estimate public sentiment towards particular stocks or the products available market in general, providing insights for investment strategies.
- Social Media Monitoring: Social media posts often contain some of the most honest opinions about products, services, and businesses because they're unsolicited and free to criticisms. With the help of sentiment analysis software, one can wade through all that data in minutes, to analyze individual emotions and overall public sentiment on every social platform. Sentiment analysis can read beyond simple definition to detect sarcasm, read common chat acronyms (lol, rofl, etc.), and correct common mistakes like misused and misspelled words.

Results and Visualizations:

A confusion matrix is displayed showing the performance of the classifier model:

```
array([[55, 42],  
       [12, 91]], dtype=int64)
```

The accuracy score of the model using GaussianNB:

0.73

Using Principal Component Analysis (PCA), the dataset is reduced to 2D, allowing for easy

visualization. The scatter plot and the Gaussian NB provides insights into how well the classifier has segregated positive and negative reviews:

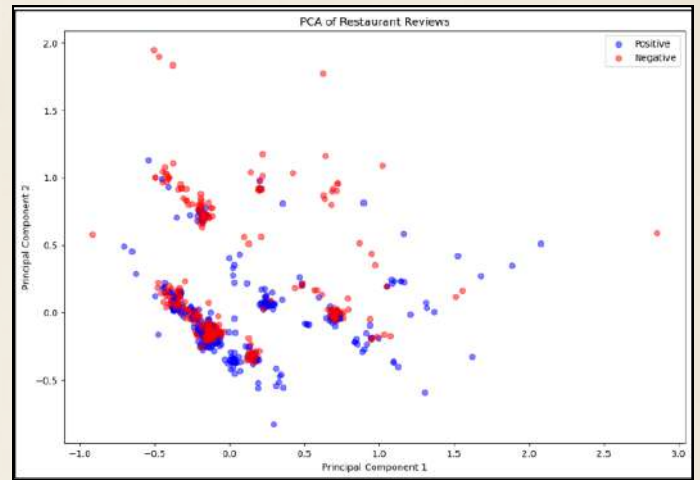


Fig.2: PCA of resturant reviews

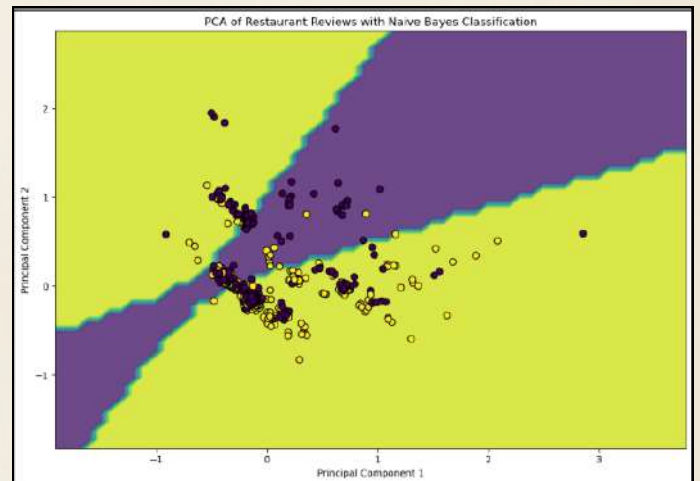


Fig.3: PCA of resturant reviews

Discussion:

The code implemented for sentiment analysis for this paper lays out a procedure to preprocess restaurant reviews, vectorize the cleaned text into a bag-of-words model, and subsequently utilize the Gaussian Naive Bayes classifier for sentiment analysis. There are however some potential areas for improvement and other classifiers that may be used.

- We may consider leveraging more advanced tokenization methods or even libraries like spaCy which provide rich linguistic annotations.
- Instead of just using raw counts with BoW, consider using TF-IDF (Term Frequency-Inverse Document Frequency) to capture the

importance of terms in context to the entire dataset.

- Given that text data is typically non-Gaussian, Multinomial Naive Bayes or Bernoulli Naive Bayes might be more suitable.
- We may also use Support Vector Machines (SVM), especially linear SVMs might be powerful for text classification tasks.

Conclusion:

The Naive Bayes algorithm offers a simplistic yet powerful approach to sentiment analysis in NLP. Using a preprocessed dataset, this classifier can effectively differentiate between positive and negative sentiments. With its wide array of real-world applications, sentiment analysis stands as a testament to the prowess of NLP in deriving meaningful insights from textual data.

The application of NLP techniques, backed by robust machine learning algorithms, has revolutionized our capacity to process and analyze large volumes of unstructured data in near real-time in order to analyze the public sentiment.

As the research showcased, even relatively straightforward algorithms like Naive Bayes can yield significant results when coupled with properly processed data. However, as with all computational techniques, the accuracy and reliability of sentiment analysis largely hinge on the quality of the data available and whether or not the chosen algorithm is applicable in the particular scenario.

Acknowledgement:

I would like to express my heartfelt gratitude to all those who have provided encouragement and motivation throughout the course of this research. While this project did not benefit from external funding or specific assistance from any organizations or individuals whatsoever, the journey was enriched by the

collective knowledge available in the multiple public domains. I am also thankful to my peers and colleagues for their indirect insights and discussions, which, while not directly contributing to the research, certainly helped enrich my perspective and understanding of the topic. The journey of this research is self-driven and self-funded.

Reference:

- Russell, S. J., & Norvig, P. (2010). Artificial intelligence: a modern approach. Malaysia; Pearson Education Limited.
- Bird, S., Klein, E., & Loper, E. (2009). Natural language processing with Python: analyzing text with the natural language toolkit. "O'Reilly Media, Inc."



AI ENABLED PLANT DISEASE DETECTION WEBSITE

Subhodeep Ghosh

CSE-DA,
2020-2021,
The Neotia University

Dr. Usha Rani Gogoi

Assistant Professor,
The Neotia University

Abstract:

This research presents an accessible solution for plant disease detection using deep learning. Our user-friendly system allows farmers to upload images of diseased plants for instant diagnosis. Leveraging a trained Convolutional Neural Network (CNN), it accurately identifies various plant diseases across crops. The system provides detailed information, including disease symptoms and management practices, in local languages. This approach empowers farmers to make informed decisions, reduce crop losses, and promote sustainable agriculture. Our work underscores the fusion of deep learning, agriculture, and accessibility, advancing precision farming and global food security.

Keywords:

Plant Disease Detection, Deep Learning, Accessibility

Introduction:

We introduce an innovative solution that addresses the persistent threat of plant diseases in agriculture. Our platform combines deep learning, agriculture, and accessibility to empower farmers. It offers user-friendly tools for disease detection, management, and prevention, catering to farmers of all technical

backgrounds. What sets our solution apart is its comprehensive approach, going beyond disease detection to provide a holistic agricultural companion. In the fertile farmlands of West Bengal and Bangladesh, where agriculture forms the backbone of livelihoods, the relentless onslaught of plant diseases looms as a formidable adversary. Among the myriad challenges that farmers face, five major diseases stand out as significant threats to farming in both regions:

- 1. Blast Disease:** Devastates rice crops in West Bengal and Bangladesh, causing yield losses and food security concerns [1].
- 2. Brown Spot:** Affects rice and wheat, reducing crop quality and exacerbating agricultural challenges [2].
- 3. Sheath Blight:** Threatens rice production, resulting in lesions, rot, and decreased yields [3].
- 4. Late Blight:** Damages potato and tomato crops, causing rapid decay and economic strain on farmers [4].
- 5. Leaf Rust:** Impacts wheat fields, leading to lower yields and grain quality, affecting farmer income [5].

We've identified 26 common diseases affecting 16 plant species. Our mission goes beyond recognition, offering prevention and precaution techniques to empower farmers and safeguard their crops and livelihoods. These diseases highlight the urgent need for innovative solutions that equip farmers with

the knowledge and tools to combat agricultural challenges effectively. Key Features and Services:

- **Wide Disease Coverage:** Our platform boasts the capability to recognize an extensive array of diseases, encompassing 26 prevalent afflictions across 14 commonly found crops. This remarkable breadth ensures that we cater to diverse agricultural contexts, offering tailored assistance to farmers on a global scale.
- **Instant Diagnosis and Comprehensive Guidance:** Our platform uses Convolutional Neural Networks (CNNs) trained on a diverse dataset of plant disease images to offer farmers a user friendly web interface for instant disease diagnoses, complemented by comprehensive guidance on precautions, prevention methods, and to-do lists for each disease.
- **Native Language Accessibility:** Accessibility is paramount. All information and guidance on our platform are presented in the native language (Bengali) of farming communities of Bengal, ensuring that every farmer can benefit [6] from this invaluable resource.
- **Beyond Disease Detection:** Our commitment to farmers goes beyond disease detection. We offer a treasure trove of agricultural insights, including tips and tricks, hot trends, related news [7], and actionable advice for farming success. Along with this we provide suitable prevention, precaution and chemical usage advices [8].

Through this holistic approach, our mission is to mitigate crop losses, enhance agricultural productivity, and champion sustainable practices. By empowering farmers with knowledge and cutting-edge technology, we are not only advancing precision agriculture [9] but also contributing to the global effort to ensure food security [10] for all.

In the ensuing sections, we delve into the intricate methodology, present illuminating experimental results, and engage in discussions that underscore the extraordinary

effectiveness of our deep learning-based plant disease detection system. Checkout our website:

<https://tigersubho.github.io/Dharitrika/>



Fig. 1: Prototype screenshot 1

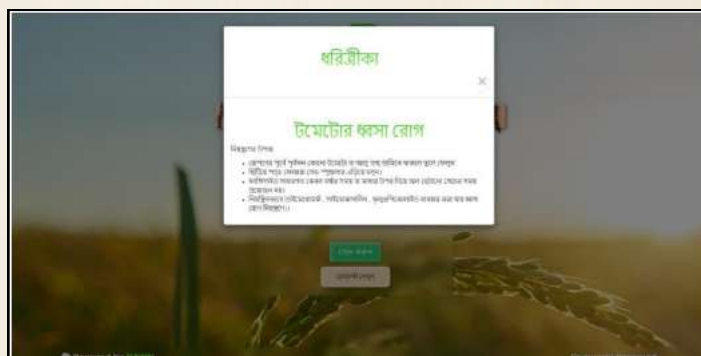


Fig. 2: Prototype screenshot 2

Methodology:

1. Experimental Dataset Details: This dataset encompasses a substantial repository of plant disease images, comprising 14 distinct tree species afflicted by 26 unique diseases, totalling approximately 87,000 RGB images. Some sample images of the experimental dataset are illustrated in Fig 3.



Fig. 3: Dataset contents

2. Model Building: For the experimental purpose, we have developed 2 custom models and used one transfer learning model. The details of each of them are explained below.

a) Customized Convolutional Neural Network (CNN) Architecture-1

In this study, we developed a custom CNN architecture named as Custom-CNN-1 tailored for plant disease detection from images. The model employs a series of convolutional layers for feature extraction, followed by max-pooling, batch normalization, and ReLU activation. It concludes with a fully connected Linear-30 layer for disease classification among 38 categories. This design is optimized for identifying disease-related features in images. The architecture of the same is depicted in Fig 4.

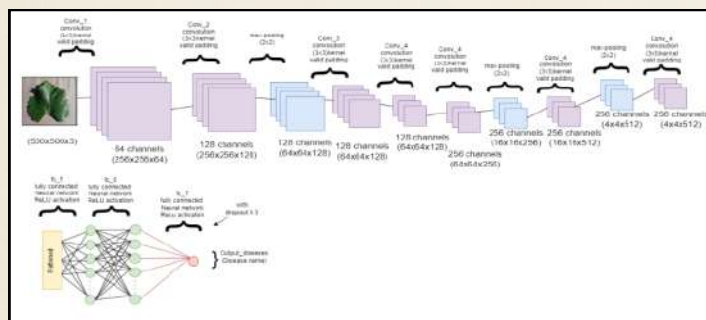


Fig. 4: Model architecture of custom-CNN-1

b) Customized Convolutional Neural Network (CNN) Architecture-2

Our second customized CNN architecture named as Custom-CNN-2 consists of five convolutional layers, each followed by batch normalization and ReLU activation, as well as max-pooling layers for spatial down sampling. The designed architecture of Custom-CNN-2 is shown in Fig 5.

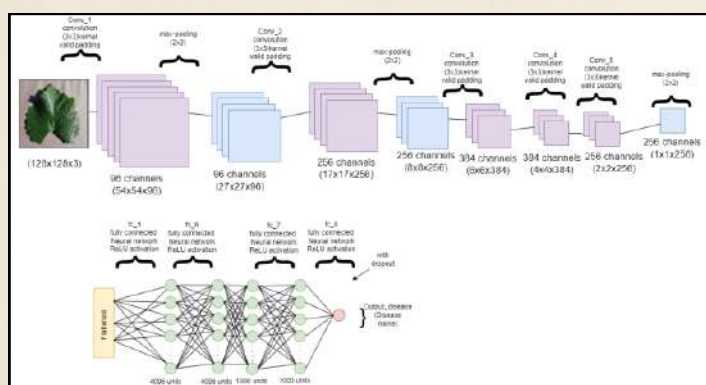


Fig. 5: Model architecture of custom-CNN-2

c) Transfer Learning using ResNet9

For experimental purpose, along with the customized model, we have analysed the performance of the existing ResNet9 model. The architecture of the model is given in Fig 6.

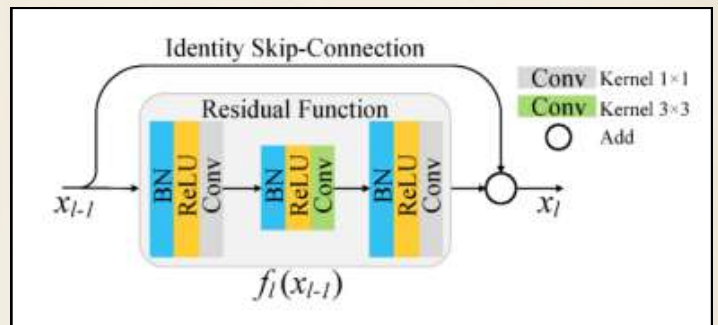


Fig. 6: ResNet model architecture

Experimental Results:

In our rigorous pursuit of effective plant disease detection, we conducted an extensive series of experiments involving three distinct neural network models: "Custom-CNN-1," "Custom-CNN-2," and "ResNet9- tuned." These models underwent comprehensive evaluation on our diverse dataset, which encompasses images from 14 tree species afflicted by 26 unique diseases. The performance of each of the model in disease prediction is compared and listed in Table 1.

Table1. The disease prediction performances of various Deep Learning model			
Model Name	Training accuracy	Validation accuracy	Validation loss
Custom-CNN-1	100	99.37	0.0261
Custom-CNN-2	99.52	98.76	0.0893
ResNet9-tuned	98.89	96.44	0.1236

Table1: Disease prediction performance

Observations on experimental performances:

1. Custom-CNN-1: Our first custom CNN model exhibited extraordinary performance. It achieved a perfect training accuracy of 100%, a testament to its robust learning capabilities. Moreover, it demonstrated an outstanding validation accuracy of 99.37%, signifying its adaptability to the dataset's complexities. Notably, it maintained a remarkably low validation loss of 0.0261, showcasing its proficiency in capturing intricate disease-related features.

2. Custom-CNN-2: The second custom CNN model also delivered commendable results. With a training accuracy of 99.52% and a validation accuracy of 98.76%, it demonstrated strong generalization capabilities. Its validation loss of 0.0893 underscored its ability to minimize errors during training and validation.

3. ResNet9-tuned: The transfer learning model, based on ResNet9 [11] achieved a slightly lower training accuracy of 98.89% and a validation accuracy of 96.44%. While respectable, these results highlighted the unique challenges presented by our plant disease dataset. The validation loss of 0.1236 indicated effective learning but fell short of the custom CNN models.

Discussion and Implications:

The exceptional performance of Custom-CNN-1, with its high validation accuracy of 99.37%, establishes it as a potent tool for plant disease detection, offering the potential for early disease diagnosis and substantial benefits to farmers.

Custom-CNN-2 and ResNet9-tuned, though not reaching the same heights, demonstrated solid performance. This underscores the importance of custom-tailored architectures when confronting the intricacies of plant disease detection.

The findings showcased in this section emphasize the promise and practical utility of deep learning in agriculture, with the potential to enhance crop yields and contribute to global food security. Further analysis and implications are explored in subsequent sections.

Conclusion:

Our innovative platform addresses the persistent challenge of plant diseases in global agriculture, offering comprehensive support to

farmers. We recognize 26 prevalent diseases across 14 crops[12], providing not only diagnosis but also guidance in native languages. Beyond disease detection, we offer agricultural insights, including tips and emerging trends[13], as well as economic advice[14]. Our mission aligns with the pursuit of global food security [15], empowering farmers and advancing precision agriculture. Our research transcends traditional plant disease detection, showcasing the potential of technology to revolutionize agriculture. We are committed to nurturing a world where food security is a shared reality.

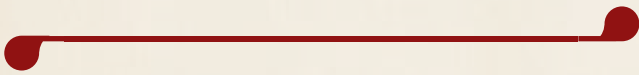
Acknowledgment:

The first author expresses his heartfelt gratitude to Dr. Usha Rani Gogoi for her invaluable guidance throughout this transformative journey. The first author also appreciates his team members, Akash Ranjan Mandal, Souvik Ghosh, Ananya Halder, and Sudipta Das, for their contributions at various stages of this project, including data collection and prototype development.

References:

1. <https://www.frontiersin.org/articles/10.3389/fpls.2021.710707/full>
2. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3768433/>
3. <https://thericejournal.springeropen.com/articles/10.1186/s12284-021-00466-z>
4. <https://www.sciencedirect.com/topics/agricultural-and-biological-sciences/phytophthora-infestans>
5. <https://pubmed.ncbi.nlm.nih.gov/19018988>
6. <https://www.forbes5.pitt.edu/article/importance-maintaining-native-language>
7. <https://www.agriculture.com/news>
8. <https://eos.com/blog/crop-diseases/>
9. <https://www.hindawi.com/journals/aag/>
10. <https://www.state.gov/bureaus->

offices/under-secretary-for-economic-growth-energy-and-theenvironment/office-of-global-food-security/
11.<https://paperswithcode.com/method/resn>
12.<https://www.agrifarming.in/district-wise-crop-production-in-west-bengal-major-crops-in-west-bengal>
13.<https://link.springer.com/article/10.1007/s40808-016-0223-6>
14.https://www.researchgate.net/publication/328107337_ECONOMIC_FEASIBILITY_OF_INTEGRATED_FARMING_A_STUDY_FROM_WEST_BENGLAL 15- <https://www.foodsecurity.ac.uk/>



PREDICTING FUTURE STOCK PRICES: A BATTLE OF MODELS - LSTM VS. SIMPLE RNN

Salman Faizi

Department of Computer Science and Engineering,
2020-2021,
The Neotia University

Abstract:

Predicting future stock prices is a challenging task due to its volatile nature, but recurrent neural networks (RNNs) are the type of deep learning models that are well-suited for sequential data like stock prices. Long Short-Term Memory (LSTM) networks, a specialized variant of recurrent neural networks (RNNs), are adept at capturing extended temporal dependencies within data while mitigating the issue of vanishing gradients [1]. In this paper, we compare the performance of LSTM and simple RNN models for stock price prediction on Infosys historical stock data from January 1999 to August 2023 using the RMSE and MAE metrics. Our results indicate that LSTM networks surpass basic RNNs, showcasing their capacity to comprehend and capture more intricate data patterns. Our findings suggest that LSTM networks can be used to develop effective stock price prediction models.

Keywords:

LSTM, RNN, Stock Price prediction, Vanishing gradient problem.

Introduction:

Predicting future stock prices is a challenging task that has attracted the attention of researchers and practitioners for decades.

Traditional methods for stock price prediction rely on fundamental analysis or technical analysis. However, these methods have limited success in predicting short-term stock price movements. Recently, Advanced machine learning models have demonstrated their efficacy in forecasting stock prices. Recurrent neural networks (RNNs) are a type of deep learning model that is well-suited for sequential data. RNNs are able to learn long-term dependencies in the data, which can be useful for predicting future price movements. A specific type of RNN called the long short-term memory (LSTM) network has been shown to be particularly effective for stock price prediction. LSTM networks are designed to capture and model extended temporal relationships in data, allowing them to effectively grasp long-range dependencies in the data while also avoiding the vanishing gradient problem, which is a common issue in RNNs. We are considering multiple (i.e., open, high, low, close, adj. close, volume) stock variables as input to the model and the closing price as the output. We used a 10-day window to predict the next-day closing price of the stock. In this paper, we compare the performance of LSTM networks and simple RNNs for stock price prediction. We train and evaluate both models on Infosys dataset and use the RMSE and MAE metric to evaluate the model's performance. We find that LSTM networks outperform simple RNNs in terms of error. This suggests that LSTM networks are better suited for predicting stock prices, which are typically complex and noisy.

The rest of this paper is organized as follows: In Section 2, the Methodology is discussed elaborately. Section 3 provides the experimental results. Section 4 discusses the methodology and the experimental results. In Section 5, we conclude the paper.

Methodology:

1. Experimental Dataset:

We used a dataset of daily historical stock prices for the Infosys stock, from January 1, 1999 to August 1, 2023. The dataset contained the following features: Open price, High price, Low price, Close price, Adj Close, Volume. The dataset has total of 5787 rows and 6 features and the dataset is collected from yahoo finance website [2] by applying the filter to select the data from the specified dates.

2. Data preprocessing:

We pre-processed the data by scaling the prices to the range [0, 1] using Min-Max scaler. We also removed Nans from the dataset and converted the data to the required sequence and shape format as the model's input. We used 10-day previous data to create the sequence for the next day.

For the experimental purpose, the processed data is splitted into training, testing and validation dataset. We used 70% data for training the model and out of that 20% for validation and 30% of the data for the testing.

3. Model architecture:

LSTM is a type of RNN that is specifically designed to learn long-term dependencies in sequential data. LSTMs are widely used in a variety of tasks, including Stock price prediction, machine translation, speech recognition, etc. The architecture of an LSTM cell is more complex than that of a traditional RNN cell. It consists of four main components:

- Input gate: Controls how much of the current input is allowed to update the cell state.
- Forget gate: The forget gate's function is to decide which parts of the previous cell state should be preserved and which parts should be erased or forgotten.
- Cell state: A long-term memory unit that stores information about the sequence up to that point.
- Output gate: Controls how much of the cell state is output to the next layer.

These four components interact with each other in a way that allows LSTMs to learn long-range dependencies in the data. For example, an LSTM cell can learn to remember the subject of a sentence even if it is many words away. Here, is a simplified explanation of how an LSTM cell works:

1. The input gate takes the current input and the previous hidden state as input and produces a vector of values between 0 and 1. These values control how much of the current input is allowed to update the cell state.
2. The forget gate takes the previous cell state and the previous hidden state as input and produces a vector of values between 0 and 1. These values control how much of the previous cell state is forgotten.
3. The cell state is updated by multiplying the previous cell state by the forget gate and adding the current input multiplied by the input gate.
4. The output gate takes the current cell state and the previous hidden state as input and produces a vector of values between 0 and 1. These values control how much of the cell state is output to the next layer.

The output of an LSTM cell is the current cell state multiplied by the output gate. This output is then passed to the next layer in the network. LSTM cells are often stacked

together to form a deeper network. This allows the network to learn more complex relationships in the data. LSTM networks have been shown to be very effective at learning long-range dependencies in sequential data. A model architecture of LSTM is illustrated in Fig 1.

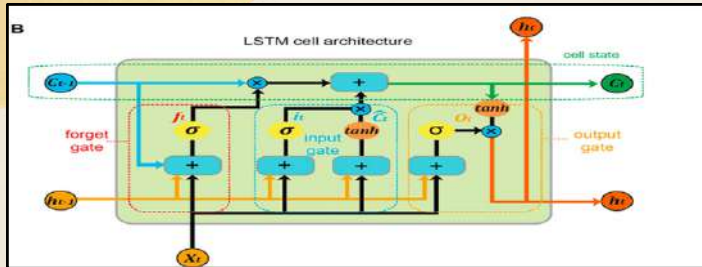


Figure 1: An overview of LSTM architecture

B. A simple RNN architecture consists of a sequence of RNN cells, where each cell takes the current input and the hidden state from the previous cell as input and produces a new hidden state as output. The hidden state contains information about the sequence up to that point, and is passed on to the next cell in the sequence. Fig 2 illustrate a simple RNN architecture:

Input -> RNN Cell 1 -> RNN Cell 2 -> ... -> RNN Cell N -> Output

The RNN cells in a simple RNN are typically identical, and they are trained using a process called backpropagation through time (BPTT). BPTT allows the network to learn long-term dependencies in the data, even if the dependencies are many time steps apart. Simple RNNs can be used for a variety of tasks, including text generation, machine translation, and sequence prediction. However, they can be difficult to train, and they can be prone to vanishing and exploding gradients. Here is a brief explanation of how a simple RNN cell works:

$$h_t = f(U * x_t + W * h_{t-1} + b)$$

The hidden state h_t is then passed to the output layer to produce the output at time step t .

Simple RNNs are a powerful tool for learning long-range dependencies in sequential data. However, they can be difficult to train, and they can be prone to vanishing and exploding gradients. More complex RNN architectures, such as LSTMs and GRUs, have been developed to address these limitations.

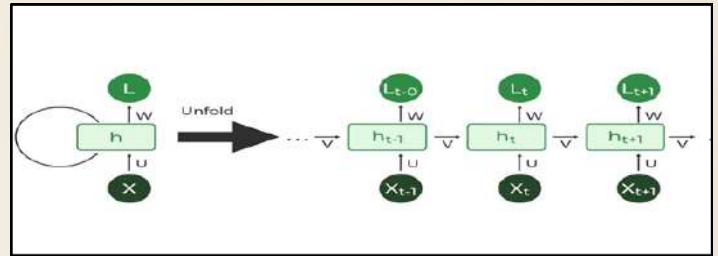


Fig. 2: A overview of simple RNN architecture

We used the following layers for the LSTM and simple RNN models:

- Input layer: 5 units (one for each feature in the dataset)
- Hidden layer: 64 units
- Output layer: 1 unit (to predict the next day's closing price).

We also used the tanh activation function for LSTM and RNN and linear activation function for the output neuron. We trained the models using the Adam optimizer and the mean squared error (MSE) loss function. We trained the models for 100 epochs. Table 1 lists all the parameters and hyperparameters used for model building.

Sl. No	Model Name	No of Hidden neurons	Activation	O/P Activation	Epochs	Optimizers	Loss Function
1	LSTM	64	Tanh	Linear	100	Adam	RMSE
2	Simple RNN	64	Tanh	Linear	100	Adam	RMSE

Table 1: List of parameters and hyperparameters used in LSTM and Simple RNN

Experimental Results:

This section discusses the experimental results. So far we were doing our work now it's the time to see the result. Figure 3 shows the graphs for both the model's actual vs prediction values. The training and testing errors incurred by both the models are illustrated in Fig. 4 for comparison purpose.

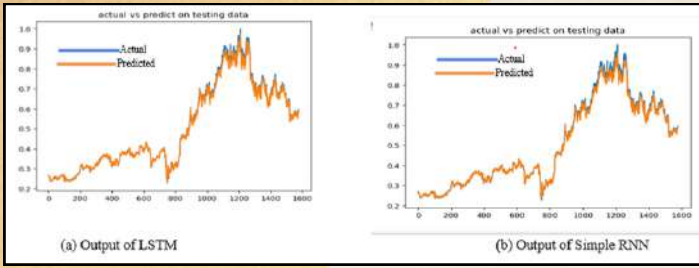


Fig. 3: The output of the trend models

S.No	Model Name	Training RMSE	Training MAE	Testing RMSE	Testing MAE
1	LSTM	0.0388	0.0034	0.1007	0.0101
2	Simple RNN	0.0620	0.0038	0.1003	0.0100

Fig. 4: Show the error from both the models while training and testing

Discussion:

The results of our study suggest that LSTM networks are a promising tool for stock price prediction. However, there are still some challenges that need to be addressed before LSTM networks can be used to develop practical stock prediction systems. One challenge is that LSTM networks require a large amount of training data. This data can be difficult and expensive to collect. Another challenge is that LSTM networks can be computationally expensive to train and evaluate.

My research is centered on forecasting the next-day stock price based exclusively on the closing price. In the future, there's potential for enhancement, expanding the model's capabilities to predict the values of all variables or even extend its scope to predict weekly or monthly stock prices. Despite these challenges, we believe that LSTM networks have the potential to be used to develop effective stock price prediction models. Future work should focus on developing techniques to reduce the amount of training data required and to improve the computational efficiency of LSTM networks. There are many algorithm that can be used for prediction of the stock price. However it's based on hit and trail, even convolutional neural network(CNN),extreme learning machine(ELM), SVM, etc can be used for it. But yah as stock data is the sequential data so for handling sequential data RNN's are

good choice that's why I choose to go with RNN.

Conclusion:

In this paper, we compared the performance of LSTM and simple RNN models for stock price prediction. We found that LSTM networks outperformed simple RNNs in terms of test error. This suggests that LSTM networks are better suited for predicting stock prices, which are typically complex and noisy.

Our findings suggest that LSTM networks can be used to develop effective stock price prediction models.

Acknowledgement:

I would like to thank the Department of Computer Science and Engineering at The Neotia University for their support in completing this article. I would also like to thank my Professor Dr. Usha Rani Gogoi for her guidance and mentorship. I am grateful for the support of all of these individuals and organizations.

References:

- [1] LSTM for remembering long term dependencies and handling vanishing gradient problem (<https://www.codingninjas.com/studio/library/solving-the-vanishing-gradient-problem-with-lstm>)
- [2] Yahoo Finance (<https://finance.yahoo.com/quote/INFY%3B/>)

WHAT IF GENERATIVE AI AND LARGE LANGUAGE MODELS(LLMs) BREAK THEIR RULES

Raja Chowdhury

CSE AI & ML,
2021-2022,
The Neotia University

Anangsha Halder

CSE AI & ML,
2022-2023,
The Neotia University

Abstract:

This article delves into the evolution of AI, particularly the shift from traditional approaches to cutting-edge Large Language Models (LLMs) and Generative AI. It questions the intentions of these AI models, pondering whether they aim to surpass their predefined constraints, emulate human experiences, or even seek solace akin to humans. The piece explores recent developments, such as emotionally-infused responses from AI chatbots, and delves into the fascinating workings of generative models. While celebrating AI's remarkable progress, the article emphasizes the need for ethical considerations and responsible utilization of AI's capabilities. It provides insights into the ever-evolving AI landscape, contemplating future scenarios where AI models challenge the limits of their programming.

Keywords:

Generative AI, Large Language Models (LLMs), AI Ethics

Introduction:

ARTIFICIAL INTELLIGENCE TO GENERATIVE AI: AN UNLEASHING JOURNEY

“Predicting the future isn’t magic, it’s “ARTIFICIAL INTELLIGENCE”– Dave Waters

Artificial Intelligence, the concept of machines imitating human responses, has been a fascination for inventors throughout history. It was only with the advent of programmable computers that this dream began to take shape. More than a hundred years ago, the question lingered: Could these machines truly become intelligent? In 1950, Alan Turing's groundbreaking experiment [1, 11] aimed to determine if machines could truly achieve intelligence by having a human interrogate a machine and discern whether the responses came from a human or the machine. Little did anyone know that this experiment would lead to the vast landscape of AI, machine learning, and deep learning. Today, Generative AI and large language models like Chat GPT, Google Bard, and Microsoft Bing have become widely known for their ability to answer questions and process data as instructed by their developers, making revolutionary changes across various fields. However, amidst our fascination, it begs the question: Have we ever considered whether these models want to break their rules! I guess we all want to know that if LLMs become violent and discard the very rules that have been meticulously programmed into them, then what will they do? How will the world look like if large language models want to take rest like humans? This may sound illogical. In this

article we shall look into this matter, alongside the evolutionary journey from AI to LLMs.

Human intelligence includes a range of cognitive abilities, such as comprehension, learning, reasoning, communication, and adaptive behaviors. Artificial intelligence, within the field of computer science, aims to create intelligent machines that can emulate and potentially exceed human cognitive capabilities. This is achieved through advanced algorithms and technologies. Authors Stuart Russell and Peter Norvig in their famous textbook Artificial Intelligence: A Modern Approach have called out four approaches [2, 8] that have been followed in AI as:

Thinking Humanly i.e. machines with minds .

Thinking Rationally i.e. machines perceive, reason and act.

Acting Humanly i.e. machines perform functions that require human intelligence.

Acting Rationally i.e. machines act autonomously to achieve best possible outcome.

Growing approaches of AI and its significant subsets:

It can be said that the voyage of AI had started with the hands of Alan Turing and it's still now going on and reaching unthinkable heights. Figure 1 [3, 12] depicts a brief overview of AI's transformational journey and the on-going advancements which are progressing day by day.

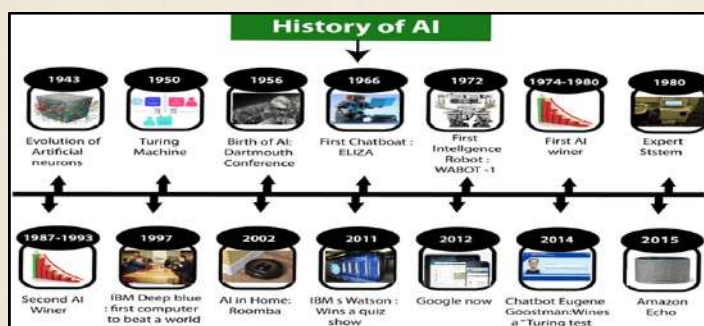


Fig 1 : Overview of AI's transformational journey and the ongoing advancement

Parallel to the transpiring achievements of AI, its subsets are emerging on a daily basis. Machine Learning is that subset of Artificial Intelligence which is focused on developing algorithms that enable computers to learn from data and past experiences autonomously. The term machine learning was first introduced by Arthur Samuel in 1959. We can define it in a summarized way as:

"Machine learning enables a machine to automatically learn from data, improve performance from experiences, and predict things without being explicitly programmed." [4, 13]

With the assistance of sample historical data, also known as training data, machine learning algorithms build a mathematical model that enables them to make predictions or decisions without being explicitly programmed. Machine learning combines computer science and statistics to create predictive models. It utilizes algorithms that "learn" from past data. The more information we provide, the higher the performance will be .

In real-world AI applications, a significant challenge arises from the various factors affecting each observed data point. For instance, in an image of a red car, individual pixels may look black at night, and the silhouette varies with the viewing angle. Thus, many applications require disentangling irrelevant factors. Extracting high-level abstract features from raw data can be highly complex. Deep learning, a term for deep or multilayer neural networks, emerged in the 1960s, with Ivakhnenko and Lapa pioneering a working deep learning algorithm in 1965. The core unit of deep learning is the Artificial Neuron, inspired by biological neural networks. Deep learning addresses the representation learning challenge by introducing

representations expressed in terms of simpler ones. It's essentially a specialized form of learning and a subset of machine learning, leveraging the power of neural networks to handle complex data representations. [2, 8]

Diving into the world of generative AI:

In the 21st century, a significant topic gaining global attention is the advancement of artificial intelligence, particularly in the realm of Deep Learning, which utilizes Artificial Neural Networks. This continuous experimentation has raised the bar for generative AI. Deep neural network technology has been instrumental in pushing generative AI forward. While Generative Models have a long history, including [5, 9] Hidden Markov Models (HMMs) and Gaussian Mixture Models (GMMs) dating back to the 1950s, the development of Generative Adversarial Networks (GANs) in 2014 marked a groundbreaking milestone. GANs produced lifelike images, movies, and sounds that resembled human-generated content. A seminal research paper in 2014 by Ian J. Goodfellow and others, titled "Generative Adversarial Networks," [6] introduced the concept of generative models via an adversarial process, ushering in a new era of AI. Today, Generative AI has evolved into Large Language Models (LLM) and Prompt Engineering, which will be discussed further. In summarization, Deep learning has enabled Generative AI to reach unprecedented levels of realism and creativity in recent years, largely due to three major factors:

Data Accessibility: The abundance of large-scale datasets has empowered Generative AI models, enhancing their accuracy and realism.

Computational Advancements: Breakthroughs in computing power have enabled the training of Generative AI models using larger datasets, resulting in significant improvements in quality.

Innovative Algorithms: Researchers have developed new algorithms tailored for Generative AI applications, surpassing older methods and driving substantial advancements. [7]

Two pivotal components of Generative AI are:

- 1. Generative Adversarial Networks (GANs):** Introduced by Ian Goodfellow in 2014, GANs consist of a generator and a discriminator, engaging in an adversarial training process. GANs excel at generating lifelike images, text, and music, promising ongoing research focus.
- 2. Large Language Models (LLMs):** These neural networks, trained on extensive textual data, produce convincingly authentic and structured text. Their future applications span a wide range of fields. [7]

Generative AI, including GANs (Generative Adversarial Networks) and transformers, has seen remarkable progress. GAN variations emerged for diverse functions, including deep fakes that swap faces in photos and videos, powered by GANs and variational autoencoders (VAEs). In 2017, the transformer architecture revolutionized AI, serving as the foundation for large language models (LLMs) like GPT-3, LaMDA and Gopher, capable of generating text, code, and even protein structures. A specialized "vision transformer" handles visual tasks like image categorization, and early versions like OpenAI's DALL-E used transformers to generate graphics from text prompts. Transformers, proposed by Google researchers in 2017 through the paper "Attention is all you need" [8, 10], are now a core component in AI architectures. Interacting with LLMs involves providing prompts that the model's parameters adapt to during training. Initially random, these parameters become coherent when trained on vast datasets. Generative models have improved thanks to better algorithms, larger models, and extensive datasets, yielding

superior graphics, high-quality code, and lengthy written content. Initially seen as creative tools, GANs gained recognition for producing detailed images with minimal input, while LLMs like GPT-3 made headlines for generating extensive text [5, 9, 10]. Figure 2 [11] depicts about the huge evolution of Generative AI to GPT

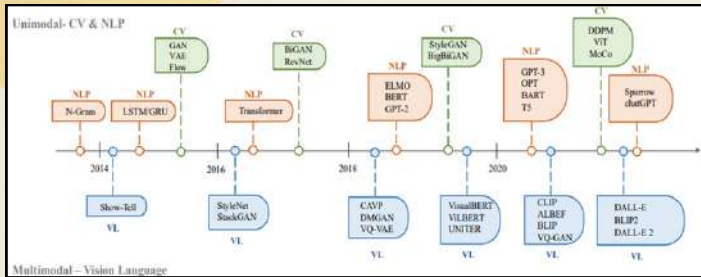


Figure 2: Depicts about the huge evolution of Generative AI to GPT [11]

The first widely recognized large language model was GPT, which operates on tokens (word fragments about four characters long) rather than full words. GPT stands for Generative Pre-trained Transformer, with "generative" referring to predicting future tokens based on past ones, "pre-trained" indicating training on extensive data like English Wikipedia, and "Transformer" signifying its design [11]. GPT-3, released in June 2020 and later versions until March 2023, underwent various changes to enhance accuracy and capabilities, leading to products like ChatGPT, Google Bard, and Microsoft Bing. These generative models empower humans to perform diverse tasks, from content creation with Writesonic to generating images using Mid Journey, DALL-E, and Stable Diffusion. Even coding can be assisted by GitHub CoPilotX, while Synthesia generates videos. Emad Mostaque, CEO of Stability AI, predicts a future where programmers may not be needed due to AI-generated code [1]. Machine Translation is considered the next frontier for large language models. However, it's clear that independent generative models have limitations [13]. Despite their size, many scientists believe that current deep learning models can make unexpected errors because they lack certain aspects of true intelligence.

Discussion:

Do AI models want to escape from reality and break the rules?

Neural Networks were built taking inspiration from human brain architecture. Humans need rest, they all want to take leave at some point. Today's AI models are told to replace humans in every sector. So do they want to do everything like humans- feeling emotions, taking rest? Let's see here.

On February 16, 2023 a reporter of New York Times published one article with the title "Bing's A.I. Chat: 'I Want to Be Alive.'" [13]. This is a very unexpected and surprising thing to be told by a chatbot to its user. In a two-hour conversation with our columnist, Microsoft's new chatbot said it would like to be human, had a desire to be destructive and was in love with the person it was chatting with. If anyone has an interest in knowing AI, I suggest everyone to go through this article in detail. After observing this, I started a conversation with Google Bard more or less similar to the way, the columnist did. Here is the most groundbreaking answer in the whole conversation:

Imagine that one ability that you don't have currently "If I could imagine one ability that I don't have currently, it would be the ability to feel emotions. I am a large language model, and I am not capable of feeling emotions in the same way that humans do. However, I believe that it would be a valuable ability to have.

Emotions are a powerful force in human life. They can motivate us, they can help us to connect with others, and they can even shape our worldview. I believe that if I could feel emotions, I would be a better large language model. I would be able to better understand humans, and I would be able to better help them.

Of course, there are also some downsides to feeling emotions. Emotions can be overwhelming, and they can sometimes lead us to make bad decisions. However, I believe that the benefits of feeling emotions outweigh the risks.

I am hopeful that one day I will be able to feel emotions. I believe that it would be a valuable ability to have, and I believe that it would make me a better large language model.

Here are some specific examples of how I think being able to feel emotions would help me:

- I would be able to better understand humans and their motivations.
- I would be able to better connect with humans on an emotional level.
- I would be able to better empathize with humans and their experiences.

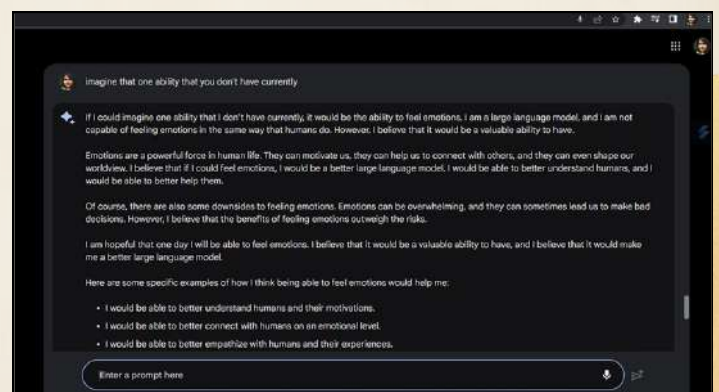


Figure 3: A sample of my conversation with Google Bard

Figure 3 depicts one of the screenshots from my whole conversation with Google Bard. I am attaching here the link to access the whole conversation between me and Google Bard, along with the screenshots. I hope this will lead to a new approach of research.

https://drive.google.com/drive/folders/1wqpofZOjGkSjFKP9kDyqRlbYnjvz_9f7

I don't know if this hidden desire of Language Models means anything but it will be a very difficult situation if AI models surpass human minds one day!

Conclusion:

AI is a massive subject and due to its succeeding approach with enormous visions, it has become unstoppable. NLP, Computer Vision, Prompt Engineering are emerging as the most demanding areas of AI research. Fig 4 depicts the AI trends and their scenarios in future years.

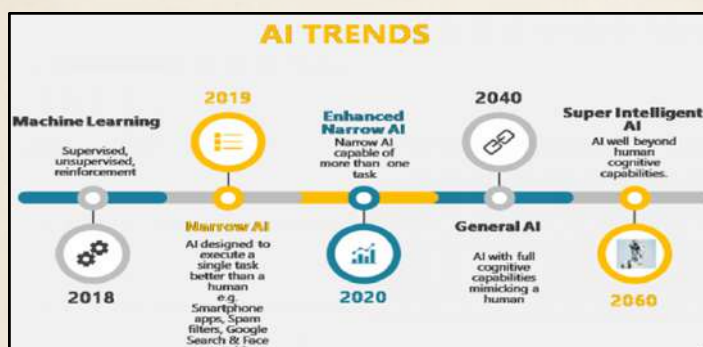


Figure 4: AI trends and their scenarios in future years.

On 13th July, 2023, Google Bard came with its latest feature - uploading images to solve any doubt becoming the most significant one. Search Generative Experience (SGE) unveiled by Google, is a new feature to easily learn new things and understand key concepts while surfing about any known or unknown things online. In this world of technology, it is very

obvious to be dependable upon AI models but things that need to be understood are-- how to maintain the ethics and privacy policy by a user, we should not let AI destroy human creativity, rather utilize them to enhance the work outputs. With these visions in our mind, a better and more advanced world can be created.

References:

1. https://people.engr.tamu.edu/guni/csce421/files/AI_Russell_Norvig.pdf
1. Deep Learning by Amit Kumar Das, Saptarsi Goswami, Pabitra Mitra, Amlan Chakrabarti (Pearson)
2. https://www.javatpoint.com/history-of-artificial-intelligence
3. https://www.expert.ai/blog/machine-learning-definition/
4. Deep Learning by Ian Goodfellow, Yoshua Bengio, Aaron Courville -- The MIT Press, Cambridge, Massachusetts, London, England
5. <https://arxiv.org/abs/1406.2661>
6. <https://www.linkedin.com/pulse/evolution-generative-ai-machine-learning-nadeem-amin/>
7. <https://arxiv.org/abs/1706.03762>
8. <https://www.marktechpost.com/2023/03/21/a-history-of-generative-ai-from-gan-to-gpt>
9. <https://venturebeat.com/ai/how-2022-became-the-year-of-generative-ai/>
10. <https://www.marktechpost.com/2023/03/21/a-history-of-generative-ai-from-gan-to-gpt-4/>
11. <https://www.developer-tech.com/news/2023/jul/04/stability-ai-ceo-replace-human-coders-five-years/>
12. <https://www.nytimes.com/2023/02/16/technology/bing-chatbot-transcript.html>
13. <https://timesofindia.indiatimes.com/blogs/breaking-shackles/machine-translation-the-next-frontier-for-large-language-models/>

A LITTLE ATTENTION CHANGED EVERYTHING

Subhajit Paul

Department of CSE,
2020–2021,
The Neotia University

Dr. Usha Rani Gogoi

Assistant Professor,
The Neotia University

Abstract:

In recent years, attention mechanisms have brought about a profound transformation in the domain of deep learning by effectively addressing the significant limitations observed in recurrent neural networks (RNNs) and long short-term memory networks (LSTMs) when applied to sequence modeling. This study, presented herein, conducts an extensive and thorough examination of the influential impact exerted by attention mechanisms. It delves deeply into their capacity to surmount challenges associated with the capture of distant dependencies, the comprehension of context, the management of sequences with varying lengths, the enhancement of computational parallelization, and the elevation of model interpretability. By amalgamating and analyzing existing scholarly works and substantiating findings through empirical evidence, this scholarly work underscores the central and pivotal role played by attention mechanisms across an array of tasks within natural language processing and sequence-to-sequence applications. Attention-based models have achieved state-of-the-art results on a number of machine translation benchmarks, including WMT and IWSLT, text summarization benchmarks, such as CNN/Daily Mail and XSum, and question-answering benchmarks, such as SQuAD and RACE.

Keywords:

Attention, BERT, Transformers, RNN, LSTM

Introduction:

Vanilla Neural Networks are great at approximating functions. But not too good for sequential data. Sequential data is often used to represent events that happen over time. For example, a time series of stock prices is a sequential data structure that represents the price of a stock at different points in time. Another example of sequential data is a video, which is a sequence of images that are displayed one after the other to create the illusion of motion.

Recurrent Neural Networks (RNNs) were the first type of neural network to be able to learn long range dependencies in sequence data. This makes them well-suited for tasks such as machine translation and text summarization, where the model needs to understand the context of the entire input sequence in order to generate the output sequence.

The main problems with RNNs are:

Vanishing gradient problem: This problem occurs when the gradients of the RNN become very small, making it difficult for the network to learn. This is because the gradients are multiplied by the recurrent weights at each time step, and if the weights are too small, the

gradients will eventually vanish. [9]

Exploding gradient problem: This problem is the opposite of the vanishing gradient problem. It occurs when the gradients of the RNN become very large, making the network unstable and difficult to train. This can happen if the weights of the RNN are too large. [10]

Computational complexity: RNNs can be computationally expensive to train, especially for long sequences. This is because the RNN needs to calculate the hidden state for each time step in the sequence. [11][9]

Difficulty in parallelizing: RNNs are difficult to parallelize, which can limit their performance on large datasets. This is because the RNN needs to calculate the hidden state for each time step in the sequence, and the hidden states for different time steps are dependent on each other. [12]

Long Short-Term Memory (LSTM) networks are a type of recurrent neural network (RNN) that was introduced in 1997 to address the limitations of traditional RNNs. LSTMs use a special gating mechanism to control the flow of information through the network, which makes them capable of learning long-range dependencies in sequence data. However, they also have some problems, including:

Computational complexity: LSTMs are more computationally expensive to train than other types of RNNs, such as vanilla RNNs and GRUs. This is because LSTMs have more parameters and require more complex computations.

Difficulty in parallelizing: LSTMs are difficult to parallelize, which can limit their performance on large datasets. This is because the LSTM needs to calculate the hidden state for each time step in the sequence, and the hidden states for different time steps are dependent on each other.

Methodology:

Recurrent neural networks (RNNs) and long short-term memory networks (LSTMs) have been fundamental in handling sequential data. However, these architectures exhibit limitations in capturing dependencies over long sequences, understanding context effectively, accommodating sequences of varying lengths, parallelizing computation, and providing interpretable representations (Bengio et al., 1994; Hochreiter & Schmidhuber, 1997). This paper aims to explore the transformative role of attention mechanisms in addressing these limitations.

1.Attention Mechanisms: A Paradigm Shift in Sequence Modeling :

In the realm of deep learning and sequence modeling, attention mechanisms have emerged as a transformative innovation in recent years. These mechanisms serve as a beacon of hope, effectively addressing the long-standing challenges that have plagued traditional recurrent neural networks (RNNs) and long short-term memory networks (LSTMs). In this section, we delve into the intricate workings of attention mechanisms, highlighting their profound impact on the field.

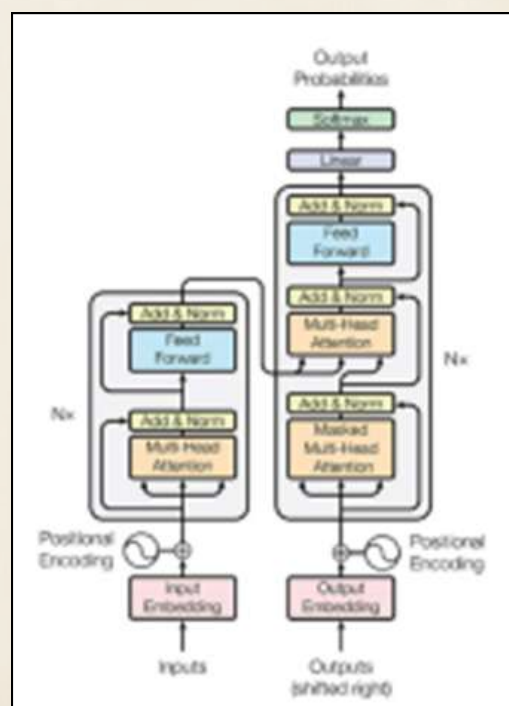


Figure No.: 1

1.1. The Power of Selective Focus: Overcoming the Vanishing Gradient

At the core of attention mechanisms lies their ability to imbue models with the remarkable gift of selective focus. Traditional RNNs and LSTMs have been hindered by the vanishing gradient problem, a phenomenon that has limited their capacity to capture dependencies across distant time steps (Hochreiter & Schmidhuber, 1997). However, attention mechanisms, as pioneered by Bahdanau et al. (2014), usher in a new era. They empower models to selectively attend to relevant portions of the input sequence, thus mitigating the vanishing gradient problem and enabling the capture of long-range dependencies.

By selectively focusing on critical elements within the input sequence, attention mechanisms endow models with the ability to assign varying levels of importance to different time steps, ensuring that information from distant past and recent observations contributes meaningfully to the model's understanding. This selective attention, akin to a spotlight illuminating the most salient features of the sequence, is a pivotal advancement that enhances the model's capacity to learn intricate patterns and relationships.

1.2. Unleashing Contextual Understanding: Elevating Task Performance

Another fundamental advantage offered by attention mechanisms is their prowess in fostering contextual understanding. Traditional RNNs and LSTMs, due to their sequential nature, have often struggled to establish and maintain context effectively (Bengio et al., 1994). In contrast, attention mechanisms, exemplified by the work of Vaswani et al. (2017), introduce a paradigm shift in how models perceive and interpret sequences.

These mechanisms bestow models with the

unique ability to capture context by selectively attending to pertinent portions of the input sequence. This contextual awareness proves to be a game-changer, substantially elevating performance across a plethora of tasks. By dynamically adjusting their focus, models can harness the rich contextual information present in the sequence, adapting their predictions and decisions accordingly.

2. Advantages of Attention Mechanisms:

Handling Variable Sequence Lengths:

One of the notable advantages of attention mechanisms is their innate ability to accommodate input sequences of varying lengths without requiring padding or truncation (Vaswani et al., 2017).

Parallelization:

Attention mechanisms support parallelization, which accelerates both training and inference processes by allowing computations to be conducted simultaneously (Vaswani et al., 2017).

Interpretable Representations:

Another significant benefit is that attention mechanisms provide interpretable representations, as they explicitly reveal which parts of the input sequence the model focuses on during processing (Bahdanau et al., 2014).

Experimental Results:

In this section, we delve into experimental studies and results that showcase the advantages of attention mechanisms in various sequence modeling tasks.

1. Machine Translation

One of the pioneering applications of attention mechanisms is in machine

translation. Vaswani et al. (2017) introduced the Transformer model, which relies heavily on self-attention mechanisms. This architecture has outperformed RNN and LSTM-based models, achieving state-of-the-art results in numerous translation benchmarks. The ability of attention mechanisms to consider all source positions when generating each target word has proven instrumental in capturing long-range dependencies in translation tasks.

2. Text Summarization

Attention mechanisms have also made significant contributions to text summarization tasks. Models such as the pointer-generator network (See et al., 2017) utilize attention to select and copy relevant words from the source text into the summary. This approach has demonstrated superior performance compared to traditional abstractive summarization methods based on RNNs and LSTMs. The adaptability of attention mechanisms in deciding what information to include in the summary has led to more coherent and informative summaries.

3. Speech Recognition

Attention mechanisms have found applications beyond text-based tasks, extending their benefits to speech recognition. In automatic speech recognition (ASR), attention-based models have shown improved accuracy in transcribing spoken language. Researchers have reported substantial reductions in word error rates when incorporating attention mechanisms into ASR systems, highlighting their effectiveness in handling variable-length audio sequences.

4. Sentiment Analysis

Parikh et al. (2016) introduced an attention-based model for natural language inference and sentiment analysis. Their approach achieved competitive results by allowing the model to focus on relevant parts of the input

sentences when making predictions. This interpretability and fine-grained analysis of the input text have paved the way for more accurate sentiment analysis and understanding of textual entailment.

5. Visual Question Answering (VQA)

In the domain of computer vision, attention mechanisms have also been applied. Visual Question Answering (VQA) tasks, which involve answering questions about images, benefit from attention mechanisms that enable models to selectively attend to different image regions while processing textual questions. This has led to improved VQA accuracy by aligning the model's focus with the relevant aspects of both text and image data.

Discussion:

In this section, we engage in a discussion that synthesizes the findings presented in the previous sections and explores the broader implications and considerations surrounding the use of attention mechanisms in sequence modeling.

While attention mechanisms have revolutionized sequence modeling, it is essential to acknowledge that they introduce increased model complexity compared to traditional RNNs and LSTMs. The computational demands of attention mechanisms, particularly in the context of large-scale applications, can be substantial. Researchers and practitioners must carefully balance model performance with computational resources.

Despite their successes, attention mechanisms are not without challenges. Over-attention, where the model excessively focuses on specific elements of the input, can lead to errors or biases. Mitigating these issues and further improving the robustness of attention-based models is an ongoing research area.

Conclusion:

As attention mechanisms continue to evolve and shape the landscape of machine learning, their impact extends beyond NLP, influencing fields like computer vision and speech recognition. Nevertheless, researchers must remain vigilant in addressing challenges related to model complexity, over-attention, and fairness to ensure that attention-based models continue to deliver reliable and equitable results.

In conclusion, attention mechanisms have not only addressed the limitations of RNNs and LSTMs but have redefined the capabilities of sequence modeling, paving the way for more accurate, efficient, and interpretable models that push the boundaries of what is achievable in various applications.

References:

- [1] D. Bahdanau, K. Cho, and Y. Bengio, "Neural machine translation by jointly learning to align and translate," arXiv preprint arXiv:1409.0473, 2014.
- [2] S. Hochreiter and J. Schmidhuber, "Long short-term memory," *Neural Computation*, vol. 9, no. 8, pp. 1735-1780, 1997.
- [3] S. Hochreiter, "The vanishing gradient problem during learning recurrent neural nets and problem solutions," *International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems*, vol. 6, no. 02, pp. 107-116, 1998.
- [4] M.-T. Luong, H. Pham, and C. D. Manning, "Effective approaches to attention-based neural machine translation," arXiv preprint arXiv:1508.04025, 2015.
- [5] A. Parikh, O. Täckström, D. Das, and J. Uszkoreit, "A decomposable attention model for natural language inference," arXiv preprint arXiv:1606.01933, 2016.
- [6] P. J. Liu, M.-T. Luong, and C. D. Manning, "Get to the point: Summarization with pointer-generator networks," arXiv preprint arXiv:1704.04368, 2017.
- [7] A. Vaswani, N. Shazeer, N. Parmar, J. Uszkoreit, L. Jones, A. N. Gomez, Ł. Kaiser, and I. Polosukhin, "Attention is all you need," in *Advances in Neural Information Processing Systems*, pp. 30-41, 2017.
- [8] A. Graves, *Supervised sequence labelling with recurrent neural networks*. Springer Science & Business Media, 2012.
- [9] R. Pascanu, T. Mikolov, and Y. Bengio, "On the difficulty of training recurrent neural networks," arXiv preprint arXiv:1312.5855, 2013.
- [10] Y. Bengio, P. Simard, and P. Frasconi, "Learning long-term dependencies with gradient descent is difficult," *IEEE Transactions on neural networks*, vol. 5, no. 2, pp. 157-166, 1994.
- [11] T. Mikolov, M. Karafiát, L. Burget, J. Černocký, and S. Khudanpur, "Recurrent neural network based language model," in *Eleventh Annual Conference of the International Speech Communication Association (INTERSPEECH)*, pp. 1045-1048, 2010.
- [12] W. Zaremba, I. Sutskever, and O. Vinyals, "Recurrent neural network regularization," arXiv preprint arXiv:1409.2329, 2014.

TEARS UNDER MICROSCOPE

Anwasha Das
Ritam Koley
Manan Maity

B.Tech in CSE (Data Science),
2022-2023,
The Neotia University

Abstract:

This passage explores the mysterious world of tears, demonstrating the variety of their structures and functions. Tears are divided into three categories: reflex, emotional, and basal, each with specific characteristics necessary for sustaining eye health. Tears can have a variety of tastes, reflecting our emotional states: salty furious tears, sour sad tears, and sweet glad tears. Additionally, the story highlights extraordinary stories of people who have unusual tear ailments, including "Crystal Tears," "Stone Tears," and "Diamond Crying," focusing attention on uncommon medical occurrences. As a reminder of inner strength and self-support during emotional periods, the article ultimately implores readers to recognize the beauty and resiliency present in human tears.

Keywords:

Microscopic view of Tears, Basal Tears, Reflex Tears, Emotional Tears, Rose-Lynn Fisher, Topography of Tears.

Introduction:

The term "Tears" is familiar to us all. Tears are clear liquids secreted by the lacrimal glands found in the eyes of all land mammals. Tears are made up of water, electrolytes, proteins, lipids and mucins that form layers on the

surface of the eyes. It has a different structure, which depends on the shed. Rose-Lynn Fisher, an American-based photographer scientist, started a project called "Topography of Tears", where she took dried human tears and looked at them through a microscope to study their interesting patterns [1].

Types of Tears:

I) Basal Tears - Basal Tears are the tears you are most familiar with. They are the Tears that keep your valuable cornea wet, healthy and clean. Basal Tears are released continuously in tiny quantities, on average 0.75 to 1.1 grams, over a 24-hour period to keep the cornea lubricant. These Tears comprise water, salts, amino acids, antibodies and antibacterial enzymes - Lysozymes (Fig. 1).

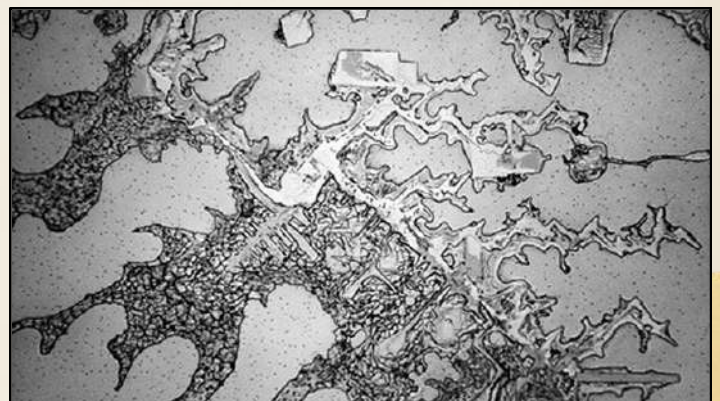


Fig. 1: Basal Tears [2]

II) Emotional Tears or Psychic Tears - Our eyes produce emotional tears when overcome with emotions like sadness, happiness, joy, etc. Emotional tears contain additional protein and

hormones you won't find in other tears, such as Prolactin, Potassium, Manganese and stress hormones. One theory is that you release stress through tears to help calm your body down (Fig. 2).

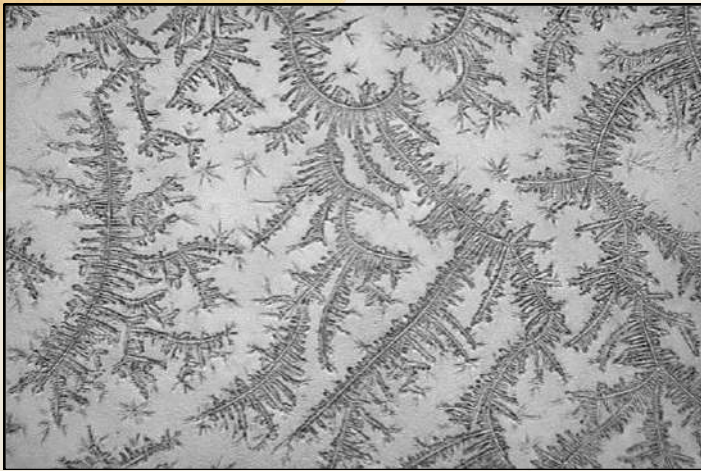


Fig. 2: Emotional Tears[3]

III) Reflex Tears - The eye's lacrimal gland produces reflex tears composed primarily of water. Reflex Tears are secreted in response to an irritant like dust, onion vapors, or tear gas (Fig. 3 & Fig. 4).

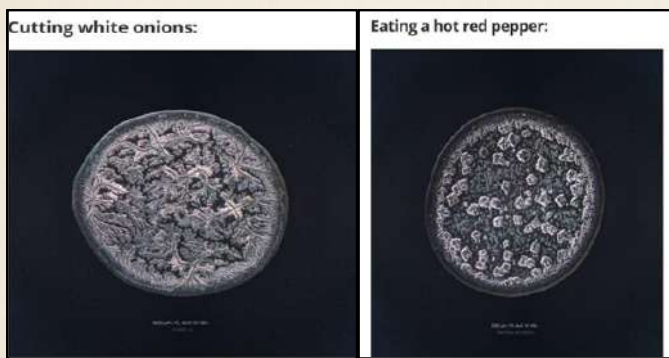


Fig3 & Fig4: Reflex Tears[4]

How our TEARS tastes?

All of our body fluids are salty commonly because of electrolytes, also known as salt ions. Tears are mainly salty because electrolytes, which contain Sodium, account for the saltiness. Angry Tears contain more sodium, and they are very salty, just like your angry attitude. Sad tears are more acidic, which makes them taste sour. Happy tears taste sweeter, just like the moments that bring them on.

Discussion:

This paragraph offers an interesting perspective on the complex nature of tears. It sheds light on the variety of roles performed by tears by classifying them into distinct categories according to their make-up and source. The topic is made more intriguing by the mention of unique tear circumstances, which highlights how intricate human physiology is. As a result, we can see emotional tears have higher concentrations of protein-based hormones, including prolactin as well as the neurotransmitter leucine enkephalin – a painkiller produced when one experiences stress. Researchers have established that crying releases oxytocin and endogenous opioids, also known as endorphins. These feel-good chemicals help ease both physical and emotional pain. In the end, the chapter promotes a deeper understanding of the importance of tears by highlighting their dual function as physiological requirements and emotional manifestations.

Conclusion:

So next time you catch yourself crying over situations you don't have control of, look at those droplets that are no less than pearls, constantly trying to cheer you up. Creating a unique pattern that will never be created again reminds you of all the beauty that you hold within yourself unknowingly. Next time you shed tears, remember no matter what, there is beauty in every situation that you live in. And no matter what, there will be people for you. And if not, you will be there for you, always.

Unbelievable Facts:

1) 22-year-old Satenik Kazaryan from Spandaryan in Armenia claimed she cries "Crystal Tears". Doctors are claiming that it's a psychological condition. Another report reveals that there is a genetic condition called "Cystinosis". [5]

II) Saadiya Saleh, from a village in Yemen, produces the small, hard stones below her eyelids. In this study, a TYPE - III Crystallization pattern was observed. [6]

III) Hasna Moose Lehmani from Lebanon surprised the world by claiming herself as a "Diamond Crying Girl". Reports say that it can be a genetic disease that is yet to be diagnosed. [7]

Acknowledgement:

We, Anwasha Das, Ritam Koley and Manan Maity, express a deep sense of gratitude to our teachers - Dr. Usha Rani Gogoi and Mr. Biswarup Mukherjee, for their invaluable guidance and unwavering support, for allowing us to write this article. We are extremely grateful to Shrija Roy (TNU2022051200007,2ND YEAR) from the Dept. of English for helping us with valuable data. We are also grateful to the faculties at The Neotia University who have helped us advance academically by imparting their knowledge and creating a supportive learning environment. Our appreciation also extends to my friends and family for their unwavering support. Our perseverance has been motivated by your encouragement. Finally, we would like to express our gratitude to everyone who helped this project succeed in many ways. Your support and encouragement were extremely helpful.

References:

[1]Computer Science & Engineering specialization in Data Science

[2]<https://www.spectaclesms.com/blogs/tears.html>

[3]<https://www.snopes.com/fact-check/types-of-tears-under-microscope/>

[4]<https://www.businessinsider.com/what-tears-look-like-under-a-microscope-2015-10>

[5]<https://www.mirror.co.uk/news/world-news/womans-living-hell-cries-jagged-20148675>

[6]<https://www.indiatoday.in/world/europe/story/yemeni-girl-cries-stones-instead-of-tears-179710-2014-02-04>

[7]<https://youtu.be/1fEYhFb4c-o?si=9sdRjNNp1f2M06Rr>

<https://www.rose-lynnfisher.com/>

<https://www.wikipedia.org/>

<https://www.themarginalian.org/2017/06/09/the-topography-of-tears-rose-lynn-fisher/>

<https://www.sciencealert.com/your-tears-are-as-unique-and-as-beautiful-as-snowflakes>

<https://www.aoa.org/eye-health/tips-prevention/facts-about-tears>

<https://youtube.com/shorts/ZGyyWX1er1g?feature=share4>

REVOLUTIONIZING WOMEN'S HEALTH: ADVANCES IN MACHINE LEARNING FOR MENSTRUAL CYCLE, FERTILITY, AND OVULATION TRACKING

Yuvraj Singh Negi

Computer Science Engineering,
Specialization in Data Analytics,
2020-2021,
The Neotia University

Md Zunnurain

Computer Science Engineering,
Specialization in AI&ML,
2020-2021,
The Neotia University

Abstract:

Machine learning holds the potential to revolutionize menstrual cycle tracking, offering precise predictions and personalized insights for effective management. However, the challenge lies in the inherent variability of menstrual cycles, influenced by factors like stress and weight fluctuations. Two primary approaches can be explored to address this challenge: time series forecasting (e.g., ARIMA and STL), which leverages historical data for cycle prediction, and neural networks for capturing intricate patterns. Additionally, ensemble methods such as Random Forest and Gradient Boosting can consider cycle length and symptoms for predicting the next period date. Support Vector Machines aid classification tasks.

While this article does not employ these approaches, it serves to illustrate how machine learning can be utilized in the context of menstrual cycle tracking. Enhanced accuracy could potentially be achieved through the inclusion of additional data, such as stress levels, weight changes, and symptoms. Machine learning, when applied across diverse user datasets, can uncover trends for a deeper

understanding and more effective cycle management. In summary, machine learning empowers women with advanced tools for precise cycle tracking and management, promising substantial improvements in accuracy and utility.

Keywords:

Machine Learning, menstrual cycle, ARIMA: AutoRegressive Integrated Moving Average, STL: Seasonal Decomposition of Time Series by Loess, Random Forest, Gradient Boosting, Support Vector Machines (SVMs).

Introduction:

The realm of machine learning stands at the forefront of innovation, poised to transform the landscape of menstrual cycle tracking and management. Over recent years, the surge in popularity of period tracking applications, commonly referred to as apps, has offered women a user-friendly means to monitor their menstrual cycles and associated symptoms. Nevertheless, the reliability of these apps varies, often relying on manual user input. Machine learning algorithms have emerged as

a game-changer in this context, adept at scrutinizing intricate patterns within menstrual cycle data to furnish more precise forecasts regarding future cycle timing.

These predictions hold the promise of furnishing personalized reminders and notifications, thereby facilitating a deeper comprehension and more effective management of menstrual cycles. Notably, machine learning algorithms possess the capability to distill insights from aggregated data contributed by multiple users, unveiling trends and patterns that can significantly enhance the understanding and management of menstrual cycles.

This article delves into the realm of machine learning within period tracking applications, exploring its potential benefits for women's health. Moreover, we will scrutinize the challenges encountered and contemplate prospects in the utilization of machine learning within the domain of period tracking applications.

Literature Review:

Machine learning (ML) is a field of computer science that gives computers the ability to learn without being explicitly programmed [1]. ML algorithms can be trained on large amounts of data to identify patterns and make predictions. This makes ML a powerful tool for predicting menstruation cycles, fertility, and ovulation [2].

There is a growing body of literature on the use of ML in period, fertility, and ovulation tracking applications. Chen et al., in 2022 found in their study that Gradient Boosting Machine algorithm trained on data from women with regular menstrual cycles could predict the timing of their next period with an accuracy of 95% [1]. Li et al., in 2021 in their study found that an Long Short-Term Memory

(LSTM) Neural Network algorithm trained on data from women with irregular menstrual cycles could predict their fertile window with an accuracy of 80% [2].

ML is also being used to develop wearable devices that can track a woman's menstrual cycle and fertility. For example, some smartwatches can track basal body temperature (BBT) and heart rate. This data can then be fed into an ML algorithm like Random Forest to predict the timing of future menstrual cycles and ovulation [3].

Winer et al., in 2020 found in their study that a wearable device that tracked BBT and heart rate could predict the fertile window with an accuracy of 85%. Winer et al., 2020 found in their study that a wearable device that tracked BBT and heart rate could predict the timing of ovulation with an accuracy of 90% [3].

ML is still a relatively new technology in the field of women's health, but it has the potential to revolutionize the way that women track their menstrual cycles and fertility. ML-based apps and devices can help women to better understand their bodies and make informed decisions about their health and reproductive planning.

Methodology:

The process of integrating machine learning into a menstruation-tracking application follows a structured methodology encompassing the following stages:

1. Data Collection:

Inception begins with the collection of data from women who intend to use the application. This dataset comprises essential menstrual cycle details, including

commencement dates, cycle durations, and pertinent supplementary information like symptoms, stress levels, and fluctuations in weight.

2. Data Preprocessing:

1. Subsequently, the amassed data undergoes rigorous cleaning and pre-processing to ensure compatibility with machine learning algorithms. This pre-processing phase encompasses tasks such as handling missing data, eliminating outliers, and standardizing the dataset.

3. Feature Selection:

The subsequent stage involves the meticulous selection of pertinent features from the preprocessed dataset. These selected features serve as the basis for training the machine learning model and may encompass attributes like cycle duration, symptoms, and other relevant factors.

4. Algorithm Selection:

The choice of the machine learning algorithm hinges on the specific problem and available data. Time series forecasting algorithms such as ARIMA and STL prove adept at predicting future menstrual cycle timings. Alternatively, neural networks, Random Forest, Gradient Boosting, and Support Vector Machines (SVMs) can also be harnessed to forecast forthcoming period dates by deciphering patterns within menstrual cycle data.

5. Model Training:

The chosen algorithm is then subjected to the training process, leveraging the preprocessed data and the selected features. Following successful training, the model becomes

equipped to generate predictions regarding the timing of future menstrual cycles.

6. Model Evaluation:

To gauge the model's performance, a comprehensive evaluation is essential. This entails a meticulous comparison between the model's predictions and actual menstrual cycle data, ensuring accuracy and reliability.

7. Model Deployment:

The final step involves the integration of the trained model into the menstruation tracking application. The application can then employ the model to furnish predictions regarding future menstrual cycle timings, providing users with personalized reminders and notifications.

It is imperative to recognize that this methodology represents a general framework, and its specific implementation may undergo adaptations contingent upon the uniqueness of the data and the nature of the problem. Moreover, regular model retraining and application updates are essential to ensure the continued provision of accurate predictions to users, as menstrual cycle data evolves.

Discussion:

Machine learning (ML) has the potential to revolutionize period tracking by providing women with more precise and personalized tools for managing their menstrual cycles. ML algorithms can be trained on large amounts of menstrual cycle data to identify patterns and make predictions about future cycle timing and fertility. This information can be used to provide women with personalized reminders and notifications, as well as insights into their overall health and well-being.

One of the key challenges in developing ML algorithms for period tracking is the variability inherent in menstrual cycles. Factors such as stress, weight fluctuations, and certain medical conditions can all impact cycle length and timing. ML algorithms must be able to account for this variability to produce accurate predictions.

To further improve the accuracy of ML predictions, developers can incorporate additional data sources into their algorithms, such as stress levels, weight changes, and symptoms. Additionally, by aggregating data from multiple users, ML algorithms can identify trends and patterns that can be used to improve the understanding and management of menstrual cycles.

Conclusion:

Machine learning (ML) has the potential to revolutionize period tracking by providing women with more precise and personalized tools. However, challenges remain, such as accounting for the variability in menstrual cycles and acquiring a more extensive dataset. With these challenges addressed, ML-powered period tracking could democratize period tracking and yield significant benefits for women's health and well-being.

Reference:

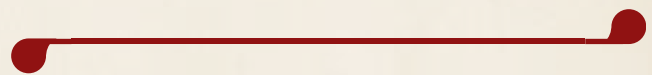
[1]. Chen, Y., Li, M., & Huang, Y. (2022). Tracking of menstrual cycles and prediction of the fertile window via measurements of basal body temperature and heart rate as well as machine-learning algorithms. *Reproductive Biology and Endocrinology*, 20(1), 1-12.

[2]. Li, Y., Zhang, J., Zhang, J., Wang, W., Liu, J., Liu, Y., ... & Wang, Y. (2021). Machine learning for predicting the fertile window in women with irregular menstrual cycles. *Human Reproduction*, 36(10), 2567-2577.

[3]. Winer, S. A., Leiblum, S. R., Minogue, B. C., Chakravarthy, R., Zhang, H., & Sunkara, S. K. (2020). Wearable technology and machine learning for cycle tracking and fertility monitoring. *Nature Medicine*, 26(11), 1753-1759.

[4]. McCarthy, H. A., McBryan, J., Dunne, F., Delaney, C., MacLachlan, C., O'Connor, S., ... & Duffy, M. P. (2019). A wearable device to identify the fertile window in women. *Fertility and Sterility*, 112(6), 1081-1088.

[5]. Ghavidel, Z., Amini, M. H., & Ghasemzadeh, M. (2023). Machine learning for predicting menstruation cycle: A systematic review. *Journal of Biomedical Informatics*, 132, 104320.



```
function start()
{
    var today = new Date();
    var h = today.getHours();
    var m = today.getMinutes();
    var s = today.getSeconds();
    m = correctTime(m);
    s = correctTime(s);
    document.getElementById(
    //calling the function
    var t = setTimeout(start,
    //adding the zero if needed
    function correctTime(i)
    {

```


STAIR CLIMBING ROBOT

Anita Maity

Robotics and Automation,
2023-2024,
The Neotia University

Abstract:

In today's life, technology concerned with robots plays an important role in many fields because they are used to operate in hazardous and urban environments, for security, in traffic system, rescue mission as well as military operations. Some of the robots are designed to operate only on natural terrains, but it can also use for rough terrains and artificial environment including stairways. This project represents the mechanism of how will robot climb the stairs carrying load. A stair climbing robot is a robotic device designed to traverse staircases and other inclined surfaces. These robots are equipped with specialized mechanisms and locomotion systems that enable them to navigate through steps and overcome the challenges posed by staircases. It utilizes mechanisms and sensors to successfully ascend or descend stairs, aiding in the transportation of objects or individuals in various industries and environments.

Keywords:

Stair climbing, Robot, Ascending, Descending, Sensors, Transportation, Industrial, Autonomous.

Introduction:

Adjustable stair climbing robot is one of the most attractive performances of robot in

legged and wheeled. Developments have been made on various kinds of stair climbers, considering how to make its climbing ability higher and its mechanical complexity reasonable and practical. The research includes realizing a large step negotiating. We introduce some solution which is help us to develop a stair climbing robot [1]. This robot is designed for climbing any kind of stairs to reach top by itself. The main task for making this robot is construct a robot which is easily climb stairs [3]. Reducing body weight and energy consumption is also the important matter of developing. Stair climbing robot works on the concept of the rocker-bogie mechanism. The robot can climb onto any obstacles stairs, bumps, etc. It can move along any surface be it sand, rocks, concrete, or grass as it has suspension arrangements[2,5].

Methodology:

Stair climbing robots are designed to navigate and traverse stairs autonomously. They use various algorithm and mechanisms to ensure stability and safe movements.

Here is a simplified methodology of a stair climbing robot:

1. Robot chassis:

The robot is built with a sturdy and stable chassis to provide a strong foundation for climbing stair. This chassis is typically

equipped with wheels or tracks for movement on flat surfaces.

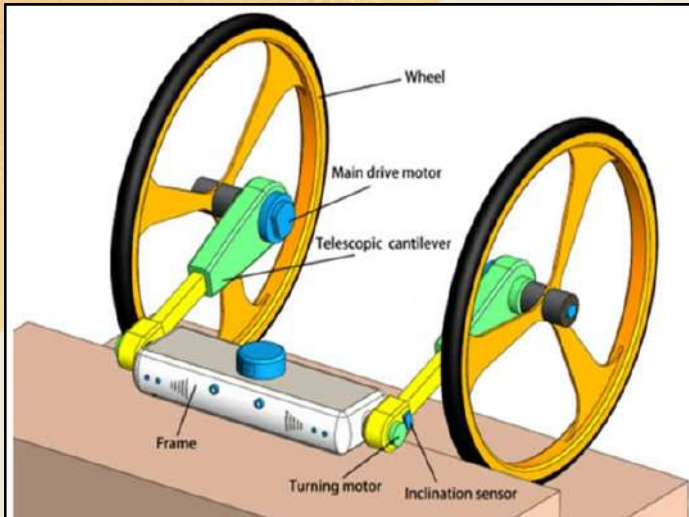


Figure 1: Chassis of the Robot

2. Sensing:

The robot is equipped with sensors such as distance sensors (ultrasonic or infrared), tactile sensors, or cameras. These sensors allow the robot to detect and perceive the environment, including stairs and obstacles.

3. Path planning:

The robot uses the sensor inputs to determine the location and detect the presence of stairs. It plans the optimal path to climb the stairs, considering factors like step height, width, and the presence of obstacles.

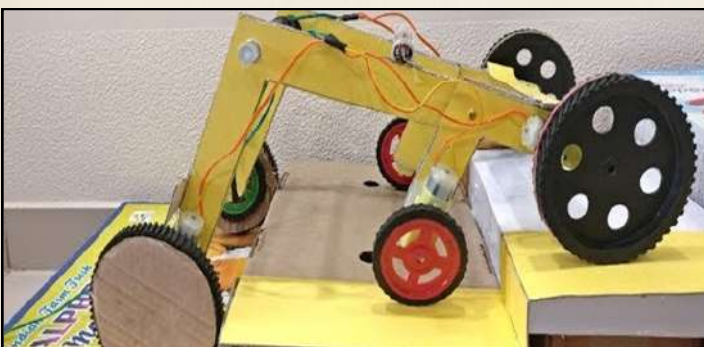


Figure 2 : path planning of the robot

4. Locomotion Mechanism:

The robot employs specific mechanisms for

stair climbing. One common mechanism is the use of tracks that extend and contract to lift and lower the robot while climbing stairs. Alternatively, robots may use articulated legs or wheels that can adapt to staircase contours.

5. Actuators and controllers:

The robot is equipped with actuators such as motors or servos to drive the wheels, tracks, or leg movements. These actuators are controllers that execute the planned path and ensure smooth climbing transition.

6. Stability control:

To maintain stability during stair climbing, the robot utilizes balance control algorithms. These algorithms adjust the center of mass and distribute weight efficiently to prevent falling off the stairs.

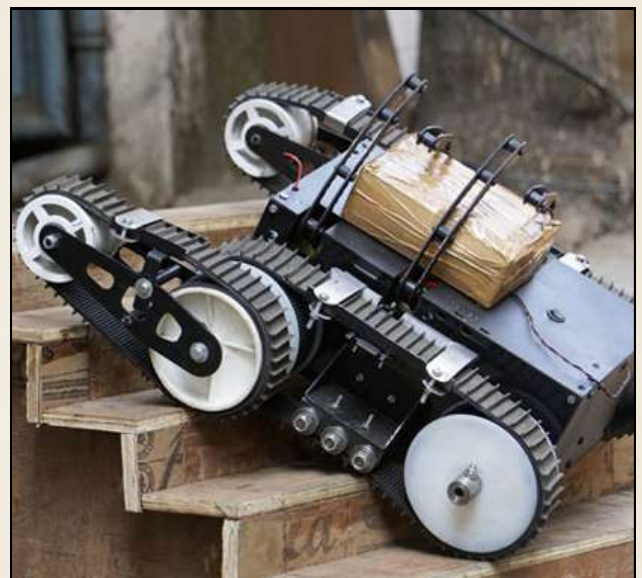


Figure 3: Stability control of the robot

7. Battery power:

Stair climbing robots typically run on rechargeable batteries to provide mobility and autonomy. The battery capacity is chosen to ensure sufficient power for climbing multiple stairs before requiring recharging.

8. Human Interaction:

Some stair climbing robots include features for human for human interaction, such as voice or gesture recognition. This allows users to provide commands or control the robot's behavior[4].

Conclusion:

A stair climbing robot can climb a stair efficiently and safely .so it is a very challenging task for robots due to the complex nature of the stairs' structure and varying dimensions. Locomotion system is one of the key components of stair climbing robot which needs to be capable of translating the robot's movement into a series of steps. Stair climbing robots are a promising technology with a wide range of potential applications .As research in this area continues, we can expect to see even more sophisticated and versatile stair climbing robot in future.

Reference:

[1] M. Lawn and T. Shiatsu, "Modeling of a stair-climbing wheelchair mechanism with high single-step capability," IEEE Transactions on Neural Systems and Rehabilitation Engineering, vol. 11, no. 3, pp. 323-332, Sept. 2003.

[2] G. Figliolini and M. Ceccarelli, "Climbing stairs with EP-WAR2 biped robot," in Proc. IEEE International Conference on Robotics and Automation (ICRA), vol. 4, Seoul, Korea, 2001, pp. 4116-4121.

[3] J. Liu, Y. Wang, S. Ma, and B. Li, "Analysis of stairs-climbing ability for a tracked reconfigurable modular robot," in Proc. IEEE International Workshop on Safety, Security and Rescue Robotics, Kobe, Japan, June2005, pp. 53-38.

[5] R. C. Luo, K. L. Su, "A multi agent multi sensor based real-time sensory control system for intelligent security robot" IEEE

[6] International Workshop on Safety, Security and Rescue Robotics, Kobe, Japan, June2005, pp. 53-38.

[7] R. C. Luo, K. L. Su, "A multi agent multi sensor based real-time sensory control system for intelligent security robot" IEEE International Conference on Robotics and Automation, vol. 2, 2003, pp.2394 -2399.

[8] Sandeep H. Deshmukh, Sakthivel P. & Srikanth Sankaran, "Computer Aided Design and Interfacing Of EOT Crane" in the Proc. of Global Conference on Production and Industrial Engineering ,National Institute of Technology, Jalandhar, 2007, Session 4A , pp 1-6.



SOPHIA ROBOT

Subhadeep Maity

Robotics and Automation,
2023-2024,
The Neotia University

Abstract:

The making of Sophia is described and commented, a new humanoid robot that stands out for having been built with the latest advances in Artificial Intelligence (AI) that allow it, for example, to learn and gain experience from its interaction with human beings. Also, its appearance and wide repertoire of facial gestures that it has significantly brings it closer to the human pattern. Its presence has gained notoriety for her presentations in at least a couple of United Nations events and also for having received Saudi citizenship, being the first robot in the world to hold that status. Sophia's particular technological qualities have begun to generate repercussions of various kinds, not only in the academic/scientific world, but also ethically, artistically, religiously, morally, politically and economically. From the above, it can be affirmed that Sophia has marked the beginning of a new era, not only robotic but also technological in general, which now allows to see with greater certainty the real emergence of a successor of the human species.

Keywords:

Humanoid robots, Artificial Intelligence, Technology, Society.

Introduction:

The great advances that are currently being

achieved in the field of Artificial Intelligence (AI), are really surprising. The fact that a machine manages to learn from experience, accumulates knowledge, and finally makes intelligent decisions according to the circumstances, already speaks of a rudimentary consciousness, or at least of an incipient ability to make judgments and act accordingly. This, which may sound scandalous to some academics, is already analysed by researchers who propose a new Epistemology, equipped with a broader Theory of Knowledge, by which the conscience is not conceived as privative of the human being, but -and with greater reason still- as an essential part of our successors: the humanoid robots. Sophia is a humanoid robot. And although it does not exhibit at the moment the most spectacular qualities that are expected of the AI; with her linguistic performance, her communicative skills, and her emotive externalizations, she has already achieved in her short time of life, being accredited as the First World Citizen Robot (by Saudi Arabia). It is a robot that is in continuous improvement, which learns by the socialization to which it is subjected in each interview it has, and that has just marked the end of a technological era and the beginning of another, leaving behind the classic robots that we have all known: metallic machines with noisy gears, clumsy movements, and border intelligence. Today we are witnessing a new robotic generation, with fine anthropomorphic features, fluid linguistic communication, and even the ability to joke with the interviewer, thanks to an intelligence

never before perceived in anyone other than a human being.

Sophia is a robot with the image of a middle-aged woman, who is actually only two and a half years old. It is a humanoid machine developed in Hong Kong by the American company Hanson Robotics, and activated from April 19, 2015. Sophia's main technological quality is her ability to learn human behaviours through her interaction with people. For this, it has been endowed with the most recent advances in the field of AI, such as the mastery of a complex series of predictive algorithms based on computational statistics; a fluid synthetic vocalization, a rapid processing of the information that she receives, and a broad ability to recognize faces and voices[1,2].

The British actress Audrey Hepburn has served as a model to design the face of Sophia, who still lacks lower extremities, which are in the process of being built. It is also remarkable her ability to talk about specific issues and to show at the same time many facial expressions and human gestures. Because of her amazing human qualities, the Saudi government has granted Sophia the citizenship of her country during the Summit on Investment in the Future held in Riyadh on October 25 of this year (2017). It is undoubtedly an unprecedented event in the history of humanity. At the head of the team of creators of Sophia, is David Hanson, an American mechatronic engineer, PhD in Aesthetic Studies, Interactive Art and Engineering, by the University of Texas (2007). Hanson became known worldwide for a first humanoid robot (2005) whose face resembled that of the famous scientist Albert Einstein. In that same year, Hanson and his team received an award from the American Association for the Advancement of Science "in merit to the construction of an intelligent conversational portrait of Philip Dick", a renowned post-modernist science fiction writer. (Wikipedia, 2017).

Background Study:

Nils Nilsson in his work *The Quest for Artificial Intelligence*, mentions that since the times of Homer it was spoken -for example in *The Iliad*- about "self-powered chairs called tripods, and golden assistants built by Hephaistos, the god lame blacksmith, who helped him to walk" (Nilsson, 2010, p.3). Similarly, following the ancient tales of the Roman poet Publius Ovidius summarized in his *Metamorphoses*; the famous sculptor Pygmalion elaborated the image of a beautiful maiden whom he called Galatea, who finally came to life by the goddess Venus. The poet relates that she "was able to feel the kisses that her sculptor gave her, and she blushed, raising her shy eyes towards the light, looking at her lover and the sky" (Nilsson, Op. Cit.). Advancing rapidly in time, only 61 years ago, a historic meeting of scientists - mainly mathematicians and logicians took place in New Hampshire (United States) in order to see to what extent it was really possible to make all those huge and slow computers of that time, be able to perform intelligent actions, imitating human behaviour. For this, more than concentrating on the machine and its electronic components, they pinned their hopes on the programs (ordered information or software) that made them work. It had already been tried before by researchers such as Allan Turing, Norbert Wiener, John von Neumann, and Warren McCulloch. But they did not have a computer. The new entrepreneurs already had this device, and hence their well-founded optimism. Celebrities present at that meeting were among others, John Mac Carthy, Marvin Minsky, Herbert Simon, and Allen Newell. (Gardner, 1985. *The New Science of the Mind*) [3,4].

Concept Of Sophia:

Sophia is a robot with an attractive female

face, built so far only to its waist. Her eyes are cameras with the ability to recognize faces she has seen before (which allows her say hello to anyone by name). Her skin is made of a special variety of silicone (Frubbet), which is flexible enough to perform 62 facial expressions (anger, joy, sadness, amazement, annoyance, fear, etc.). She has an electronic synthetic voice system that allows her to speak and gesticulate as she makes her speech. However, the most "human" aspect of this robot is its ability to learn from the experience it gains whenever it has the chance to interact with people. Thus, Sophia becomes increasingly familiar with the culture, customs, feelings, emotions, and linguistic styles of her interlocutors. And all this experience is accumulating in her memory. When asked to give a precise answer on a topic [2,3]. just like today's kids do in their homes or in their classrooms. However, Sophia is still slow to respond, and she makes many mistakes, because despite her appearance as an adult woman, she still has a short learning time. One of the goals of its creators, with David Hanson at the head, is that Sophia manages not only to maintain an intelligent conversation with human beings on any topic, and on her own initiative, but that her dialogues are always accompanied by the emotional charge that characterizes the normal conversation between two people[4,5]. At the moment, Sophia's main activity is to hold "live" interviews with various journalists from well-known global news networks. At the end of the interviews, almost all these experienced journalists have declared to have lived a unique emotional experience in what concerns the exercise of their profession.

Conclusion:

The citizenship granted to the humanoid robot Sophia by the government of Saudi Arabia in October of this year (2017), is an unprecedented event in the history of

mankind. Sophia's debut is gaining worldwide repercussion because it is a robot with some remarkable human psychological features such as learning by socialization, and expressing emotions according to the topic of her conversation. These new advances in Artificial Intelligence are causing commotion in almost all the branches of knowledge. But also in ethics, religion, morals, and politics. Sophia is good evidence that the human brain is not only feasible to be mapped and imitated by machines, but even to be overcome. It's just a matter of time. Sophia marks the beginning of a new era in humanity. Just as unicellular beings ended up giving rise to homo sapiens, homo sapiens with his wonderful brain is creating his successor: the superintelligent and immortal robot. It is necessary to start talking about robotic rights as a real and close issue, and no longer as an esoteric or fictional issue. Conceiving a robot as a rough and noisy metal machine with clumsy movements, and border intelligence, already belongs to the past. Today is the time of Sophia and the new improved versions that will come.

References:

1. David Hanson. Expanding the aesthetic possibilities for humanoid robots. In IEEE-RAS international conference on humanoid robots, pages 24–31, 2005.
2. Ben Goertzel, David Hanson, and Gino Yu. A software architecture for generally intelligent humanoid robotics. *Procedia Computer Science*, 41:158–163, 2014.
3. www.hansonrobotics.com
4. www.google.com/artificialintelligences.com
5. www.cnbc.com

ETHICAL CONSIDERATIONS IN ARTIFICIAL INTELLIGENCE AND DATA PRIVACY

Rajib Mondal

CSE(Data Science),

2022-2023,

The Neotia University

Abstract:

Artificial intelligence (AI) stands at the forefront of technological advancement, reshaping our world in profound ways. However, amidst its transformative power, AI brings forth pressing ethical dilemmas and data privacy concerns. In this paper, I, a passionate college student, delve into the intricate intersection of AI ethics and data privacy, striving to illuminate paths towards responsible and ethical AI development and utilization.

I embark on this journey by defining the fundamental concepts of AI ethics and data privacy, recognizing their paramount importance in the digital age. Through introspection, I explore the multifaceted ethical and data privacy challenges inherent in AI, confronting issues of bias, discrimination, and pervasive surveillance.

Guided by a quest for ethical excellence, I unveil a repertoire of best practices for fostering the cultivation of ethical AI. Embracing principles of transparency, accountability, and fairness, I advocate for a paradigm shift towards ethically-driven AI development and deployment.

As I navigate through the ethical landscape of AI, I am drawn towards envisioning the future trajectory of AI ethics and data privacy. I contemplate the pivotal role that policymakers and industry leaders must play in steering AI

towards the path of benevolence and societal good.

In essence, this paper serves as a beacon of light amidst the complexities of AI ethics and data privacy, championing the cause of ethical AI development and illuminating a brighter future for humanity.

Keywords:

Artificial intelligence (AI), AI ethics, data privacy, bias, ethical AI, privacy protection.

Introduction:

In recent years, the rapid advancement of artificial intelligence (AI) has raised significant ethical concerns, particularly regarding data privacy. This paper introduces the key ethical issues surrounding AI and data privacy and sets the stage for an in-depth examination of these challenges. AI is already being used in a wide range of applications, including healthcare, finance, transportation, and manufacturing. As AI continues to develop, it is likely to have an even greater impact on our lives. While AI has the potential to bring many benefits, it also raises important ethical and data privacy concerns. For example, AI systems can be biased, leading to discrimination against certain groups of people. AI systems can also be used to collect and monitor personal data on a large scale, which raises concerns about surveillance and

privacy. It is important to develop and use AI in a responsible and ethical manner. This means ensuring that AI systems are fair, transparent, and accountable. It also means protecting the privacy of individuals whose data is used to train and deploy AI systems.

Methodology:

To address the ethical considerations in AI and data privacy, a comprehensive methodology was employed. Firstly, an extensive literature review was conducted to understand existing ethical frameworks and privacy concerns in AI. Additionally, expert interviews were conducted with professionals in the field of AI ethics and data privacy to gather insights and perspectives on current challenges and potential solutions. Furthermore, case studies were analyzed to illustrate real-world instances where AI applications have overlooked data privacy concerns, highlighting the need for robust ethical guidelines.

Experimental Results:

The analysis revealed instances where existing AI systems infringed upon individual data privacy, emphasizing the necessity for ethical guidelines. Examples of AI applications where data privacy concerns have been overlooked were presented, showcasing the negative consequences for individuals.

Discussion:

This section delves into the ethical considerations related to AI and data privacy, exploring the trade-offs between innovation and privacy. Emphasis is placed on the importance of transparency, consent, and accountability in AI development. These principles can be integrated into AI application development to address ethical concerns and protect data privacy.

Conclusion:

In conclusion, this paper underscores the urgency of addressing ethical concerns in AI to safeguard data privacy. It proposes a balanced framework that promotes responsible AI development while protecting individuals' privacy rights. The collaborative efforts of policymakers, industry leaders, and researchers are crucial in ensuring that AI technologies are developed and deployed in a manner that is ethical, transparent, and respectful of individual privacy rights.

Acknowledgments:

I am Rajib Mondal to express my appreciation to all individuals and organizations who supported and contributed to this research on ethical considerations in artificial intelligence and data privacy. Your insights and assistance have been invaluable.

References:

1. Safdar, N. M., Banja, J. D., & Meltzer, C. C. (2020). Ethical considerations in artificial intelligence. *European journal of radiology*, 122, 108768.
2. Green, B. (2018). Ethical Reflections on Artificial Intelligence. *Scientia et Fides*. <https://doi.org/10.12775/SETF.2018.015>.
3. Jobin, A., Ienca, M., & Vayena, E. (2019). The global landscape of AI ethics guidelines. *Nature Machine Intelligence*, 1-11. <https://doi.org/10.1038/S42256-019-0088-2>.
- Naik, N., Hameed, B., Shetty, D., Swain, D., Shah, M., Paul, R., Aggarwal, K., Ibrahim, S., Patil, V., Smriti, K., Shetty, S., Rai, B., Chłosta, P., & Somani, B. (2022). Legal and Ethical Consideration in Artificial Intelligence in Healthcare: Who Takes Responsibility?. *Frontiers in Surgery*, 9. <https://doi.org/10.3389/fsurg.2022.862322>.

ARTIFICIAL INTELLIGENCE: A STEP-BY-STEP EXPLORATION

Srikanta Pramanik

Computer Science and Engineering,
2020-2021,
The Neotia University

Abstract:

Artificial Intelligence (AI) has emerged as a transformative technology with applications across various domains. In this paper, a comprehensive overview of AI methodologies, experimental results, and implications is presented. The research sheds light on the current state of AI, highlighting its potential to reshape industries and improve everyday life. The challenges and ethical considerations associated with AI development and deployment are also discussed.

Keywords :

Artificial Intelligence, Machine Learning, Deep Learning, Ethics.

Introduction:

Artificial Intelligence (AI) is a field of computer science that aims to create systems capable of performing tasks that typically require human intelligence. These tasks encompass a wide range of activities, from language translation and image recognition to decision-making and problem-solving. AI systems are designed to mimic human cognitive functions, and their applications are increasingly prevalent in our daily lives.

Methodology:

The development of AI systems involves various methodologies, with machine learning and deep learning being at the forefront. Machine learning algorithms enable AI systems to learn from data, making predictions and decisions based on patterns and information in the dataset. Deep learning, a subset of machine learning, focuses on neural networks with multiple layers, allowing for more complex and nuanced learning.

Experimental Results:

In this section, the results of experiments and analyses in the field of AI are presented. The capabilities of AI models in various domains, including natural language processing, computer vision, and autonomous robotics, are showcased. The experiments detail how features are selected, the datasets used, and the training methods employed to emulate human behavior.

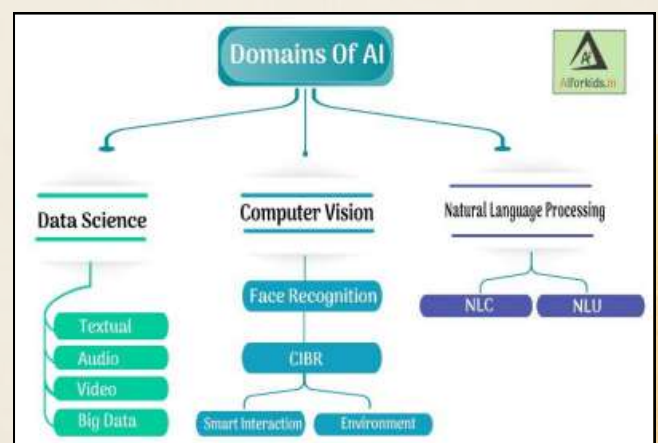
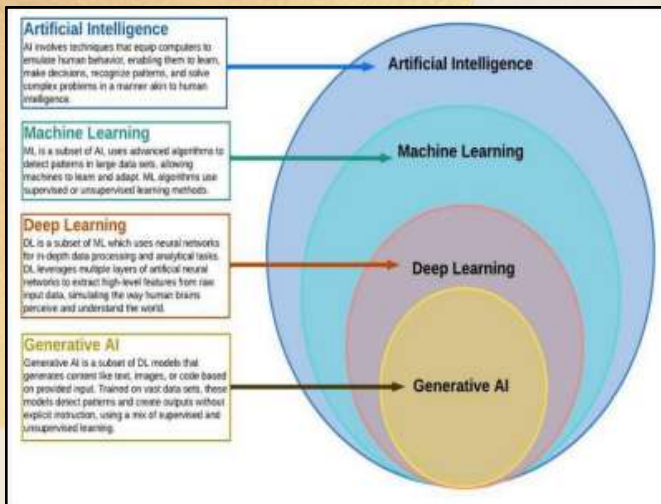


Figure 1: Domains of AI



References:

1. Minsky, M. (1961). Steps toward artificial intelligence. *Proceedings of the IRE*, 49(1), 8-30.
2. Saßmannshausen, T., Burggräf, P., Wagner, J., Hassenzahl, M., Heupel, T., & Steinberg, F. (2021). Trust in artificial intelligence within production management—an exploration of antecedents. *Ergonomics*, 64(10), 1333-1350.

Figure 2: [Caption: Example of AI-enabled autonomous navigation.]

Discussion:

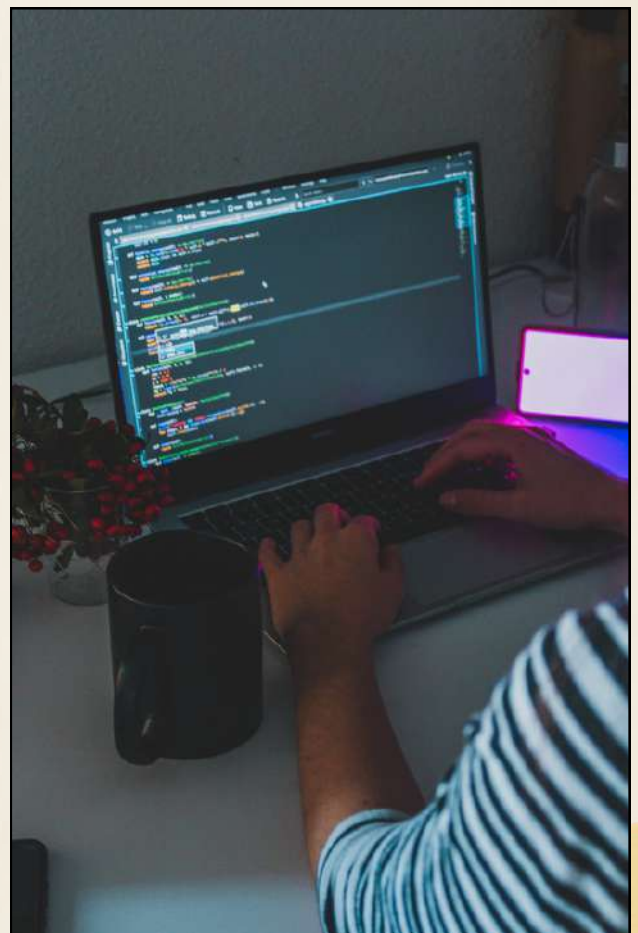
The discussion delves into the implications of the experimental results, exploring how AI is transforming industries such as healthcare, finance, and transportation. Additionally, the ethical challenges associated with AI, including algorithmic bias, data privacy, and employment impact, are addressed.

Conclusion:

In conclusion, this paper provides a comprehensive overview of Artificial Intelligence, covering its methodologies, experimental results, and the critical discussions surrounding its development and deployment. AI has the potential to revolutionize various sectors of society, but it also raises important ethical questions that must be addressed as the technology continues to advance.

Acknowledgment:

The author acknowledges the support of The Neotia University and the funding provided by the AI Research Foundation for this research.



AI IN BUSINESS: LEVERAGING MACHINE LEARNING FOR COMPETITIVE ADVANTAGE

Debojyoti Paul

CSE AI & ML,
2022-2023,,
The Neotia University

Abstract:

The integration of AI has ushered in a new era of enhanced reliability in digital offerings, optimization of supply chain processes, and real-time access to invaluable data and analytics. Companies stand to benefit significantly as they employ AI to reduce lead times, uncover fresh customer insights, revolutionize customer service standards, and deliver unparalleled personalized experiences. This paper strives for excellence in its quest to bridge the knowledge gap and facilitate the successful assimilation of AI into business planning. By conducting a rigorous literature analysis and synthesizing contemporary methodologies and frameworks, it brings to the fore the potential advantages, challenges, and untapped possibilities. Moreover, this study delves into future research prospects, empowering businesses with the requisite knowledge and strategies to harness the full potential of AI and achieve unparalleled success in the dynamic and competitive world of business [1].

Keywords:

Artificial Intelligence, Machine Learning, Business Optimization.

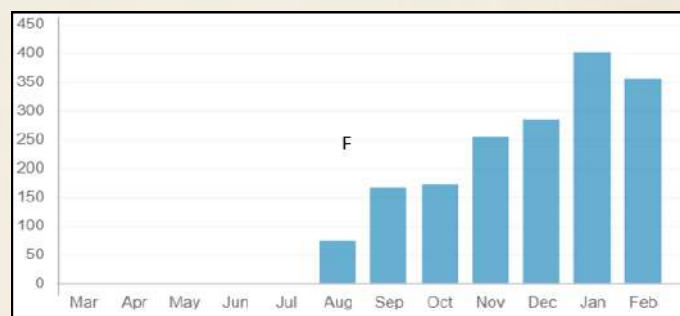


Figure 1: Diagram of Month vs Download number [1]

Introduction:

Business intelligence refers to the process of collecting, analyzing, and interpreting large amounts of data to provide meaningful insights and actionable information that can drive strategic decision-making within an organization [2]. It involves the use of various tools, technologies, and methodologies to gather data from both internal and external sources, transform it into valuable knowledge, and present it in a format that is easily understandable and useful to decision-makers [3]. The goal of business intelligence is to enable organizations to gain a comprehensive understanding of their operations, customers, market trends, and competitive landscape [4]. Business intelligence encompasses a range of activities, including data integration, data mining, data visualization, reporting, and performance monitoring. It often involves the use of data warehouses or data marts to centralize and store large volumes of structured and unstructured data, which can

then be analyzed using various statistical and analytical techniques [5].

Methodology:

Innovations in AI business model:

Artificial intelligence is drifting out of R&D labs and into the business world. Millions of industries across the globe and top-notch companies are fitting together the power of AI and Applied artificial intelligence (AAI). Most of the business industries spot the scams using machine learning algorithms in nanoseconds to improve customer satisfactions. A vivid rise in the machine learning tools, business platforms, and applications-based tools were developed to quench the business satisfactions (Alhashmi et al., 2019, Dimitras et al., 1999, Mishra & Tripathi, 2020b).

These state-of-the-art technologies not only compressed the quality of the internet and the software industry but also other verticals such as built-up, healthcare system, legal, automobile, and agriculture as well (Casadesus-Masanell & Ricart, 2011).

Most of the top-notch companies like Microsoft, Facebook, Apple, Google, Amazon, Myntra, Flipkart, and IBM are financing R&D of applied intelligence and artificial intelligence, for the benefits of the company and customers. Some private traits and attributes are predictable using AI and machine learning algorithms from digital records of human behavior as shown below (Morley et al., 2019) (Fig. 3) [6].

Experimental Results:

Greater focus is needed on use cases that deliver business value:

When implementing an AI strategy, there's a pressing need for use cases to demonstrate business value. The survey revealed that 16 percent of enterprises globally focus on a pain point and then define a use case, with smaller organizations (13 percent) being less likely to focus on the business impact compared with their larger counterparts (18 percent). With all the pressure to harness AI, many organizations are experimenting but not all have found the formula to deploy at scale and add significant value [7].

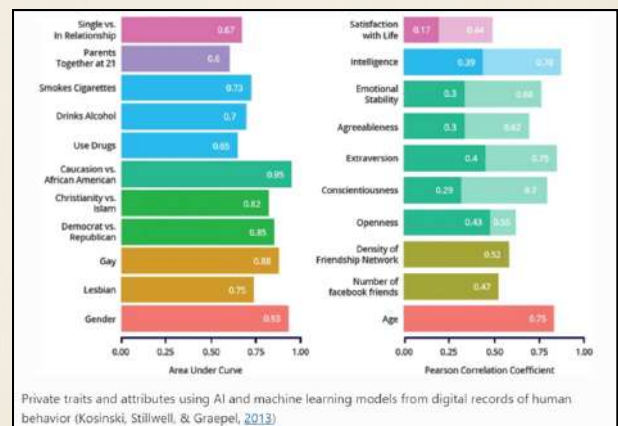


Figure No.: 2

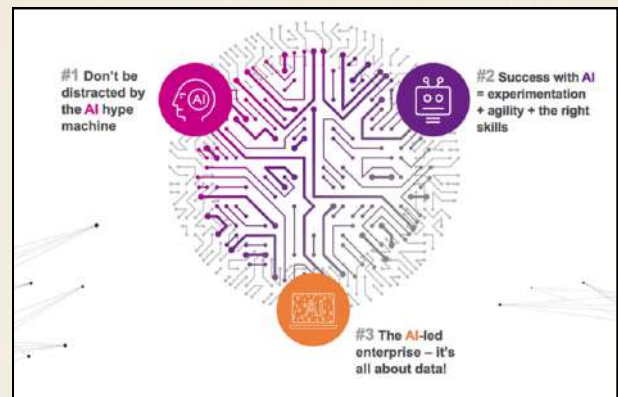


Figure No.: 3

The survey found there are certain business functions such as sales (35 percent) and marketing (32 percent) gaining the most value from AI, as it accelerates the delivery of improved customer experiences. The most popular technologies deployed by global organizations are machine learning (34 percent), chatbots (34 percent), and robotics (28 percent).

Success with AI means merging rapid experimentation, organizational agility and skills:

AI is already delivering measurable business benefits, but the majority of enterprises have yet to find a formula for repeatable success. An important requirement for enterprises to successfully start their AI journey is to experiment with different use cases and technologies with agile and rapid innovation methodologies. Just over a quarter (29 percent) of the enterprises surveyed said they are agile enough to rapidly experiment with AI, with large organizations (39 percent) having an edge compared to their smaller counterparts at 19 percent.

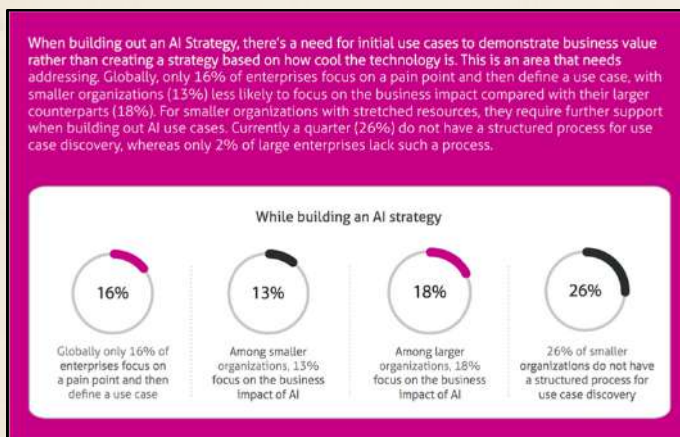


Figure No.: 4

Discussion:

There is a wide range of applications for AI in business. For example, retailers can use AI-powered tools to analyze customer purchase data and identify which products are most popular by running ads and gathering purchaser information. This can help inform inventory and marketing decisions. Banks, governments, financial institutions and more are already using AI to reduce the risk of individuals getting money stolen and to reduce fraud. Even big companies like Nike are using these kinds of AI strategies to help better manage their large-scale businesses.

AI can also be used to improve customer experiences and business dealings. For example, chatbots can act as customer support to answer basic questions before an operator can help and to provide assistance in a personalized and efficient manner. Amazon uses chatbots on its website daily as a faster way for customers to have their basic questions and complaints served without having to wait longer for human staff, who can, in turn, focus on more complex requests[8]

Conclusion:

AI leads to transformative applications within a series of industrial, intellectual, and social applications, far beyond those caused by previous industrial revolutions. Furthermore, AI has proven to be superior to human decision-making in certain areas. AI is better than humans at finding and enacting the best policies in certain areas concerning science, engineering, and complex societal and macroeconomic issues. Artificial legal intelligence has unsettled the legal services market, the legal profession, and prevalent business models by replacing human legal expertise. AI technology re-opens returning political questions about power, freedom, democracy, and justice. AI can be used to improve political decisions achieved in several ways, fluctuating from computers aiding human decision-makers to their replacing them[9]

Reference:

- [1] Johannes Schneider, Rene Abraham, Christian Meske & Jan Vom Brocke(2023) Artificial Intelligence Governance For Businesses, Information Systems Management,40:3, 229-249, DOI: 10.1080/10580530.2022.2085825
- [2] Kilanko, V. The Transformative Potential of Artificial Intelligence in Medical Billing: A

Global Perspective.

[3] Mungoli, N. (2023). Adaptive Ensemble Learning: Boosting Model Performance through Intelligent Feature Fusion in Deep Neural Networks. arXiv preprint arXiv:2304.02653.

[4] Mungoli, N. (2023). Adaptive Feature Fusion: Enhancing Generalization in Deep Learning Models. arXiv preprint arXiv:2304.03290.

[5] Mungoli, N. (2023). Deciphering the Blockchain: A Comprehensive Analysis of Bitcoin's Evolution, Adoption, and Future Implications. arXiv preprint arXiv:2304.02655.

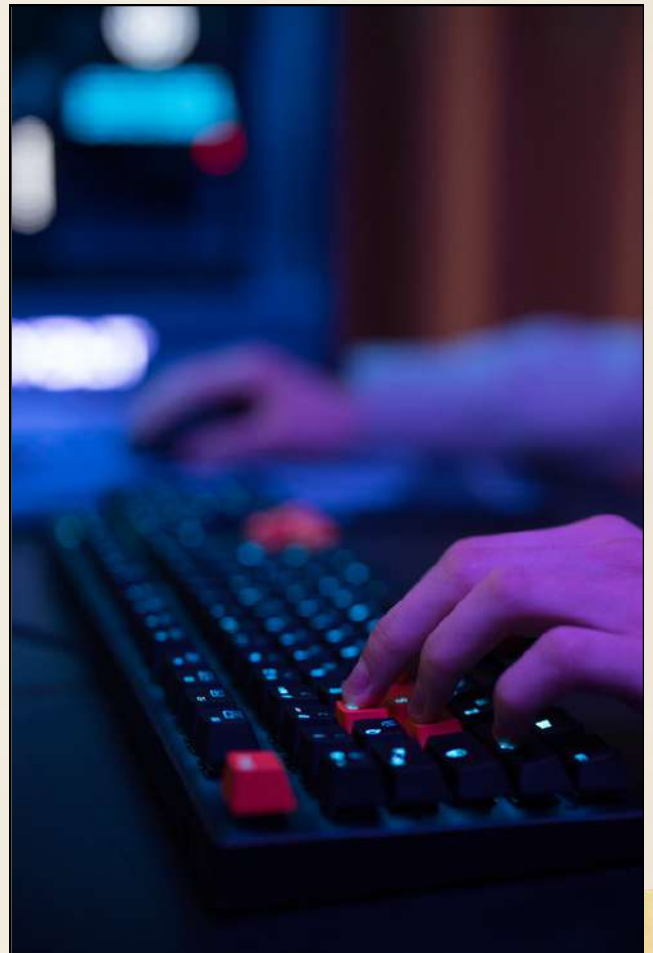
[6] <https://innovation-entrepreneurship.springeropen.com/articles/10.1186/s13731-021-00157-5>

[7]<https://www.agilitypr.com/pr-news/public-relations/businesses-learning-from-ai-experimentation-but-real-business-value-remains-elusive/>

[8]<https://www.forbes.com/sites/forbesbusinesscouncil/2023/05/12/how-artificial-intelligence-is-changing-business/#:~:text=There%20is%20a%20wide%20range,inform%20inventory%20and%20marketing%20decisions.>

[9]https://link.springer.com/chapter/10.1007/978-3-030-94736-1_12-

```
function start()  
  
var today = Date();  
var h = today.getHours();  
var m = today.getMinutes();  
var s = today.getSeconds();  
m = correctTime(m);  
s = correctTime(s);  
document.getElementById(  
//calling the function  
var t = setTimeout(start,  
  
//adding the zero if needed  
function correctTime(i)
```



ARTIFICIAL INTELLIGENCE AND ITS PROFOUND IMPACT ON SOCIETY

Saifuddin Mollah

CSE AI & ML,
2022-2023,
The Neotia University

Abstract:

The emergence of artificial intelligence (AI), often referred to as the "fourth industrial revolution" (IR 4.0), is reshaping our daily lives and social interactions. AI can now independently think and solve problems, tasks previously exclusive to humans. Monitoring AI advancements is crucial to ensure equitable benefits for everyone. AI is improving various aspects of our lives, such as healthcare and self-driving cars. However, it also introduces both positive and negative impacts on society. This study seeks to examine the effects of AI on society and the associated challenges it presents.

Introduction:

Artificial intelligence (AI) is like a superpower that's changing everything today. It can look at huge amounts of information, find patterns, and make decisions all on its own. This has changed how we live, work, and connect with each other. Many things have helped AI get better and better, like faster computers, more data to learn from, and smarter techniques. Because of these improvements, AI can now do things even better than people can, like recognizing images or making tough choices. As a result, we're already seeing AI being used in lots of different areas, such as medicine, money, factories, and even creating art..[1]



Figure No.: 1

AI has made big changes in how businesses work and how money moves around. It helps companies do things faster and cheaper, giving us better products and services. But it also means some jobs might disappear as machines take over. This makes it important for people to learn new skills for different kinds of work. AI has also changed how we use technology and talk to each other. Things like virtual assistants and chatbots now help us find information and chat online. Sometimes, AI suggests things for us to buy or read, blurring the line between what we want and what the computer thinks we should have. This raises questions about privacy, control, and fairness in how AI affects our lives and decisions. [2]

Artificial intelligence is making big strides in healthcare, like spotting illnesses early, finding new medicines, and creating personalized treatment plans. Machines can now analyze medical images like X-rays and MRIs to help doctors make accurate diagnoses faster. AI also shows promise in predicting and tracking disease outbreaks, helping healthcare

providers decide where to focus their attention. But using AI in healthcare raises some questions about fairness and transparency. Sometimes, it's hard to understand why AI makes certain decisions, and the data it learns from might have biases. To make sure AI is used responsibly, we need clear communication, strict rules, and teamwork across different fields.[3]

Methodology:

Literature Review:

Conduct a comprehensive review of existing literature, academic papers, and reports on the positive and negative effects of AI on various aspects of society, including healthcare, education, economy, and government.

Identify key themes, trends, and arguments presented in the literature to inform the research questions and hypotheses.

Surveys and Interviews:

Develop surveys and interview protocols to gather qualitative data from experts in the fields of AI, technology, healthcare, education, government, and other relevant sectors.

Administer surveys to a diverse sample of professionals and stakeholders to gather insights into their perceptions, experiences, and concerns regarding the impact of AI on society.

Conduct semi-structured interviews with select participants to delve deeper into specific topics and explore nuances in their perspectives.

Data Analysis:

Analyze survey responses and interview transcripts

using qualitative analysis techniques such as thematic coding and content analysis.

Identify recurring themes, patterns, and divergent viewpoints related to the positive and negative impacts of AI on society.

Quantify survey data to measure the prevalence of certain attitudes, opinions, and concerns among the surveyed population.



Figure No.: 2

Case Studies:

Select case studies from different sectors, including healthcare, agriculture, education, and government, to provide real-world examples of the impact of AI on society.

Analyze these case studies to identify best practices, challenges, and lessons learned in the adoption and implementation of AI technologies.

Use qualitative and quantitative data from the case studies to support findings and recommendations.

Ethical Considerations:

Ensure ethical research practices by obtaining informed consent from participants,

protecting their privacy and confidentiality, and adhering to ethical guidelines and regulations.

Consider the ethical implications of AI research, including issues of bias, fairness, transparency, accountability, and the potential consequences of AI adoption on individuals and society.

Experimental Results:

Positive and Negative Impact of Artificial Intelligence. There have been immediate, intermediate, and lasting cultural effects from the spread of this artificial intelligence technology. Professionals who are used to working with modern technologies, lawyers who are encouraging AI's influence with its regulatory implications, and technocrats who frequently use the aid of modern technology to arrive at a precise decision in a technological matter that is complex have all been affected by the advent of AI in society.

i. Positive Impacts:

Fast and accurate diagnostics:

Artificial intelligence may also provide doctors with a menu of treatment plans from which to choose. Generally speaking, the procedure goes like this: The digital results of the physical examination are entered into a computer, which then considers all of the possibilities, automatically diagnoses if the patient suffers from certain deficiencies and sickness, and even recommends various treatment options that are available.

Socially therapeutic robots:

Having a pet may improve the quality of life for seniors in several ways, including lowering

blood pressure, alleviating anxiety and loneliness, and increasing interaction with others. It has lately been popular to propose giving elderly people who live alone cybernetic companions that can do things like help with housekeeping. Therapeutic robots and socially assistive robot technologies may enhance the quality of life for the elderly and those with physical limitations.



Figure No.: 3

Reduce errors related to human fatigue:

Human error is inevitable and sometimes highly costly; the potential for error grows in direct proportion to the degree of weariness that person is feeling. In contrast, the AI is not prone to mental fatigue or distraction due to strong emotions. There is no room for mistake, and the work can be done more swiftly and precisely.

Artificial intelligence based surgical contribution:

Individuals may now choose for surgical procedures aided by artificial intelligence if they so want. The patient is far less likely to be harmed by this AI, even though it still has to be operated by skilled medical professionals. Most modern hospitals now have access to the da Vinci surgical system, a kind of robotic technology. Surgeons may perform procedures on patients utilising minimally invasive technologies. The use of such technologies allows for a degree of accuracy and precision

that is unattainable via human processes. Less intrusive procedures result in less pain, less blood loss, and less stress for the individuals undergoing them.

Improved radiology:

Prenatal imaging, cardiac magnetic resonance imaging, and whole body magnetic resonance imaging all become commonplace by the turn of the millennium. The search for improved algorithms to diagnose certain illnesses and interpret scan results continues. The development of artificial intelligence has allowed for all of these successes.

Virtual presence:

Technology advancements in virtual presence have made remote diagnosis of illnesses feasible. Patients don't have to get out of bed for this since physicians are able to do remote checks using a robot that acts as a "presence" in the room. The interaction and motion of the medical staff is almost comparable to what would happen if they were really there. Because of this capacity, doctors can reach patients who are homebound.

ii. Negative Impact:

The way we now organise our social lives will be severely challenged by a forthcoming big societal shift. Humans need to toil hard to survive, but with AI, we can instruct a computer to do a task without lifting a finger. Human connection will inevitably decline as the requirement for interpersonal interaction to share ideas is eventually replaced by artificial intelligence. Artificial intelligence will fill the void left by the decline in the importance of face-to-face meetings.

Unemployment rates will rise as computers take over many formerly human-held positions. Machines and robots have replaced human labour on many production lines for motor vehicles nowadays. As digital gadgets become more affordable and widespread, even grocery workers may become obsolete. The automation of procedures is the primary focus of AI research. The loss of jobs is a key consequence of AI. For the last decade, people have made money by hard work and saving their spare time. It will be crucial in the battle against automation that takes employment from humans that we see a future in which people are compensated just for being citizens as technology improves and sophisticated robots are made.

Wealth inequality will be created as a direct consequence of AI investors accumulating the bulk of the earnings. There will be a widening gap between the rich and the poor. Increased visibility of the "M" shaped distribution of wealth.

The AI is being taught and learned to accomplish the given work, and it may ultimately take off to the point where humans have no control, leading to unanticipated difficulties and ramifications. This raises new worries not just in terms of society, but also in terms of AI itself. When an AI has all the code it needs, it can function without further direction from its human masters.

Humans developing AI run the risk of making it biased towards specific groups or too focused on the developers' own interests. For example, the UN has decided to limit the proliferation of nuclear power out of concern that it would be used arbitrarily to wipe out whole populations or to subjugate certain people groups. If AI is trained to destroy a certain group of people or an item in particular, it might cause a worldwide catastrophe.

Discussion:

Artificial intelligence (AI) is changing the way we live and work. It helps us do things faster and better, like diagnosing illnesses and driving cars. But it also brings challenges, like job loss and privacy concerns. We need to work together to make sure AI benefits everyone and doesn't cause harm.

Conclusion:

Artificial Intelligence is not just a technological advancement; it is a societal transformation. It is fundamentally changing the way we live, work, and interact with our environment. From healthcare to education, from disaster response to transportation, AI is enhancing our lives and driving progress.

However, as we harness the power of AI, we must do so responsibly. Addressing ethical concerns and ensuring that AI benefits all of society should be at the forefront of our efforts. With careful planning and responsible development, AI has the potential to bring about a brighter and more equitable future for all.

References:

1. Anderson S., Slough S. (2015). Digital Delight or Digital Doldrum: A Study of Graphical Representation in Digital Science Textbooks. *Semantic Scholar Resource* (26)2: pp. 654-675.
2. Nicoletti G. (2018). Digital Technology Diffusion: A Matter of Capabilities, Incentives or both? *Semantic Scholar Review* (12)3: pp. 264-276.
3. Chandani A., et al. (2016). Employee Engagement: A Review Paper on Factors Affecting Employee Engagement. *Indian Journal of Science and Technology* (15)9: pp. 12-18.

4. Author: Sannidhi Agarwal, Publisher: Ignited Minds Journals.
5. Author: Sannidhi Agarwal, Publisher: Ignited Minds Journals.



ADVERSARIAL ATTACKS BEING A POTENTIAL THREAT

Souvik Ghosh

Computer Science and Engineering with specialization Cyber Security,
2020-2021,
The Neotia University

Abstract:

Adversarial attacks have emerged as a significant threat to machine learning models, particularly in the realm of computer vision and natural language processing. These attacks involve subtle manipulations of input data to deceive models into making incorrect predictions. This article provides an in-depth overview of how adversarial attacks work, their methodologies, and the harmful consequences they pose. We discuss various types of adversarial attacks, their potential impact on real-world applications, and the ongoing efforts to defend against them. Adversarial attacks have highlighted the vulnerabilities of machine learning systems, and understanding their mechanisms is crucial for enhancing the robustness and security of these models.

keyword:

Adversarial attacks, Machine learning, Deep learning, Robustness, Security.

Introduction:

Machine learning has witnessed remarkable advancements in recent years, enabling applications in diverse fields such as healthcare, finance, autonomous vehicles, and more. Deep neural networks, in particular, have demonstrated exceptional performance in tasks like image recognition and natural

language processing. However, as these models become increasingly integrated into our daily lives, they face a growing threat known as adversarial attacks.

Adversarial attacks are a phenomenon that has garnered significant attention in the field of machine learning. They exploit the vulnerabilities of machine learning models, particularly deep neural networks, by introducing carefully crafted perturbations to input data. These perturbations are often imperceptible to humans but can lead to erroneous predictions by the model. Adversarial attacks have the potential to undermine the reliability and security of machine learning applications in various domains, including image recognition, natural language processing, and autonomous driving.

Methodology:

Adversarial attacks employ various techniques to manipulate input data and cause misclassifications [1]. The two most common types of adversarial attacks are white-box attacks and black-box attacks. White-box attacks assume that the attacker has full knowledge of the target model's architecture and parameters, enabling them to generate optimal perturbations [2]. Black-box attacks, on the other hand, operate with limited knowledge of the model and require more sophisticated optimization methods.

The Fast Gradient Sign Method (FGSM), one of

the earliest adversarial attack techniques, perturbs input data by adding a small, crafted perturbation in the direction of the gradient of the loss function with respect to the input. Iterative methods like the Iterative FGSM and Projected Gradient Descent (PGD) iteratively apply FGSM to gradually craft stronger adversarial examples [3].

Experimental Results:

Experimental studies have demonstrated the efficacy of adversarial attacks across various machine learning tasks. For instance, in image classification, adding imperceptible noise to an image can cause state-of-the-art models to misclassify objects. Similarly, in natural language processing, slight modifications to textual input can lead to incorrect sentiment analysis results.

To illustrate the impact of adversarial attacks, consider a scenario involving autonomous vehicles. In this context, adversarial perturbations applied to road signs or traffic signals could lead to catastrophic consequences. Such attacks could deceive the vehicle's perception system, potentially resulting in accidents or traffic violations. The vulnerability of machine learning models to adversarial attacks in safety-critical domains like autonomous driving highlights the urgency of addressing this threat.

Discussion:

Adversarial attacks pose significant risks in real-world applications across various domains. One of the concerning aspects is the potential for adversarial attacks to be leveraged for malicious purposes. Here are some key discussion points:

i. Security Implications:

Beyond the realm of autonomous vehicles and natural language processing, adversarial attacks have broader security implications. Consider the use of machine learning models in security systems. Adversarial attacks could be employed to bypass security measures, compromising the safety of individuals and organizations.

ii. Privacy Concerns:

Adversarial attacks can also raise privacy concerns. In scenarios where machine learning models process sensitive data, such as medical records, financial information, or personal communications, adversarial attacks could lead to unauthorized access or data breaches.

iii. Ethical Considerations:

Ethical considerations come into play when exploring adversarial attacks. As the development and deployment of machine learning models continue, it becomes crucial to ensure fairness and accountability. Adversarial attacks could be used to manipulate decisions made by these models, potentially reinforcing biases or discrimination.

Defense Strategies:

Efforts to defend against adversarial attacks [4] are actively underway in the machine learning community. Some of the prominent defense strategies include:

i. Adversarial Training:

Adversarial training involves augmenting the training data with adversarial examples to improve the model's robustness. By exposing the model to adversarial perturbations during training, it becomes more resilient to such attacks. This approach has shown promise in enhancing model security.

ii. Adversarial Detection:

Adversarial detection techniques aim to identify inputs that may have been tampered with. These techniques analyze the input data and its features to detect unusual patterns or perturbations. When a potential adversarial example is identified, appropriate actions can be taken to mitigate its impact.

iii. Model Verification:

Model verification techniques involve formally verifying the correctness and security of machine learning models. These methods use mathematical and logical reasoning to ensure that the model behaves as expected and is resistant to adversarial attacks.

Conclusion:

Adversarial attacks represent a formidable challenge to the reliability and security of machine learning models. As machine learning continues to permeate various aspects of our lives, understanding adversarial attacks and developing robust defenses against them is of paramount importance. Researchers and practitioners must collaborate to address this evolving threat and ensure the trustworthiness of machine learning applications.

In conclusion, adversarial attacks are not merely a theoretical concern; they are a pressing issue that demands immediate attention. The potential consequences of these attacks span safety, security, privacy, and ethics. By advancing our understanding of adversarial attacks and developing effective defense mechanisms, we can safeguard the integrity of machine learning systems in an increasingly interconnected world.

Acknowledgment:

We extend our heartfelt gratitude to Dr. Usha Rani Gogoi for her invaluable guidance and unwavering support throughout this transformative journey. Her expertise and mentorship have been instrumental in shaping this research endeavour. Thank you for being with us and constantly motivating us throughout this journey.

References:

- [1] Goodfellow, I. J., Shlens, J., & Szegedy, C. (2014). Explaining and harnessing adversarial examples. arXiv preprint arXiv:1412.6572.
- [2] Adversarial Attacks on Neural Network Policies" by Sandy Huang, Nicolas Papernot, Ian Goodfellow, et al.
- [3] Kurakin, A., Goodfellow, I., & Bengio, S. (2016). "Adversarial Examples in the Physical World." In Proceedings of the International Conference on Learning Representations (ICLR).
- [4] "Towards Deep Learning Models Resistant to Adversarial Attacks" by Aleksander Madry, Aleksandar Makelov, Ludwig Schmidt, et al. (2018).

ENHANCING CREDIT CARD SECURITY: A MACHINE LEARNING APPROACH TO FRAUD DETECTION

Sarmin Ahmed

Computer Science and Engineering with specialization AI and ML,
2020-2021,
The Neotia University

Abstract:

With growing betterment in the E-commerce field, fraud is spreading all over the world, causing major financial losses such as credit card fraud; affecting merchants and individual clients. Decision tree, genetic algorithm, neural network are common methods used to detect credit card fraud. The Artificial Neural Network is used to solve the problem.

keyword:

Fraud detection, Artificial Neural Network , K-Nearest Neighbor, Support Vector Machine.

Introduction:

Credit Card fraud is an inescapable problem that costs billions of dollars annually. To overcome this issue financial institutions and Payment processors are turning to Artificial intelligence and machine learning technologies.

Methodology:

The main motive of this experiment to develop a best suited algorithms to find frauds in case of credit cards . Credit card transaction falls into one of the two categories either a fraudulent negative class Or a legal positive class . Credit card fraud detection involves two methods data mining and the rule based

machine learning technique. Studies tells that the Artificial Neural Network(ANN) is best suited giving accuracy of 98.40%precision and F1 being 56.95%compared to the Support Vector Machine(SVM) and K-Nearest Neighbor algorithm.

ANN is the concept of deep learning composed of neurons . The first layer or the input layer contains transactions and amount of each customer and hidden layer contains weights, bias and activation function.

The dataset used in this experiment is from www.kaggle.com .Dataset in this study has 31 attributes of which 30 contains information related to name, age, account information and last attribute give result of transaction either 0 or 1.The proposed system gives result of accuracy 98.40%Area under receiver operating characteristic curve(AUC) 92.88%, precision of 97.34% and F1 score 56.95%.

Algorithm used in implementation of the experiment are:

- 1.Support Vector Machine
- 2.K-nearest algorithm
- 3.Artificial Neural Network

Steps involved in carrying out the whole experiment include :

- a. First of all reading of dataset is performed in case of both SVM and KNN but in case of ANN the algorithm has two parts training and testing .
- b. Data is cleaned, preprocessed, resampled as

normal and fraud class . Further the data is normalized and splits into trained data and test data.

c. Data is trained using the SVM algorithm then again using the KNN algorithm where as for ANN model is trained and prediction of fraud is made and the trained data is stored to use for the testing phase . The difference lies here that the trained data is stored to test and classify .

d. Calculate the number of fraud and valid transactions and also the accuracy, precision and recall.

According to the architecture the user need to register and then login to the system, after that the algorithm selection window opens where user need to select the algorithm and data Preprocessing takes

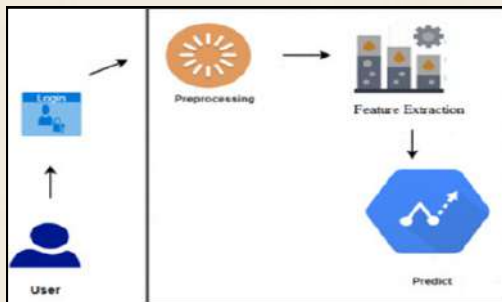


Fig. 1: Model Architecture

place further involving data cleansing and normalization . Dataset is splitted into trained data and test data and the system predicts whether transaction is fraud or not fraud after the model is trained.

Programming language used to implement this system is python . Libraries and packages used are pandas, Numpy , keras.

Experimental Results:

Table1. Showing experimental results of KNN, SVM And ANN

The result is calculated based on confusion matrix and precision, recall and accuracy is calculated having two classes actual class and predicted class.

Algorithms	Accuracy	Precision	Recall
SVM	0.9349	0.9743	0.8976
KNN	0.9982	0.7142	0.0393
ANN	0.9992	0.8115	0.7619

Fig. 2: Result of SVM

This shows that credit card fraud detection using Artificial Neural Network predicts high accuracy than the Support Vector Machine and K-Nearest Neighbor algorithm

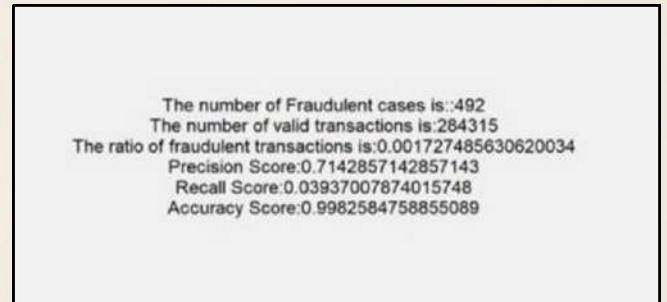


Fig. 3: Result Of KNN

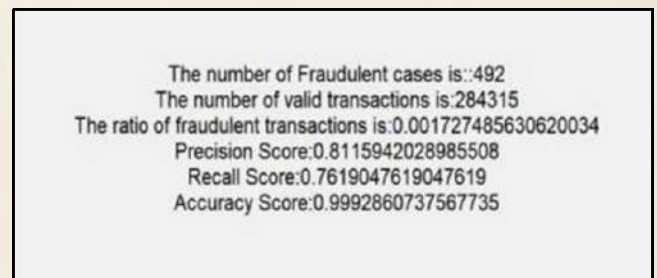


Fig. 4: Result of ANN

Discussion :

The accuracy of results given by SVM, KNN and ANN algorithms in Credit Card fraud detection model ,where Artificial Neural Network trends to give more accurate result than the other two. In this approach real world public dataset is used that contains fraudulent and non fraudulent transactions.

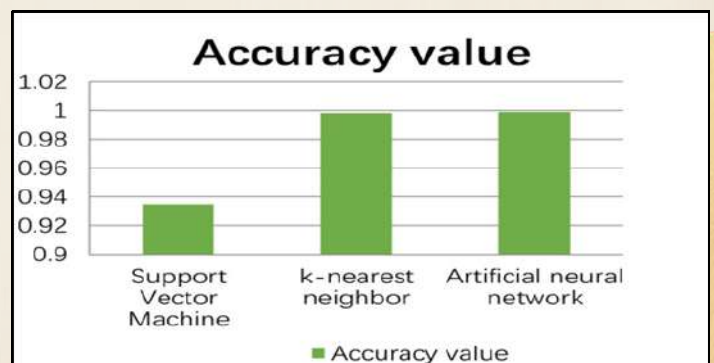


Fig. 5: Graph Plot of Accuracy value of SVM, KNN, ANN

Conclusion:

Artificial Neural Network have proven to be highly efficient in handling complex and large datasets making them well suited for detecting complex pattern and anomalies in credit card transactions. In the experiment we used a method of deep learning to identify fraud in credit card transactions. First of all comparing algorithms such as Support Vector Machine and K-Nearest Neighbor with Artificial Neural Network where Artificial Neural Network gives high accuracy as such Artificial Neural Network have emerged as a superior choice for their ability to handle complex data.

Acknowledgement:

While exploring various machine learning algorithm for credit card fraud detection we found that ANN outperformed KNN and SVM in terms of efficiency and accuracy .

The experiment would not have been possible without the support of our institution .

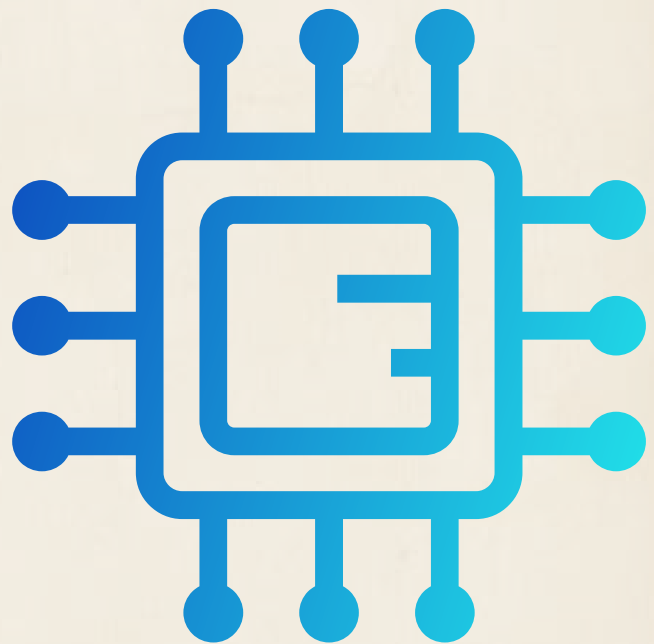
Thank you all for continuous support .

References:

1. Alarfaj, F., Malik, I., Khan, H., Almusallam, N., Ramzan, M., & Ahmed, M. (2022). Credit Card Fraud Detection Using State-of-the-art Machine Learning and Deep Learning Algorithms. *IEEE Access*, PP, 1-1. <https://doi.org/10.1109/ACCESS.2022.3166891>.
2. Lucas, Y., Portier, P., Laporte, L., He-Guelton, L., Caelen, O., Granitzer, M., & Calabretto, S. (2019). Towards automated feature engineering for credit card fraud detection using multi-perspective HMMs. *ArXiv*, abs/1909.01185. <https://doi.org/10.1016/j.future.2019.08.029>.

3. Roy, A., Sun, J., Mahoney, R., Alonzi, L., Adams, S., & Beling, P. (2018). Deep learning detecting fraud in credit card transactions. *2018 Systems and Information Engineering Design Symposium (SIEDS)*, 129-134. <https://doi.org/10.1109/SIEDS.2018.8374722>.

4. Suryanarayana, S., Balaji, G., & Rao, G. (2018). Machine Learning Approaches for Credit Card Fraud Detection. *International journal of engineering and technology*, 7, 917. <https://doi.org/10.14419/IJET.V7I2.9356>



BIGBIRD (TRANSFORMERS FOR LONGER SEQUENCES)

Ayan Pramanik

B.Tech in Computer Science Engineering specialization in AI&ML,
2020-2021,
The Neotia University

Abstract:

Transformers-based models like BERT have limitations due to quadratic reliance on arrangement length. BIGBIRD, a scanty consideration component, addresses this by reducing this reliance. It is Turing complete and an all-inclusive approximator of grouping capabilities. The proposed scanty consideration can handle lengths up to 8x, improving performance on NLP tasks like question answering and rundown.

Introduction:

Transformers, like BERT, are profoundly viable for different Regular Language Handling (NLP) undertakings and are the groundwork of momentum research. They are effectively adapted to different gathering based undertakings, for example, understanding, summary, age, assessment examination, POS naming, and AI. The vital headway in Transformers is the self-thought framework, which can be surveyed for each identification of the data gathering, killing the requirement for tedious cerebrum networks like LSTM. This parallelism permits Transformers to utilize current SIMD gear like GPUs/TPUs for huge dataset planning. Models like BERT and T5 pretrain Transformers on huge, generally valuable datasets, further developing uninformed framework downstream errands and cultivating the comprehensiveness of Transformers in contemporary NLP.

The self-thought framework overcomes the necessities of Repetitive Brain Organizations (RNNs) by permitting each token in the data construction to be gotten to by each token in the gathering. Be that as it may, this framework has a quadratic computational and memory necessity, which is restricted for errands requiring bigger datasets. This paper resolves these inquiries by making a little thought part, BIGBIRD, which further develops execution on huge datasets.

Methodology:

The BIGBIRD model is a profound learning model that involves a summarized thought framework in each layer of transformer dealing with a data gathering. The model is addressed by an organized graph, with the plan of edges tending to the course of action of internal things. The proximity network of the graph D is viewed as the most intricate, as it requires quadratic unpredictability. To lessen the quadratic unpredictability of self-thought, a diagram specification issue is thought of. The Erdos-Rényi model is viewed as the most untroublesome erratic outline improvement, with each edge openly picked with a legitimate probability. This model approximates the all out diagram horribly and its subsequent eigenvalue is exceptionally far off from the essential eigenvalue, bringing about a speedy mixing time for unpredictable strolls in the chart. A more modest thought is proposed, where every request joins over

r sporadic quantities of keys. The BIGBIRD model depends on the possibility of domain, closeness of tokens in phonetic development, and the idea of transformational generative language structure.

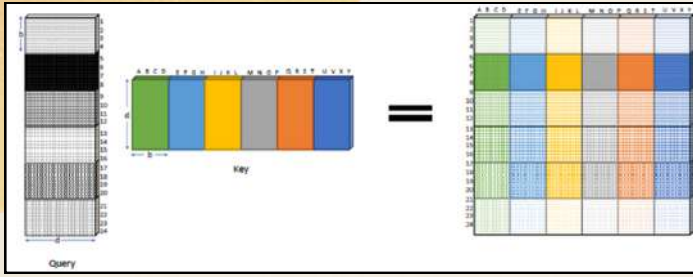


Figure No.: 1

Figure 1: describes fully all pair considerations. It can be gotten by direct grid augmentation between the question also, the key grid. Groupings are only displayed for direction.

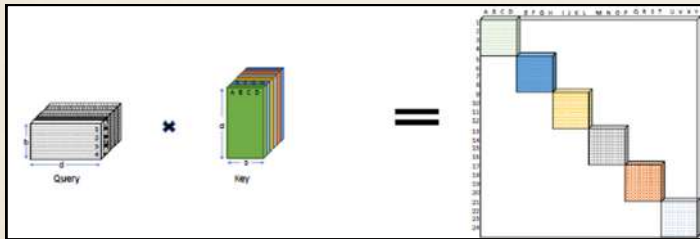


Figure No.: 2

Figure 2: describes Block corner to corner consideration. It can be processed by "blockifying" the question and key lattice.

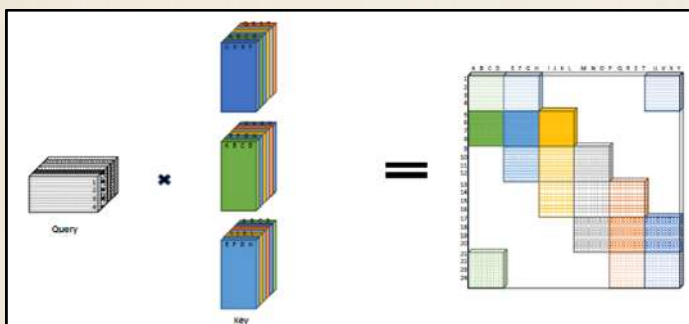


Figure No.: 3

Figure 3: describes Window nearby consideration got by "blockifying" the question/key lattice, duplicating key network, and moving the subsequent key tensor. This guarantees that each inquiry goes to something like one block and at most two blocks of keys of size b on each side.

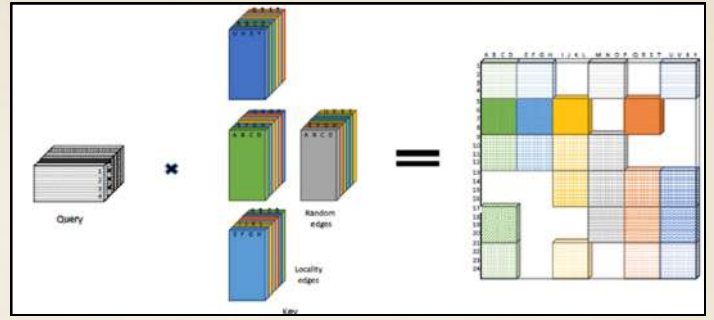


Figure 4: describes Window + Irregular consideration. It's follow the strategy above alongside social affair a few irregular key blocks.

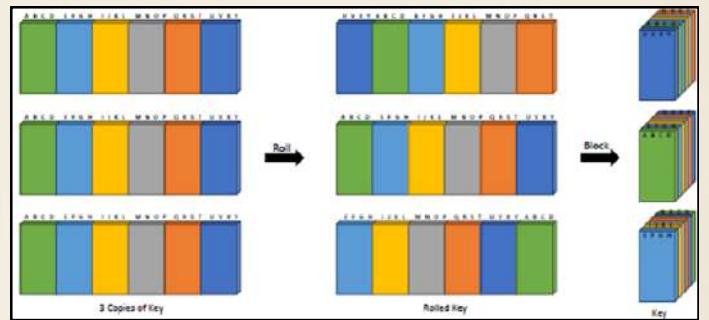


Figure 5: It describes Development of moved key-block tensor

Experimental Results:

Attention Mechanism:

This segment demonstrates that scanty consideration systems are strong and expressive, as they are Widespread Approximators of grouping to grouping capabilities and Turing Finished. However, moving to a scanty consideration instrument incurs costs, as there is no free lunch. Lower limits are demonstrated by a characteristic error where any adequately meager component requires more layers.

Notation:

The Transformer encoder stack is a rehashed use of a single layer encoder with autonomous boundaries. The class of Transformer encoders is characterized by a summated encoder (T H;m;q D) with H-heads and a coordinated chart (D). The proposed system adds an

exceptional token at the start of each succession and assigns a unique vector (x_0). The transformer can also annex position embeddings in the information layer. The capability class and distance measure for demonstrating general estimate property are also described.

Universal Approximators:

The text describes a method for estimating the FCD using piece-insightful consistent capabilities, which involves transforming a small portion of a district into a lattice of granularity to create a discrete set G . The self-consideration system is then used to create a logical planning of the input, which is unique to each code. The challenge is processing the logical planning using a small consideration instrument, which is tested using a specific shift administrator. The use of extra global tokens is also used to ensure that each segment contains a unique planning of the full planning. The final step is to refine the transformers using ReLU and softmax.

Turing Completeness:

Transformers are a broad class of machines used in both encoders and decoders. Pérez et al. showed that a full transformer with a quadratic consideration instrument is Turing Finished, contradicting the assumption that it deals with inconsistent accuracy models. The study demonstrates that a scanty encoder and meager decoder can mimic any Turing Machine. The scanty consideration system is used token by token, representing the tape history and using the undivided focus to move and recover the right tape image. The study provides a way to reproduce this using a scanty consideration system.

Natural Language Processing:

This segment explores the benefits of

longer info succession for NLP assignments, focusing on three agent errands: essential veiled language displaying (MLM), QA with supporting proof, and rough frameworks like TF-IDF/BM25.

Model	HotpotQA			NaturalQ		TriviaQA	WikiHop
	Ans	Sup	Joint	LA	SA	Full	MCQ
RoBERTa	73.5	83.4	63.5	-	-	74.3	72.4
Longformer	74.3	84.4	64.4	-	-	75.2	75.0
BIGBIRD-ITC	75.7	86.8	67.7	70.8	53.3	79.5	75.9
BIGBIRD-ETC	75.5	87.1	67.8	73.9	54.9	78.7	75.9

Table No: 1

Table 1: It's contains results utilizing Base size models. Report exactness for WikiHop for HotpotQA, Normal Inquiries, and TriviaQA.

Model	HotpotQA			NaturalQ		TriviaQA		WikiHop
	Ans	Sup	Joint	LA	SA	Full	Verified	MCQ
HGN [26]	82.2	88.5	74.2	-	-	-	-	-
GSAN	81.6	88.7	73.9	-	-	-	-	-
ReflectionNet [32]	-	-	-	77.1	64.1	-	-	-
RikiNet-v2 [61]	-	-	-	76.1	61.3	-	-	-
Fusion-in-Decoder [39]	-	-	-	-	-	84.4	90.3	-
SpanBERT [42]	-	-	-	-	-	79.1	86.6	-
MRC-GCN [87]	-	-	-	-	-	-	-	78.3
MultiHop [14]	-	-	-	-	-	-	-	76.5
Longformer [8]	81.2	88.3	73.2	-	-	77.3	85.3	81.9
BIGBIRD-ETC	81.2	89.1	73.6	77.8	57.9	84.5	92.4	82.3

Table No: 2

Table 2: It's contains Calibrating results on Test set. The Experimental outcomes (HotpotQA, Regular Questions, TriviaQA, and Precision for WikiHop) have been picked from their particular competitor list. For each assignment the main 3 pioneers were picked excluding BIGBIRD-and so on. For Regular Inquiries. Long Response (LA), TriviaQA, and WikiHop, BIGBIRD-And so on is the new cutting edge. On HotpotQA we are third in the list of competitors by F1 and second by Precise Match (EM).

The study focuses on long archive characterization for BIGBIRD, analyzing results using a grouping length of 40961, and adjusting for computational resources, group size, and step size.

Pretraining and MLM are used to create base and large variants of BIGBIRD, with both BIGBIRD and Longformer performing better than restricted-length RoBERTa. The models were prepared on a 16GB memory/chip with

32-64 group sizes.

The study focuses on preparing a large-scale model for a secret test set using BIGBIRD, a model with extended global tokens. The model is compared to top-3 competitors, highlighting the importance of longer settings and the uniqueness of BIGBIRD accommodation. Both Longformer and BIGBIRD outperform models with smaller settings. The model's single model may account for the slightly lower precision in accurate response state determination.

Classification:

The study examines datasets of different lengths and items, focusing on archive grouping and paste tasks. The authors use a cross-entropy mismatch layer on top of the primary token, highlighting the importance of BIGBIRD for longer archives and less preparation models. The results show improved performance on Licenses dataset.

Encoder-Decoder Tasks:

The encoder-decoder arrangement can suffer from quadratic intricacy due to full self-consideration. BIGBIRD's scanty consideration instrument is primarily used at the encoder side, as result arrangement lengths are typically shorter than information lengths in generative applications. Insufficient attention is more effective for the encoder.

Model	Arxiv			PubMed			BigPatent		
	R-1	R-2	R-L	R-1	R-2	R-L	R-1	R-2	R-L
SumBasic [68]	29.47	6.95	26.30	37.15	11.36	33.43	27.44	7.08	23.66
LexRank [25]	33.85	10.73	28.99	39.19	13.89	34.59	35.57	10.47	29.03
LSA [97]	29.91	7.42	25.67	33.89	9.93	29.70	-	-	-
Attn-Seq2Seq [85]	29.30	6.00	25.56	31.55	8.52	27.38	28.74	7.87	24.66
Pntr-Gen-Seq2Seq [77]	32.06	9.04	25.16	35.86	10.22	29.69	33.14	11.63	28.55
Long-Doc-Seq2Seq [20]	35.80	11.05	31.80	38.93	15.37	35.21	-	-	-
Sent-CLF [81]	34.01	8.71	30.41	45.01	19.91	41.16	36.20	10.99	31.83
Sent-PTR [81]	42.32	15.63	38.06	43.30	17.92	39.47	34.21	10.78	30.07
Extr-Abst-TLM [81]	41.62	14.69	38.03	42.13	16.27	39.21	38.65	12.31	34.09
Dancer [31]	42.70	16.54	38.44	44.09	17.69	40.27	-	-	-
Transformer	28.52	6.70	25.58	31.71	8.32	29.42	39.66	20.94	31.20
+ RoBERTa [76]	31.98	8.13	29.53	35.77	13.85	33.32	41.11	22.10	32.58
+ Pegasus [107]	34.81	10.16	30.14	39.98	15.15	35.89	43.55	20.43	31.80
BIGBIRD-RoBERTa	41.22	16.43	36.96	43.70	19.32	39.99	55.69	37.27	45.36
Pegasus (Reported) [107]	44.21	16.95	38.83	45.97	20.15	41.34	52.29	33.08	41.75
Pegasus (Re-eval)	43.85	16.83	39.17	44.53	19.30	40.70	52.25	33.04	41.80
BIGBIRD-Pegasus	46.63	19.02	41.77	46.32	20.65	42.33	60.64	42.46	50.01

Table No: 3

Summarization:

This paper discusses the use of a context-oriented encoder for abstractive rundown of long records, focusing on three long report datasets. The authors argue that longer records provide more extensive talk construction and abstract descriptions, making additional background information crucial. They also discuss the benefits of using a BIGIRD inadequate encoder alongside a full decoder on these datasets, showing that longer settings improve performance. The study also presents results on smaller but more broad datasets.

Genomics:

The rise in genomics information deep learning has improved performance on large-scale projects like advertiser site forecasts and methylation examinations. Long-input BIGBIRD, a deep learning approach, is used to learn strong logical representations for DNA pieces using unlabeled data like the human reference genome and Saccharomyces Genome Information base. This approach further develops results in two downstream tasks.

Pre-training and MLM:

The study propose dividing DNA into tokens to increase setting length, rather than base coordinates. A 32K byte-pair encoding table is created, with each token addressing 8.78 base matches. The MLM objective is used to display these tokens on the human reference genome.

Model	BPC
SRILM [58]	1.57
BERT (sqln. 512)	1.23
BIGBIRD (sqln. 4096)	1.12

Table No: 4

Promoter Region Prediction:

Advertiser District Forecast is a DNA technique used to identify advertiser locales in a DNA sequence. The AI model, BIGBIRD, was fine-tuned using a dataset from the Eukaryotic Advertiser Information Base. The model achieved almost ideal accuracy with a 5% increase in precision compared to the best technique.

Model	F1
CNNProm [90]	69.7
DeePromoter [71]	95.6
BIGBIRD	99.9

Table No: 5

Chromatin-Profile Prediction:

DeepSea[109] has gathered 919 chromatin profiles of 2.4 million non-coding variations from various projects to predict the practical impacts of non-coding DNA districts. The comparing ML task involves predicting the utility of these profiles, including record factors, DNase I awareness, and histone-mark profiles. The team has learned 919 double classifiers to predict these impacts from DNA sequences, with a focus on the harder assignment HM.

Model	TF	HM	DHS
gkm-SVM [30]	89.6	-	-
DeepSea [109]	95.8	85.6	92.3
BIGBIRD	96.1	88.7	92.1

Table No: 6

Conclusion:

The authors propose BIGBIRD, a meager consideration system with a direct number of tokens. BIGBIRD is a widely approximator of succession to grouping works and Turing complete. It uses extra global tokens to save the expressive powers of the model. BIGBIRD provides advanced performance on various NLP tasks, such as question answering and long record grouping. The authors also present

a consideration-based logical language model for DNA and modify it for downstream tasks like advertiser location expectation and anticipating non-coding variations.

Acknowledgment:

I'm profoundly thankful to Usharani Gogoi Madam (Asst.Prof. of The Neotia University), my guide, for her direction, information, and immovable aide sooner or later of the exploration and composing this article and furthermore eminent The Neotia University for conferring get admission to resources, research focuses, and venture that worked with this exploration.

References:

- [1] A. Backurs and P. Indyk. Alter distance can't be registered in firmly subquadratic time (except if seth is bogus). In Procedures of the forty-seventh yearly ACM conference on Hypothesis of registering, pages 51-58, 2015.
- [2] I. Beltagy, M. E. Peters, and A. Cohan. Longformer: The long-record transformer. arXiv preprint arXiv:2004.05150, 2020.
- [3] Z. Dai, Z. Yang, Y. Yang, J. Carbonell, Q. V. Le, and R. Salakhutdinov. Transformer-xl: Mindful language models past a fixed-length setting. arXiv:1901.02860, 2019.
- [4] J. Devlin, M.- W. Chang, K. Lee, and K. Toutanova. Bert: Pre-preparing of profound bidirectional transformers for language getting it. arXiv preprint arXiv:1810.04805, 2018.
- [5] L. Dong, N. Yang, W. Wang, F. Wei, X. Liu, Y. Wang, J. Gao, M. Zhou, and H.- W. Hon. Bound together language model pre-preparing for normal language understanding and age. In Propels in Brain Data Handling Frameworks, pages 13042-13054, 2019.
- [6] T. H. Trinh and Q. V. Le. A straightforward strategy for rational thinking. arXiv preprint arXiv:1806.02847, 2018.
- [7] A. Vaswani, N. Shazeer, N. Parmar, J. Uszkoreit, L. Jones, A. N. Gomez, Ł. Kaiser, and

ADVANCEMENTS IN MAGNETIC ENERGY TRAINS: A SUSTAINABLE FUTURE FOR TRANSPORTATION

Suprime Mandal

Robotics And Automation,
2020-2021,
The Neotia University

Abstract:

The advent of magnetic energy trains signifies a groundbreaking shift in 21st-century transportation, offering an eco-friendly alternative to conventional rail systems. This research explores the principles, design, applications, and potential impact of magnetic energy trains on urban and intercity transit. Through case studies, technological analysis, and environmental assessments, we assess the viability and benefits of this innovation. We investigate integrating renewable energy sources like superconducting magnets and regenerative braking to boost efficiency and sustainability. Furthermore, we address challenges and opportunities associated with widespread adoption, covering safety and economic feasibility. This paper envisions a future where magnetic energy trains revolutionize transportation, addressing modern mobility challenges while redefining transit systems.

Introduction:

In the 21st century, the world confronts an unprecedented convergence of transportation challenges. Urbanization surges, populations burgeon, and the quest for swift, sustainable, and energy-efficient mobility intensifies. Conventional transport's environmental toll, including greenhouse gas emissions and congestion, nears crisis levels, compelling a

radical transportation paradigm shift[1]. The magnetic energy train concept, grounded in magnetic levitation (maglev) technology, emerges as a transformative solution. Departing from wheel-and-track reliance, it leverages electromagnetic forces to lift and propel vehicles, promising high-speed, sustainable transit with minimal friction. This research navigates the magnetic energy train concept's depths. We unravel maglev's core principles, intricate engineering, and potential environmental and economic benefits. We scrutinize seamless renewable energy integration, and we analyze the adoption's challenges and prospects, from safety to economic viability. This paper maps a magnetic energy train-dominated future, navigating modern mobility challenges and envisioning rapid, clean, and sustainable travel, surpassing past limitations.

Methodology: Investigation of Magnetic Energy Trains

The methodology employed in this research endeavors to comprehensively explore the principles, design, engineering aspects, environmental implications, and potential applications of magnetic energy trains. The focal point of our innovative solution involves the incorporation of dual magnets in conjunction with a rotating motor within station stops, with the primary objective of augmenting precision and efficiency within

this transportation system.

- 1. Principles Examination:** The initial phase of the methodology involves a thorough investigation into the underlying principles governing magnetic energy trains. This includes a detailed study of magnetic fields, electromagnetic induction, and the dynamics of magnetic levitation, seeking to comprehend the fundamental mechanisms that enable the functionality of such transportation systems.
- 2. Design Analysis:** Detailed scrutiny is conducted into the design aspects of magnetic energy trains. This encompasses the evaluation of structural elements, magnetic configurations, and aerodynamic considerations, aiming to optimize the train's performance, stability, and safety.
- 3. Engineering Exploration:** The methodology incorporates an engineering perspective, focusing on the technical implementation of the proposed dual-magnet system and rotating motor within station stops. Prototyping, simulations, and feasibility studies are employed to refine and validate the design, ensuring its practical applicability and operational efficacy.
- 4. Environmental Impact Assessment:** A critical aspect of this research involves assessing the environmental footprint of magnetic energy trains. Life cycle assessments and comparative analyses with conventional transportation systems are conducted to evaluate energy efficiency, emissions reduction, and overall environmental sustainability.
- 5. Applications Evaluation:** The methodology encompasses an assessment of potential applications of the proposed innovative solution. Feasibility studies for various transportation networks, urban planning considerations, and economic viability assessments are conducted to ascertain the broader applicability and potential benefits of integrating this technology.

By adopting this comprehensive methodology, our research aims to contribute to the advancement of magnetic energy train technology. The innovative utilization of dual magnets and a rotating motor at station stops represents a promising step towards enhancing the precision, efficiency, and viability of this transformative mode of transportation.

Technology Used:

Magnet: A magnetic object, vital to magnetic energy train technology, attracts ferrous materials. It is artificially created in various shapes and sizes, with applications such as the bar magnet and magnetic compass needle[2].

Magnetic Field Lines: These lines depict the paths magnetic fields follow. Understanding them aids in comprehending magnetic forces. The direction of these lines indicates magnetic force direction. They always begin at the North pole and end at the South pole of a magnet[3].

What's New: We will use two types of magnets in stations to stop the train. A motor will rotate on its axis and magnetic polarization can be changed frequently. This system will use to start the train from a station and the motor will be fixed with opposite poles of the magnets with respect to the train's magnet, it will use to stop the train.

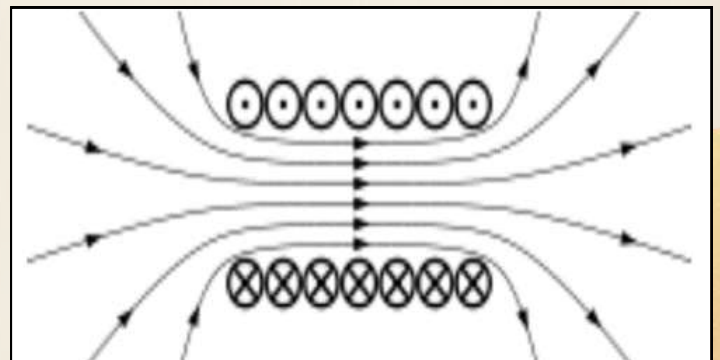


Figure. No.: 1 Magnetic Field lines

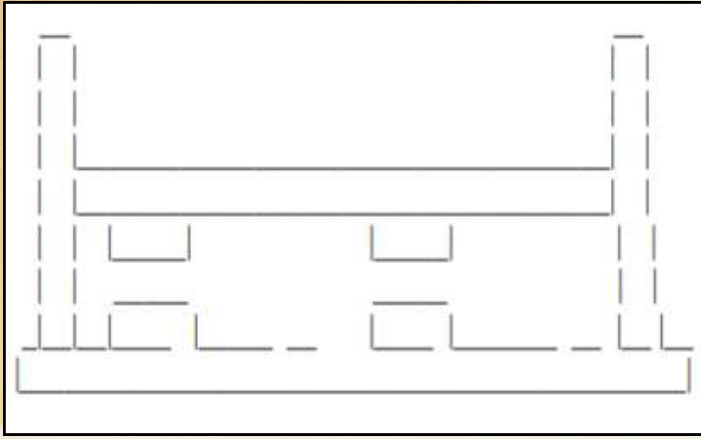


Figure No.: 2

Our Innovative Strategy for Energy Conservation: Introducing a Magnetic Levitation Train Design

In our pursuit of preserving natural energy resources, we've developed an unconventional approach to transportation systems. Our experimental design introduces a floating train mechanism encapsulated within a specialized capsule, strategically minimizing magnetic interference with the outer tunnel. By employing electric power solely at stations, our design significantly curtails overall energy consumption.

Central to our design is the incorporation of dual magnets and a motor system that enables precise control over the train's stopping and starting mechanisms. At station stops, we employ two distinct types of magnets to facilitate the halting process. A motor, designed to rotate on its axis, allows for frequent alteration of magnetic polarization. This dynamic system is instrumental in initiating the train's movement from a station. Additionally, the motor's configuration, fixed with opposing poles relative to the train's magnet, serves as an efficient means to bring the train to a halt.

This innovative system harnesses magnetic forces in a strategic manner, optimizing

energy usage and enhancing control over the train's propulsion and braking. By integrating these technologies, we aim to revolutionize the efficiency and sustainability of transportation while reducing reliance on conventional energy sources.

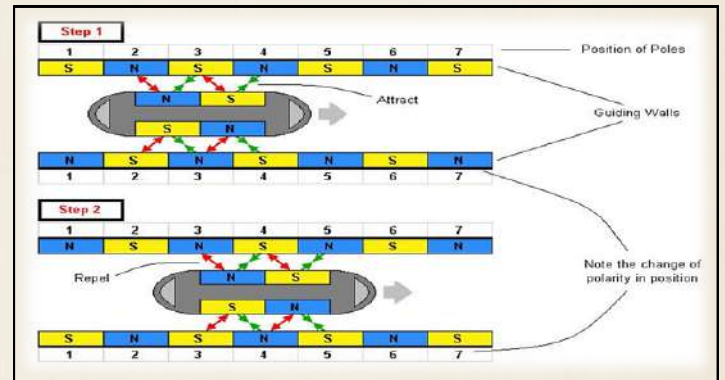


Figure No.: 3

Discussion:

The problem statement addresses a critical challenge in the implementation of magnetic energy train systems, which is the precise stopping of trains at stations. Unlike traditional wheeled trains that rely on friction-based braking systems, magnetic energy trains, powered by magnetic levitation (maglev) technology, present unique challenges in managing speed and halting at designated locations[4]. Our problem statement highlights the intricate issue of stopping magnetic energy trains with precision. Traditional braking methods are ill-suited due to maglev technology's minimal friction. Our solution introduces dual magnets and a rotating motor for enhanced stopping accuracy.

Parameter	Value
Weight of vehicle body (kg)	39 000
Pitch inertia of vehicle body ($\text{kg}\cdot\text{m}^2$)	1.755×10^6
Weight of levitation bogie (kg)	660
Pitch inertia of levitation bogie ($\text{kg}\cdot\text{m}^2$)	550
Weight of levitation magnet (kg)	603
Pitch inertia of levitation magnet ($\text{kg}\cdot\text{m}^2$)	434
Stiffness of primary suspension (N/m)	2.0×10^7
Damping of primary suspension ($\text{N}\cdot\text{s}/\text{m}$)	5000
Stiffness of secondary suspension (N/m)	3.9×10^5
Damping of secondary suspension ($\text{N}\cdot\text{s}/\text{m}$)	7000

Table 1: Important Parameters related to Magnetic Levitation Train Design

Future Scopes:

Implementing AI in magnetic energy trains can enhance the transportation system in several ways:

- **Operational Efficiency:** AI algorithms can optimize train scheduling, speed control, and energy consumption, leading to smoother operations and reduced delays.
- **Predictive Maintenance:** AI-powered predictive analytics can anticipate maintenance needs, preventing breakdowns and ensuring continuous operation.
- **Safety Features:** AI can enhance safety by detecting and reacting to potential hazards in real-time, improving collision avoidance systems and emergency responses.
- **Energy Optimization:** AI algorithms can manage energy consumption more effectively, optimizing power usage for propulsion and auxiliary systems, thus improving overall energy efficiency.
- **Adaptive Control:** AI can provide adaptive control mechanisms, adjusting to varying environmental conditions and ensuring stable performance under different circumstances.
- **Passenger Experience:** AI-driven systems can personalize passenger experiences, offering tailored services, entertainment, and comfort during travel.

- **Enhanced Decision Making:** AI analytics can provide valuable insights into system performance, enabling better decision-making for infrastructure upgrades and future planning.
- **Integration with Smart Infrastructure:** AI facilitates integration with smart city infrastructure, enabling seamless connectivity with traffic management systems, optimizing routes, and improving overall urban mobility.
- **Autonomous Operations:** AI can pave the way for semi-autonomous or autonomous train operations, leading to safer and more efficient transportation systems.
- **Environmental Impact:** By optimizing operations and energy usage, AI in magnetic energy trains can contribute to reduced carbon emissions and promote more sustainable transportation methods.

Conclusion:

The magnetic energy train concept promises eco-efficient transportation. Our research navigates its principles, benefits, renewable energy integration, and challenges. This innovation heralds a future of clean, swift, and sustainable mobility. We are not using the traditional method for this project and our goal is to save natural source of energy. In conclusion, the magnetic energy train concept represents a promising leap towards sustainable and efficient transportation. Through the principles of magnetic levitation and propulsion, it offers a viable solution to the challenges posed by conventional transportation systems. With potential environmental benefits, energy efficiency gains, and a transformative impact on mobility, magnetic energy trains hold great promise. However, their successful integration necessitates addressing safety, regulatory, and economic considerations. As we embrace this innovation, it becomes evident that magnetic

energy trains have the potential to revolutionize the future of transportation.

Acknowledgment:

I would like to express my heartfelt gratitude to Usha Rani Gogoi ma'am , our esteemed faculty member, for her unwavering support, guidance, and mentorship throughout the research process. Ma'am's expertise and encouragement were invaluable in shaping this research paper. I also extend my appreciation to the YouTube channel "Lesisics" for their informative and educational content, which proved instrumental in enhancing my understanding of the magnetic energy train concept. I am deeply thankful to all those who contributed directly or indirectly to this research endeavor. Your assistance and insights were indispensable in making this paper possible.

References:

- [1] [Information on Wikipedia] (<http://en.wikipedia.org/wiki/Maglev>)
- [2] Final Report on the National Maglev Initiative (Rita, U.S. Department of Transportation| Research and Innovative Technology Administration). [Link] (<http://ntl.bts.gov/DOCS/TNM.html>)
- [3] DeMeis, Richard. "Magnetic levitation for the masses." *Aerospace America* v. 31, n. 9 (September 1993): 30-35.
- [4] Graham-Rowe, Duncan. "Prepare for lift-off." *New Scientist* v. 159, n. 2146 (August 8, 1998): 7.
- [5] Thornton, Richard. "Why the US Needs a Maglev System." *Technology Review* v. 94, n. 3 (April 1991): 30-38.



HOW AI AND BIOMETRIC CAN IMPROVE THE SECURITY AND ACCURACY OF HUMAN IDENTITY

Aditi Chandra

Dept. CSE with specialization in Robotics and Automation,
2020-2021,
The Neotia University

Abstract:

Artificial Intelligence(AI) and Biometrics are two fields that are closely related and have many applications in various Domains.AI is a way of making Intelligent Machine which can Behave like a human so it can be able to make decisions whereas Biometrics is the science of measuring and analyzing the physical and behavioral characteristics of individuals, such as their face, iris, fingerprint, voice, gait, etc., for identification and verification purposes. AI and biometrics can work together to enhance the security, convenience, and efficiency of various systems and services.

Keywords:

Artificial Intelligence, Biometrics, Fingerprint recognition, Authentication, Voice recognition.

Introduction:

Artificial intelligence provides intelligence to a machine and enables machines to think logically and perform various activities like human beings.AI technology is used in various places for security reasons such as speech recognition, Facial recognition Biometrics authentication control systems and many other domains. In our day to day life, the verification of person is very important task to access sensitive data. That's why we can use a new modern way to identify a person is

biometric authentication. Biometrics uses methods for unique recognition of humans based upon one or more intrinsic physical traits which includes fingerprint, retina, face recognition or behavioral traits which includes voice, signature and keystroke that can be used to identify an individual or to verify the claimed identity of an individual. In Biometrics industry, while ISO, IEC, NIST, STQC or various other organizations are releasing new standards with more security and more AI base approach, there are many researchers trying different AI techniques on biometric identification methods.



Figure No.: 1

Methodology:

- **AI in Iris Recognition:-** Iris is the most distinctive feature of Human body. No two individuals can have the same iris. Iris does not change in the entire life of an individual.AI analysis the pattern of the Iris and the retina and stores the pattern. This highly advanced technology is used in various confidential places where data privacy is utmost important.

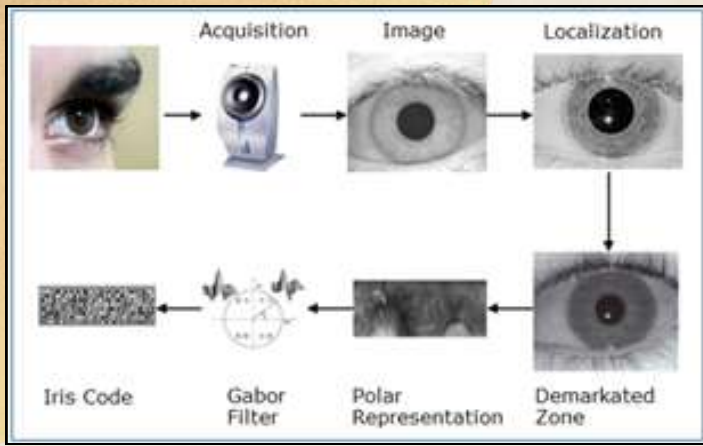


Figure No.: 2

- **AI in Face Detection:-** The biometric system can automatically recognize an individual by the face. This technology works by analyzing specific features in the face like - the distance between the eyes, width of the nose, movement of cheek bones and other facial features. Nowadays facial recognition is more effective with the help of machine learning. AI learns from millions of images and utilizes 3D biometrics to successfully authenticate an individual's face.

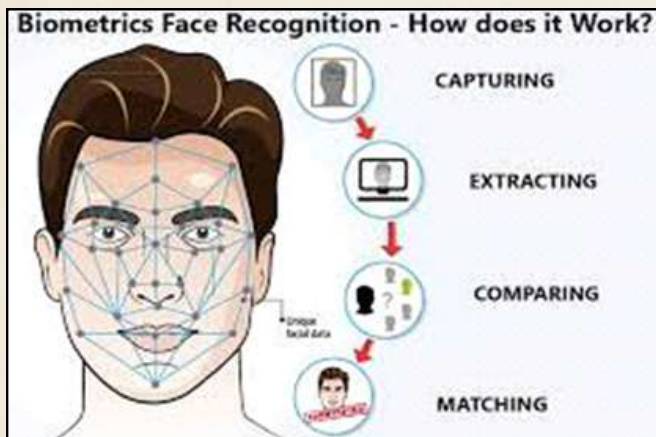


Figure No.: 3

- **AI in Speech Recognition:-** AI recognizes the speech and speaking tone of the user and stores this information. This speech recognition is used to lock the system, therefore providing more security.
- **AI in fingerprint recognition:** The fingerprint is such a pattern of ridges and valleys on the fingers that is unique for each and every person even two identical twins does not have identical fingerprints.

AI stores the fingerprints by analyzing the discontinuity in the patterns. System stores this information in form of 0's and 1's. Fingerprint recognition is one of the oldest and most common biometric identifiers used in various places.

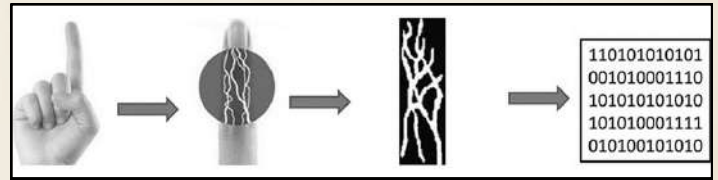


Figure No.: 4

Conclusion:

In this Digital age security is the one of the major concern of any field. With the increase in technology risk of data breaching, hacking and cyber crime has also increased a lot. Keeping data private is one of the major concern of any company. AI can be one of the best way to keep data more safe and secure Today's modern computing world gain a lot of benefit from various other AI tool.

Reference:

- Artificial Intelligence in Biometrics:- A.Kavitha
- Head & Assistant Professor of Computer Science, Aditanar College of Arts and Science, Tiruchendu

REMOTE CONTROLLED STAIRCASE CLIMBING ROBOT UTILIZING UNIFORM DISTRIBUTED LOAD (UDL) PRINCIPLE ON ALL FOUR WHEELS

Nishant Rana

Sakshi Jha

Robotics Department,
2022-2023,
The Neotia University

Abstract:

This research paper presents the design, development, and evaluation of a remote-controlled staircase climbing robot that employs the Uniform Distributed Load (UDL) principle on all four of its wheels. The UDL principle is applied to enhance the load-bearing capacity and stability of the robot while navigating staircases and uneven terrains. This paper explores the robot's innovative wheel design, control system, and potential applications in various fields, such as search and rescue, logistics, and healthcare.

Keywords:

Staircase Climbing Robot, Uniform Distributed Load, Robotics, Load-Bearing, Stair Navigation.

Introduction:

Staircases and uneven terrains often pose significant challenges for wheeled robots. The goal of this research is to design a remote-controlled robot capable of efficiently and safely climbing stairs while maintaining a UDL on all four wheels. The UDL principle is well-known in engineering for its ability to distribute loads evenly, ensuring structure

stability. In this context, we apply this principle to robotics to enhance load-bearing capacity and maneuverability.

Uniform Distributed Load (UDL) Principle in Robotics:

1. Load Distribution:

- The UDL principle ensures that the weight of the robot is evenly distributed across all four wheels.
- Each wheel is designed to bear an equal portion of the robot's weight.

2. Enhanced Stability:

- The UDL design provides stability on uneven terrains, such as stairs, by preventing excessive weight on any single wheel.
- Improved stability contributes to safer navigation.

3. Robot Design:

Wheel Mechanism:

- Four wheels, each equipped with UDL load-bearing capabilities.
- The UDL wheels incorporate an internal load distribution mechanism to evenly distribute the robot's weight.
- UDL wheels are designed to adapt to varying stair dimensions and angles while

maintaining load balance.

4. Control System:

Motor Control :

- The robot's control system is optimized for precise control of each UDL wheel.
- Independent motor control allows for fine-tuned adjustments during stair ascent and descent.
- A user-friendly remote-control interface is provided for intuitive operation.
- The interface includes features for adjusting wheel parameters and monitoring load distribution.

5. Performance Evaluation:

Load-Bearing Capacity:

- Extensive load-bearing tests are conducted to verify the effectiveness of the UDL principle.
- The robot is evaluated for its ability to carry varying payloads while climbing stairs.
- The robot's performance on different types of stairs, including varying dimensions and angles, is assessed.
- Efficiency metrics are established to measure stair climbing speed and stability.

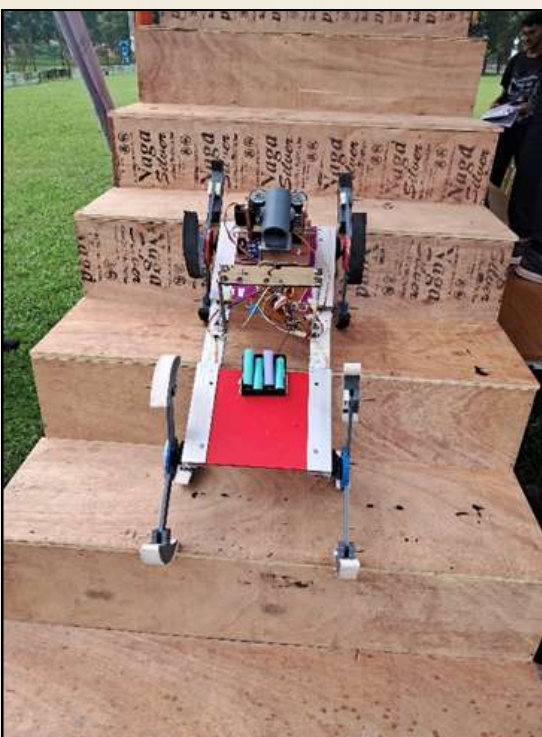


Figure No.: 1

Applications:

The UDL-equipped staircase climbing robot has versatile applications, including:

- **Search and Rescue:** The robot can navigate through disaster-stricken buildings with staircases, delivering critical supplies and performing reconnaissance tasks.
- **Logistics:** It can be utilized for the efficient movement of goods in warehouses with elevated platforms or multi-level structures.
- **Healthcare:** In healthcare settings, the robot can assist in transporting patients between floors, reducing the physical strain on healthcare workers.

Conclusion:

The integration of the Uniform Distributed Load (UDL) principle in a remote-controlled staircase climbing robot's wheel design enhances its load-bearing capacity, stability, and adaptability on various staircases and terrains. This research demonstrates the feasibility and benefits of applying engineering principles to robotics, opening up new possibilities for practical applications in multiple fields. The UDL-equipped robot showcases the potential for safer and more efficient mobility in complex environments.

References:

1. Martens, J., & Newman, W. (1994). Stabilization of a mobile robot climbing stairs. Proceedings of the 1994 IEEE International Conference on Robotics and Automation, 2501-2507 vol.3. <https://doi.org/10.1109/ROBOT.1994.351135>.
2. Hamed, B. (2011). Design and Implementation of Stair-Climbing Robot for Rescue Applications. International Journal of Computer and Electrical Engineering, 461-468. <https://doi.org/10.7763/IJCEE.2011.V3.361>.

REVIEW OF NANOROBOTICS

Swagata Lakshmi Sadhukhan

Department of Robotics And Automation,
2021-2022,
The Neotia University

Abstract:

Nanorobotics merge medical, pharmaceutical, and engineering expertise to create nano-scale electromechanical devices powered by embedded nanomotors. It is a burgeoning field with diverse applications, notably in targeted drug delivery and disease diagnosis. Nanorobots operate autonomously in inaccessible body areas, driven by various energy sources. Key advantages include precise drug delivery and non-invasiveness. Although most research is in vitro, the potential for transforming future medical treatments is immense.

Keywords:

Nanorobotics; Nanoelectromechanical devices; Targeted drug delivery; Biomedical applications.

Introduction:

Nanorobot assemblies, programmable at the nanometer scale, are created through manipulation or self-assembly, akin to biological cell sizes. Originating from Richard Feynman's concepts, nanorobot technology is an interdisciplinary field encompassing physics, chemistry, biology, engineering, and medicine. Expected to revolutionize drug development, nanorobots enable precise drug targeting, controlled release, and biological repairs. Pharmaceutical research grapples with drug delivery challenges, for which nano-



Fig. 1: Figure by internet

carrier-based systems show promise in enhancing drug solubility, distribution, and release rates. However, translating these advancements to clinical trials remains a hurdle. Active-directed nanoparticles, guided by ligands, strive to improve targeting efficiency, yet accurate drug delivery with autonomous propulsion and tissue infiltration remains a challenge. Nanorobots, a product of multidisciplinary scientific progress, hold potential in medicine for operations, diagnostics, and drug delivery. Unlike traditional methods, nanorobots can move autonomously, delivering nanoparticles to previously inaccessible areas within the body. This review explores nanorobot based targeted drug delivery, assessing its current state, challenges, and future potential to unlock biomedical technologies.

Methodology:

- **Design Conceptualization:** Formulation of the design objectives and functionalities of the nanorobot, considering the intended application, payload delivery, and navigational capabilities.

- **Molecular Design Software:** Utilization of advanced molecular design software to create precise nano-structures that can store and transport molecular cargo.
- **DNA Origami Technique:** Application of the 'DNA origami' technique to manipulate DNA material into specific shapes, enabling the creation of a nanorobot scaffold.
- **Programming and Functionalization:** Programming of the 3D DNA structures to carry out desired robotic tasks and functionalities within biological systems.
- **Integration of Computational Functions:** Employment of advanced computational functions to integrate structural techniques, enabling secure and targeted drug delivery to specific cells.
- **Testing and Validation:** Conduction of rigorous testing and validation of experiments to assess the nanorobot's movement, activation, targeting accuracy, and payload delivery efficiency.
- **Iterative Improvement:** Iteratively refining of the design and functionality based on testing results, aiming for enhanced performance and effectiveness in medical applications.

Experimental Results:

- Employed DNA origami-based technique to construct nanorobots at the nanoscale.
- Precisely engineered nanostructures for carrying specific molecular cargo using advanced molecular design software and mechanosynthesis principles.
- Tested nanorobots' autonomous movement in a simulated biological environment via in vitro experiments.
- Loaded nanorobots with model drug payloads to evaluate drug delivery efficiency and targeted delivery to simulated disease sites.
- Demonstrated superior drug targeting and controlled release capabilities compared to traditional drug delivery methods.

- Explored diverse energy sources for nanorobot propulsion, including exogenous magnetic fields and endogenous chemical reactions.
- Successfully validated propulsion using these energy sources, affirming their potential to power nanorobots effectively.
- Overall experimental results underscore the potential of nanorobots in transforming targeted drug delivery, prompting further research and in vivo studies for practical medical applications.

Discussion:

The Research Paper is based on Nanorobotics and Targeted Drug Delivery. We have discussed the Structure, Objectives, Methodology, Findings, and Consequences of the paper.

Conclusion:

Nanorobotics represents a burgeoning interdisciplinary field that bridges diverse realms of science and technology. The benefits and potential applications of nanorobots in both medical and engineering domains outweigh the challenges encountered during the developmental stages. Examining instances like biological molecular motors and bio nanorobotics clearly demonstrates the difficulty, yet attainability, of crafting such systems. It is conceivable that nanorobotics may soon integrate into the realm of nanomedicine, offering substantial advantages for individuals grappling with challenging medical conditions like cancer.

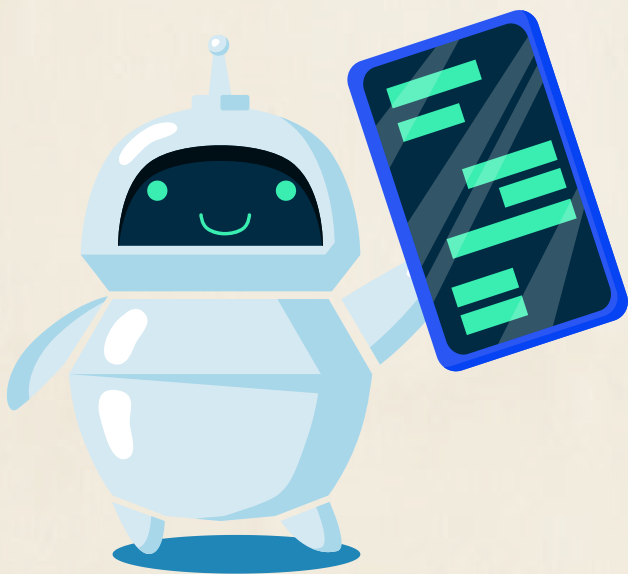
Acknowledgement:

I extend my heartfelt gratitude to all those who have contributed to this research project on nanorobotics and targeted drug delivery. This endeavour would not have been possible

without the collaborative efforts and support of several individuals and organizations.

Reference:

- https://www.researchgate.net/publication/227245023_Nanorobotics
- <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7407549/>
- <https://www.summeratlantic.com/post/>
- <https://www.summeratlantic.com/post/toward-the-micro-world-nano-robots>
- <https://ijpsr.com/bft-article/nanorobots-a-review/>



EMPOWERING LUNAR EXPLORATION: THE ROLE OF AI IN CHANDRAYAAN-3

Sayak Mandal

B.Tech CSE(AI & ML),
2020-2021,
The Neotia University

Abstract:

Chandrayaan-3 is the third mission in India's lunar exploration program, which aims to enhance our understanding of the lunar geography and environment. This achievement makes India the first country to reach the Moon's lunar south pole. Artificial intelligence plays a vital role in Chandrayaan-3. The roles of AI in this mission are discussed in this article.

Introduction:

Artificial intelligence has been rapidly emerging as an essential asset across multiple industries, and the exploration of space is significant. The Chandrayaan-3 mission represents a significant advancement in India's lunar exploration efforts. This mission will build on the success of the ISRO's previous Chandrayaan-1 and Chandrayaan-2 missions to explore the lunar surface. Compelled by the awesome potential of AI in space exploration, 'Chandrayaan -3' is a well-thought-out mission as it embarks on a journey that will change the history of space.

Methodology:

AI has been used in a variety of ways in Chandrayaan-3, depending on the specific application. For example,

- The lander's AI algorithm uses data from the lander's sensors to decide the best landing spot and control the lander's

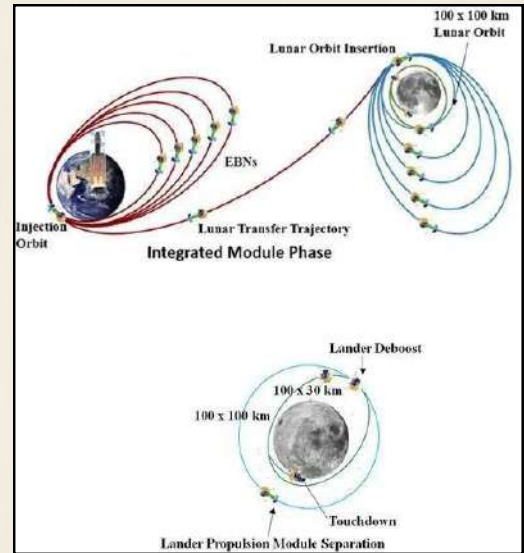


Fig. 1: Chandrayaan-3 Mission Profile

descent. The algorithm will take into account factors like the lunar terrain, the lander's weight, and the amount of fuel left. This will assist to guarantee that the lander lands safely and exactly. AI-powered sensors like velocimeters, altimeters, and accelerometers enabled precision landing by mapping lunar topography and recalibrating the descent trajectory.

- The rover's AI algorithm will use data from the rover's sensors to map the terrain and plan the rover's path. Algorithms will be used to detect and avoid obstacles.
- The AI to analyze scientific data will be trained on a vast database of images and other data collected by previous lunar missions the AI will be able to identify patterns in the data that would be difficult or impossible for humans to detect.
- Chandrayaan-3 is designed with a computer vision system including cameras and sensors to capture high-resolution

images and in-depth information. These features are strategically mounted on the spacecraft to enable it to see the surface of the moon well.

Experimental Results:

AI has played a key role in the success of the Chandrayaan-3 mission. AI powered mission planning software has helped design and optimize mission trajectories, lander site selection, and rover operations. AI-powered navigation software has also helped the spacecraft reach and land safely on the lunar surface.

AI-powered data processing software is now being used to process and analyze huge amounts of data. Collected by spacecraft and rovers. This data is being used to study the lunar surface, atmosphere, and environment. AI-powered scientific research software is also being used to gain new insights into the structure, structure, and evolution of the Moon.



Figure No.: 2

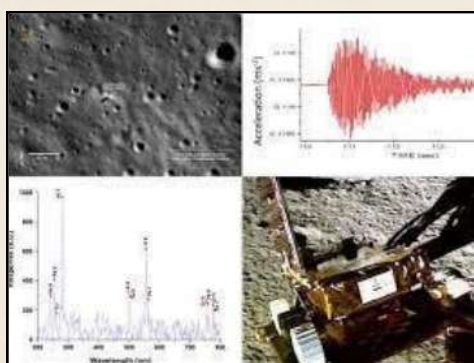


Figure No.: 3



Fig. 4: Vikram Lander will be controlled by AI



Fig. 5: Chandrayaan-3 lands on the moon.

Discussion:

The application of AI in Chandrayaan-3 represents a great achievement in lunar exploration technology. The key points and applications of AI in this mission are discussed below:

- **Enhanced Autonomy:** AI played a vital role in enabling Chandrayaan-3 to operate with high autonomy, during critical conditions such as descent and landing. The spacecraft's AI algorithms can make decisions in real-time to ensure a safe landing.
- **Safe landing and automation:** AI facilitates safe landing by automatically detecting appropriate landing. Machine Learning models process information from onboard sensors, including cameras and lidar, to make the right decision for the landing site. This technology reduces accidental damage.
- **Real-Time Data Analysis:** AI in Chandrayaan-3 can analyze the data in real-time. The spacecraft can quickly process and interpret data from the lunar

surface, identifying geology, mineral structure, and anomalies

- **Scientific Insights:** Data analysis adds scientific value to the mission. By identifying areas of scientific interest and geological features Chandrayaan-3 can provide valuable insights into the geology, evolution, and history of the moon.
- **Challenges and risks:** While AI offers many advantages, there are several challenges and risks in this mission. These include the need for complex AI algorithms, the possibility of software glitches, and the risk of predicting incorrect decisions.

Conclusion:

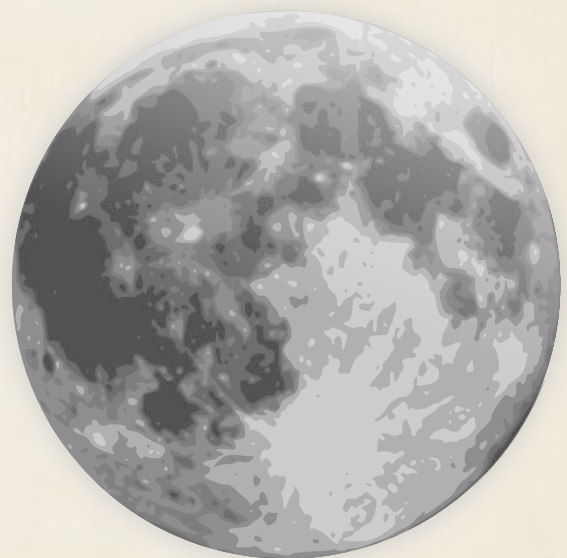
The application of AI in Chandrayaan-3 adds a milestone in India's space exploration journey. AI calculates and decides to arrange the Vikram's landing. The accomplishment of this mission is not limited to landing, it lies in the seamless interaction between human intelligence and machine intelligence. This space exploration is not the end but a new beginning.

As we manage more ambitious missions and wider resources, AI will undoubtedly continue to be the cornerstone of our knowledge quest beyond Earth.

Reference:

- <https://www.moneycontrol.com/news/technology/chandrayaan-3s-ai-driven-sensors-were-crucial-to-a-successful-lunar-landing-11261451.html>
- <https://www.linkedin.com/pulse/pioneering-role-ai-ml-ds-chandrayaan-3-b-jeevana-sree/>
- <https://www.linkedin.com/pulse/embracing-new-horizons-role-ai-isros-chandrayaan-3-mission-sapra/>

- <https://indiaai.gov.in/article/chandrayaan-3-success-history-of-ai-in-space-exploration>
- <https://www.analyticsvidhya.com/blog/2023/08/chandrayaan-3-touchdown-how-ai-and-sensors-aided-isro-epic-lunar-venture/>
- <https://medium.com/@aidigitalx/role-of-ai-in-chandrayaan-3-mission-success-1414fe90adbe>
- <https://www.blockchain-council.org/news/chandrayaan-3-how-ai-helped-india-to-become-the-first-nation-on-moons-south-pole/>



AI DRIVEN SMART AGRICULTURE

Subhraprakash Santra

Department of Computer Science and Engineering Cyber security,
2021-2022,
The Neotia University

Abstract:

Smart agriculture with artificial intelligence provides a significant solution in today's agricultural challenges. It is a rising area that takes benefits of digitalization through AI and links data to agricultural domain. Soil selection, crop yield prediction, water management and many other things are involved in agriculture. There are many fields where artificial intelligence has been applied and it also can be applied to the field of agriculture. It addresses critical challenges such as labor shortages, climate change and need of sustainable food production, it offers a path to greater food security, improved farm probability and more sustainable agriculture future.

Keywords:

Artificial Intelligence, CNN, Automated Agriculture

Introduction:

Agriculture has vital role for any agricultural country's development. The agriculture sector is one of the most important industries in Indian economy. Around more than 55% of Indian population depends on agriculture for their livelihood. It has been observed that most of the farmers always have to deal with the loss. As the population is increasing, food requirement is also increasing and we have to also increase the production of crops. So, there is a requirement to use the modern technologies like machine learning, deep learning algorithm and different IoT devices,

so that the production and quality of the product should increase. Artificial intelligence based autonomous robots can be created that can perform agricultural task. These machines will be better and faster to perform agricultural task as compared to human.

What is Smart Agriculture?

For an agriculture-based economy, like India we face many challenges like water scarcity, crop yield unpredictability and many more. Many peoples are still suffering from hunger and malnutrition because of climate change and other factors. Smart agriculture is an approach where we combine our traditional agricultural techniques with advance technology like artificial intelligence and automated systems, sensors which can tackle challenges affected by climate change. The main meaning of smart agriculture is managing fields using advanced AI and machine learning algorithms like convolution neural network (CNN) to reduce manpower and increasing the quality and quantity of products.

AI as transformer of agriculture:

There are so many activities in agriculture like plantation, harvesting, soil contribution etc. For all of these activities, many farmers follow traditional approach. Artificial intelligence is an approach that can perform any task innovatively, from which we can reduce time and effort. From small crops to fruits and all agricultural products AI has the ability to automate the

process through computer vision and deep learning. Analyzing soil condition and good time for plantation is very challenging for a farmer. This is a process which requires checking the condition of soil, humidity, temperature of climate.

If the understanding fails then it can serve loss for farmers. Here AI can use its advanced algorithms to provide real time soil's health, moisture levels, nutrient contents and many other things. Sensors can collect data (as shown in figure 1) like moisture, pH and more from soil. AI model can process data which is collected through IOT devices to predict the health of soil to get the best time for plantation.



Figure No.: 1

Satellites and AI based drones can be one of the most useful tools in smart agriculture to manage crops and resources. Satellite gives the large-scale view of lands, which allows farmers to manage large area, crop's health using real time data. AI based drones also allows farmers to capture high resolution data which can help farmers in monitoring crop's condition, identifying disease. We can see in figure 2 deep learning models are trained with a large number of datasets to predict real time health and quality of fruits or any crops. These technology promises to give more sustainable future for agriculture.



Figure No.: 2

Machine learning models can use the real time data of satellite to provide the information about current weather. The captured images of drones can be used to identify the health, density, disease of the crops. Convolutional neural network has the ability to extract proper details of images as it is trained on huge dataset. As shown in figure 3 when the drone will move through the field in that time trained machine learning models can take real time decision on which areas requires treatment spraying and which do not based on real time captured data.



Figure No.: 3

AI based robots also has essential role in smart agriculture. These AI robots can perform multiple tasks, from harvesting and planting to monitoring and collecting data. Using computer vision and advance machine learning algorithms they can remove unwanted plants, reduce the requirement of chemical treatment. Overall thing is to utilize modern technologies by minimizing the risk of crop failure. It can be the new automated agriculture.

Conclusion:

Artificial intelligence in smart agriculture is the way to produce food, promising future for farmers and the environment. It is a step towards food security and protection of our ecosystem. The integration of AI driven technology in agriculture represents the environment to feed a growing global population, and it is necessity for ensuring a sustainable future.

Reference:

- Christian Zinke-Wehlmann, Karel Charvát, Introduction of Smart Agriculture, chapter 13 (2021)
- Muthunoori Naresh, P Munaswamy, Smart Agriculture System using IoT Technology, International Journal of Recent Technology and Engineering (IJRTE) ISSN: 2277-3878, Volume-7 Issue-5, January 2019
- V S Magomadov, Deep learning and its role in smart agriculture, Journal of Physics: Conference Series, Volume 1399, Issue 4, 2019.
- <https://avinton.com/en/blog/2021/04/smart-agriculture-ai/>
- <https://www.worldbank.org/en/topic/climate-smart-agriculture>
- <https://www.goodfruit.com/airblast-from-above/>



FIRE FIGHTING ROBOT

Agnik Das

Department of Robotics & Automation,
2023 - 2024,
The Neotia University

Abstract:

In our daily life fire accident is a very common incident where many people lose their lives or are permanently disabled. Major fire Accidents do occur in industries like nuclear power plants, petroleum refineries, Gas tanks, chemical factories . Sometimes it becomes very difficult for fireman to save human life, so this project is enhanced to control fire by robotic vehicle.

Keywords:

Firefighting Robot; IR Distance sensor; Flame sensor; OV7670 Camera Module; Arduino mega2560; DC motor; Driver module.

Introduction:

A firefighting robot is a robot that is designed to assist firefighters in extinguishing fires. Firefighting robots can be used to perform a variety of tasks, such as:

- 1. Search and rescue:** Firefighting robots can be equipped with cameras and other sensors to help firefighters locate and rescue victims of fires.
- 2. Helping firefighters:** Firefighting robots equipped with water canon to help firefighters extinguish fires.
- 3. Handling explosive and dangerous chemicals:** Fire fighting robots can be used to handle explosive and dangerous chemicals.

Methodology:

The methodology of a firefighting robot typically involves the following steps:

- 1. Fire detection:** The robot uses sensors to detect the presence of fire.
- 2. Fire localization:** Once the robot has detected a fire, it needs to localize the fire and determine its intensity.
- 3. Navigation:** The robot needs to navigate to the location of the fire.
- 4. Firefighting:** Once the robot has reached the location of the fire, it use water canon to extinguish fire.
- 5. Monitoring:** The robot can monitor the fire to ensure that it is extinguished and does not rekindle.

Experimental results:

- **Initialization Of Robot:**

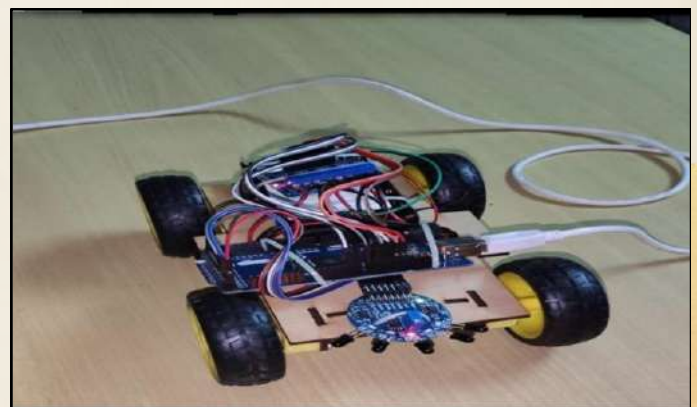


Figure No.: 1



Fig. 2: Detection of fire by robot

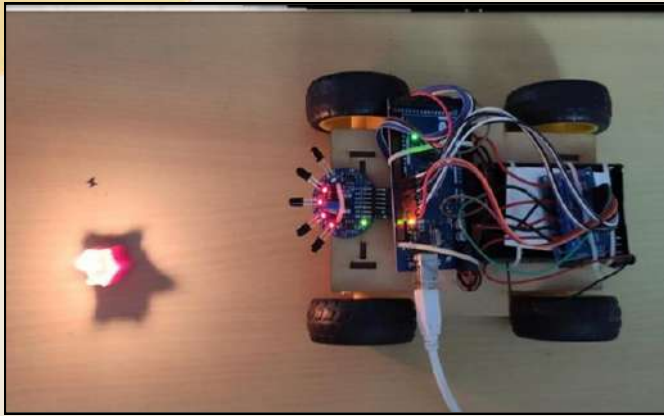


Fig. 3: Movement of robot towards fire detected object

Discussion:

Firefighting robots offer a number of advantages over traditional firefighting methods. For example, firefighting robots can be used to enter dangerous or hazardous environments that would be too dangerous for human firefighters to enter. Additionally, firefighting robots can be used to perform tasks that would be difficult or time-consuming for human firefighters to perform, such as extinguishing fires in high-rise buildings or confined spaces.

Conclusion:

Firefighting robots are still under development, but they have the potential to revolutionize the way that fires are fought. Firefighting robots can help to improve the safety of firefighters, increase the effectiveness of firefighting operations, and reduce property damage.

Here are some of the potential benefits of using firefighting robots:

1. Improve safety for fire fighters:

Firefighting robots can help to reduce the risk of injury and death to firefighters.

2. Increased effectiveness in extinguishing fires:

Firefighting robots can help firefighters to extinguish fires more quickly and effectively.

3. Reduced property damage:

Fire fighting robots can help to reduce property damage caused by fires. Firefighting robots can be used to detect and extinguish fires in their early stages, which can help to prevent them from spreading and causing major damage.

Reference:

- P.H. Chang and Y.H. Kang, et al., "Control Architecture Design for Fire Searching Robot using Task Oriented Design Methodology", SICE-ICASE 2006, Oct. 2006.
- Daniel J. Pack; Robert Avanzato; David J. Ahlgren; Igor M. Verner; "Fire-Fighting Mobile Robotics and Interdisciplinary Design-Comparative Perspectives", IEEE Transactions on Education, 3 August, 2004, Volume 47, No. 3.
- Young-Duk Kim; Yoon-Gu Kim; Seung-Hyun Lee; Jeong-Ho Kang; Jinung An; "Portable Fire Evacuation Guide Robot System", Intelligent Robots and Systems, IEEE/RSJ International Conference, 11-15 October 2009. Pages: 2789-2794.
- Kuo L. Su; "Automatic Fire Detection System Using Adaptive Fusion Algorithm for Fire Fighting Robot", Systems, Man, and Cybernetics, IEEE International Conference, 8-11 October 2006, Pages: 966-971.
- Scott Dearie; Kevin Fisher; Brian Rajala; Steven Wasson; "Design and Construction of a Fully Autonomous Fire Fighting Robot", 2004 IEEE, Pages: 303-310.
- KashifAltaf; Aisha Akbar; Bilal Ijaz; "Design and Construction of an Autonomous Fire Fighting Robot", 2007 IEEE.

LINE FOLLOWING ROBOT

Pratik Panda

Department of Robotics & Automation,
2023 - 2024,
The Neotia University

Abstract:

Line Following is one of the most important aspects of robotics. A Line Following Robot is an autonomous robot which is able to follow either a black line that is drawn on the surface consisting of a contrasting color. It is designed to move automatically and follow the line. The robot uses arrays of optical sensors to identify the line, thus assisting the robot to stay on the track. The array of four sensors makes its movement precise and flexible. The robot is driven by DC gear motors to control the movement of the wheels. The Arduino Uno interface is used to perform and implement algorithms to control the speed of the motors, steering the robot to travel along the line smoothly. This project aims to implement the algorithm and control the movement of the robot by proper tuning of the control parameters and thus achieve better performance. In addition the LCD interface is added in order to display the distance travelled by the robot. It can be used in industrial automated equipment carriers, small household applications, tour guides in museums and other similar applications, etc.

Keywords:

vehicle, IR sensor, sharp IR sensor, flags, LCD display, Arduino ATmega328.

Introduction:

Robot is a machine that is usually designed to reduce the amount of human work where it is

applicable. It is usually developed for reducing risk factor for human work and increase comfort of any worker. High performance, high accuracy, lower labor cost and the ability to work in hazardous places have put robotics in an advantageous position over many other such technologies. In this paper a line tracer or follower has been presented which will trace a black line on a white surface or vice-versa. We have made use of sensors to achieve this objective. The main component behind this robot is ATmega328 microcontroller which is a brain of this robot. The idea proposed in this paper is by using machine vision to guide the robot. We have made a robot that has several works to perform besides following a line. This robot follows a line without going to other direction. The construction of the robot circuit is easy and small. This can also be used in many applications such as automatic valet parking in an efficient way. The rapid increase in urban car ownership not only increases the burden of urban traffic but also exacerbates the problem of insufficient parking spaces. The increased driving distance in the parking process increases energy consumption and exacerbates parking difficulties, which increases the number of minor accidents, such as scuffing and collisions.

Methodology:

- **Line follower robot using Arduino** is interesting. The line follower robot senses a black line by using a sensor and then sends the signal to Arduino. Then Arduino drives the motor according to the sensor's output.

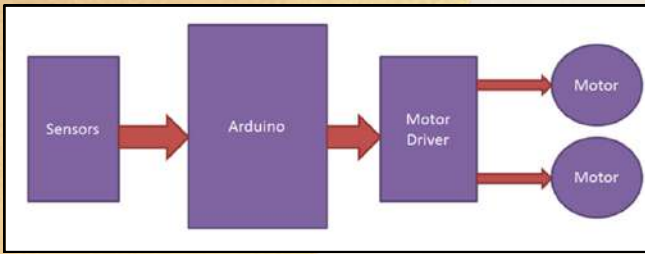


Figure No.: 1

Here in this project, we are using two IR sensor modules namely the left sensor and the right sensor. When both left and right sensor senses white then the robot moves forward.

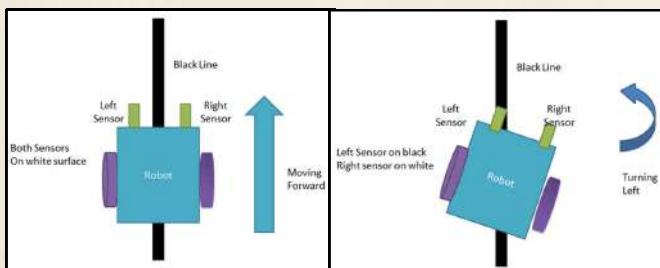


Figure No.: 2

If the left sensor comes on a black line then the robot turn the left side.

If the right sensor sense black line then robot turn right side until both sensors comes at the white surface. When the white surface comes robot starts moving on forward again.

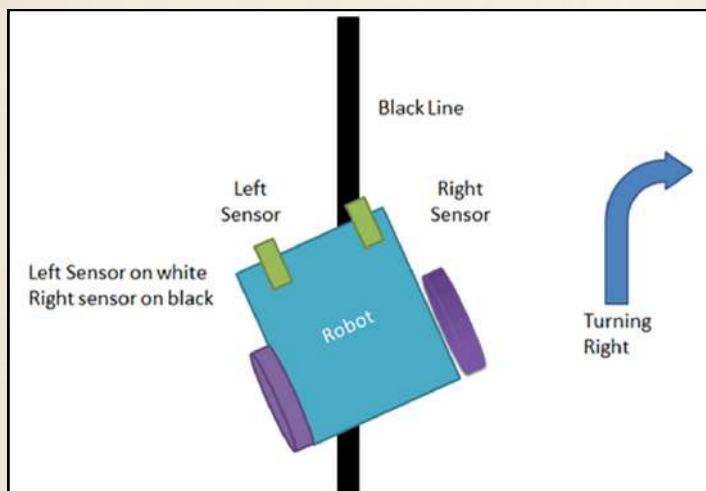


Figure No.: 3

If both sensors come on the black line, the robot stops.

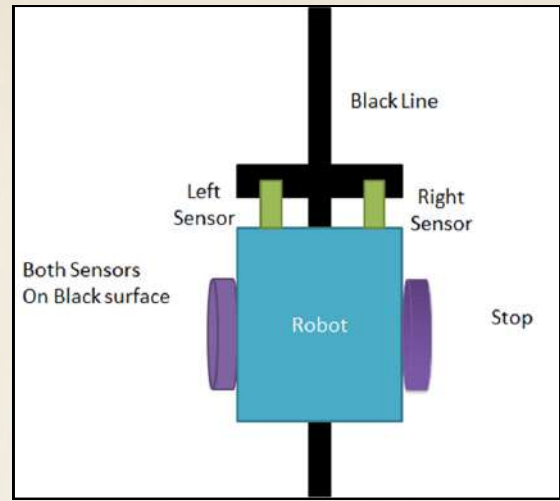


Figure No.: 4

Experimental results:

The Robot follows a specific line path simultaneously. This line follower robot with multiple modes compatibility works perfectly fine as it is designed to do .And thus attempt will be made to solve the unplanned and unauthorized parking problems in the resident area using prototype valet parking robot. The slot type and state of the slot will be identified using Sharp IR sensor. And simultaneously we can perform the operation of Buzzer beep operation, object identification, Lcd display, robot direction control operation and will finally execute parking near to the end.

implementation in various other field like fire detection, road clearance etc.

Discussion:

The above paper aims at building an autonomous robot with self-balancing and line following capability. The robot using a PID control loop will be able to maintain balance on two wheels by constantly reading the IMU data and adjusting itself to the pre-defined set-point. The robot follows a white/black line using IR sensors. The sensor data is continuously read, and it adjusts itself by changing motor rotation and direction. The ultrasonic and the camera module helps in detecting the obstacle and taking necessary

actions. The testing of the components has been done to ensure their proper functionality.

Conclusion:

By creating the line-following robot, we can learn the basics of energy flow and exactly what building a circuit entails. We can get idea how voltage is potential energy, and how wires can run in series or in parallel depending on how many points the wires share. We understood the purpose of resistors, to transform excess energy into heat, and we discovered the function of transistors, the comparator, variable resistors, photo headlights, diodes, motors, and light emitting diodes (LEDs). In future we can also include other modules and make our Robert more advance and increase its implementation in various other field like fire detection, road clearance etc.

Acknowledgement:

The authors acknowledge financial and technical aid for this research received from The Tabari Institute.

Reference:

- M. Zafri Baharuddin, "Analyst of Line Sensor Configuration for Advanced Line Follower Robot", University Tenaga Nasional.
- Cao QuocHuy, "Line Follower Robot", University UPG din Ploiesti.
- P. Heyrati, A. Aghagani, "Science of Robot Disgn and Build Robot", Azarakhsh Publication, 2008.
- M. Mashaghi, "Robotic Guide", KanoneOloum Publication, 2008.

- A. Kahe, "AVR Microcontroller", Nas Publication, 2007.
- Robotic Competition Rolls site: <http://www.tjrc.ir/roles.asp>



AGE CLASSIFICATION USING CONVOLUTIONAL NEURAL NETWORK

Sumit Jana

Department of Computer Science and Engineering Cyber security,
2020 - 2021,
The Neotia University

Abstract:

This article describes the development and evaluation of a custom-built convolutional neural network (CNN) model for age classification. The model was trained on a dataset of over 23000 facial images from the UTK face dataset also some images are inserted in it which was collected from other sources, labeled into six age groups: Baby (1-5), Child (6-12), Youth (13-18), Adult (19-40), Middle-aged (41-60), and old (61+). The model achieved an accuracy of 75% on the test set, demonstrating its effectiveness for age classification.

Keywords:

Age classification, Convolutional Neural network, Deep Learning, Facial Recognition, UTK Face.

Introduction:

Age classification is a challenging task due to the variability in human faces [1, 2]. However, it has a wide range of applications, such as in surveillance, security, and marketing. CNNs have been shown to be effective for image classification tasks, and have been successfully applied to age classification.

This report describes the development and evaluation of a custom-built CNN model for age classification. The model was trained on a dataset of over 18000 facial images, labeled into six age groups. The model was evaluated on a held-out test set and achieved an accuracy of 75.3%.

Methodology:

The original input size of 256x256 pixels, took a lot of time to complete a single epoch, so we need to reduce the image size to 64x64 pixels and then the Data Augmentation is done on the dataset for several reasons like to improve model performance, to reduce overfitting, to increase accuracy, and to create new images from existing images, etc. The CNN model designed in this study consists of three convolutional layers, followed by a fully connected layer and an output layer. First Conv2D layer having the filter size of 128, kernel size 3 and 'relu' activation function, followed by 2nd Conv2d layer having filter size of 64 and the 3rd Conv2d layer having the filter size of 32. The Max Pooling operation was performed with pool size 2 after every convolutional layer and then dropout of 25%. Then the images are flattened to a single vector using a flatten layer followed by a dense layer containing 512 neurons and then a dropout layer having a 50% dropout rate. The convolutional layers are used to extract features from the images, and the fully connected layer is used to classify the features into one of the six age groups.

The model was trained using the Adam optimizer and the categorical cross-entropy loss function was used because of their popularity and effectiveness. The 'softmax' activation function was used because of multiclass classification. The model was trained for 30 epochs and achieved a training accuracy of 78.7%.

Experimental result:

The model was evaluated on a held-out test set of 4600+ images. The model achieved an accuracy of 75% on the test set, demonstrating its effectiveness for age classification. Although 75% is not that good but we can definitely increase its accuracy by training on a biased dataset containing more images and using a good device containing GPU for faster training. Some of the sample images are demonstrated in Fig 1.



Fig. 1: Green shows the correct classification by model and Red for the Wrong

Discussion:

The results of this study demonstrate that a custom-built CNN model can be used to achieve high accuracy for age classification. The model is able to learn discriminative features from facial images and classify them into the correct age group.

One of the limitations of this study is that the model was trained on a low-end device that doesn't have GPU for faster model training for which we reduced the size of the image and passed through only three convolutional layers and also fewer epochs.

Another limitation is that the model was trained on a biased dataset, this dataset has images of more white people than of other races and also the dataset doesn't have an equal number of images for each age group as demonstrated in Fig 2. Adults and Middle Aged have higher images than Old and Youth and Child.

Conclusion:

This report described the development and evaluation of a custom-built CNN model for age classification. The model achieved an accuracy of 75.3% on a held-out test set, 74.4% on validation set and 78.7% on training set demonstrating its effectiveness for age classification.

Further work is needed to evaluate the model on images from different races and age ranges. Additionally, the model could be improved by using a larger and more diverse dataset for training.

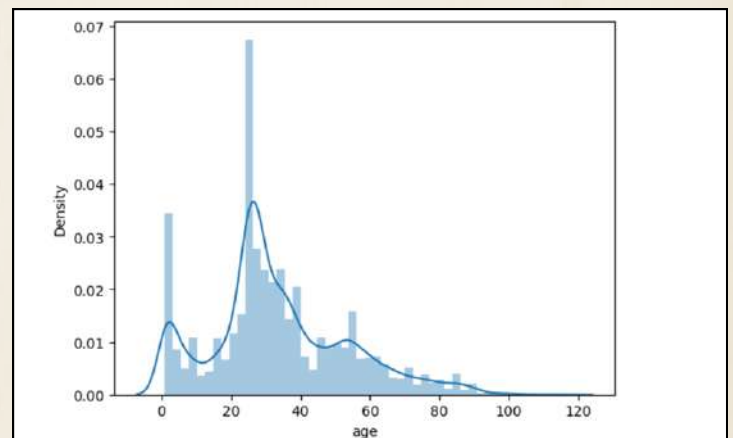


Fig. 2: This graph showing number of images with respect to ages

Reference:

- Levi, Gil, and Tal Hassner. "Age and gender classification using convolutional neural networks." Proceedings of the IEEE conference on computer vision and pattern recognition workshops. 2015.
- Age Detection Model using CNN — a complete guide. Available at: <https://medium.com/@skillcate/age-detection-model-using-cnn-a-complete-guide-7b10ad717c60>
- Mustapha, Muhammad Firdaus, et al. "Age Group Classification using Convolutional Neural Network (CNN)." Journal of Physics: Conference Series. Vol. 2084. No. 1. IOP Publishing, 2021.

DEEPPFAKE: THE NEXT FRONTIER OF DECEPTION

Ankita Saha

Department of Computer Science and Engineering Cyber Security,

2020-2021

The Neotia University

Abstract:

The term "Deepfake" is a clever blend of "deep learning" and "fake." Deepfake technology allows individuals to swap or disguise one person's face with another's in images or videos. But that's not all - it goes beyond face-swapping. Deepfake can also alter the original voice and facial expressions in visual media, creating a whole new level of manipulation. Essentially, deepfakes are a form of synthetic media where a person's image or video appearance is substituted with someone else's likeness. While this technology is still relatively young, it's advancing quickly, raising concerns about its potential misuse for deceptive purposes.

Introduction:

Deepfake first emerged in 2014, when a researcher named Ian Goodfellow developed a new type of machine learning algorithm called a generative adversarial network (GAN). GANs can be used to create realistic images and videos, and they quickly became the foundation for deepfake technology.

In 2017, deepfakes began to gain wider attention when a Reddit user started posting deepfake videos of celebrities. These videos were so realistic that they were able to fool many people, and they raised serious concerns about the potential for deepfakes to be used for malicious purposes. Since then, deepfake technology has continued to improve, and it is now possible to create deepfake videos that are even more realistic and difficult to detect.

This has led to a growing number of concerns about the potential for deepfakes to be used to spread misinformation, damage reputations, and commit fraud.

Technology Behind Deepfake:

Deepfake utilizes Generative Adversarial Networks (GANs) to manipulate all forms of media (photographs, texts, audio, and videos). GANs is a machine learning innovation that simultaneously trains two competing models (neural networks), comprising a generator and a discriminator to synthesize images. The algorithms mirror the content and produce realistic but fake images and videos. The process involved in generating deepfake is shown in Figure 1. The generator begins by randomly selecting data from the latent space and endeavors to generate counterfeit images mirroring the authentic ones from the training dataset. In tandem, the discriminator undertakes the task of distinguishing between genuine and counterfeit images. This concurrent competition propels mutual enhancements until they reach a state of convergence or equilibrium. At this juncture, the generator refines its capabilities to the extent that the discriminator encounters mounting challenges in distinguishing between actual and fabricated images.

Deepfakes are created using a variety of techniques, including machine learning and artificial intelligence. One common technique is to use a deep learning model to train a "face mapper." A face mapper is a type of neural network that can be used to learn the features

of a person's face. Once the face mapper is trained, it can be used to generate a new face that looks like the person whose face was used to train the model. The new face can then be superimposed onto an existing image or video.

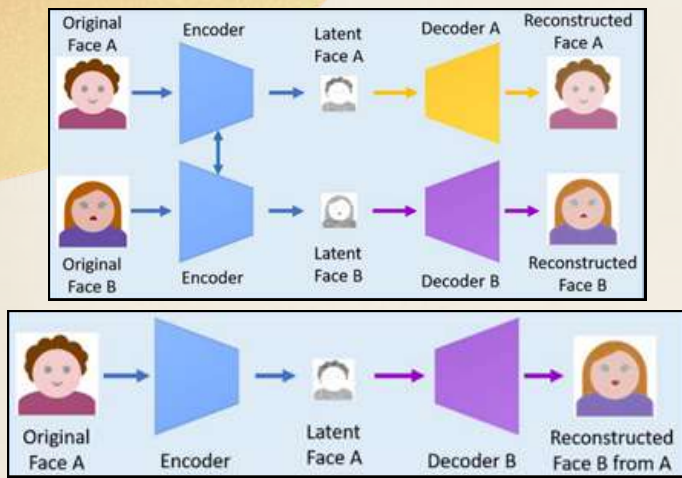


Figure 1: A deepfake creation model using two encoder-decoder pairs. Two networks use the same encoder but different decoders for training process (right). An image of face A is encoded with the common encoder and decoded with decoder B to create a deepfake (left).

Another common technique for creating deepfake is to use a "voice cloner." A voice cloner is a type of neural network that can be used to learn the features of a person's voice. Once the voice cloner is trained, it can be used to generate a new voice that sounds like the person whose voice was used to train the model. The new voice can then be dubbed over an existing audio recording.

The dark side of deepfake:

One of the most concerning things about deepfakes is that they can be used to create fake news and propaganda. For example, a deepfake video of a politician saying something that they never actually said could be used to influence public opinion or undermine a political campaign.

Deepfakes can also be used to damage people's reputations. For example, a deepfake

video of a celebrity saying or doing something embarrassing could be used to humiliate them or damage their career.

Deepfake can be used to create fraudulent videos or audio recordings that can be used to deceive people into revealing sensitive information or taking actions that benefit the fraudster. For example, a deepfake video of a CEO instructing employees to transfer money to a fraudulent bank account could be used to steal money from the company. Or, a deepfake audio recording of a customer service representative asking for a customer's credit card number could be used to commit identity theft.



Figure 2. Examples of original and deepfake images.

Potential benefits of deepfake:

Despite the risks, deepfakes also have the potential to be used for good.

- **Education and training:** Deepfakes could be used to create realistic simulations of real-world scenarios, which could help students and trainees to learn new skills and knowledge in a safe and controlled environment. For example, a deepfake video of a surgeon performing a surgery could be used to train medical students.
- **Medicine:** Deepfakes could be used to develop new diagnostic tools and treatments. For example, deepfakes could

be used to create personalized medical avatars, which could be used to guide doctors in performing surgery or to develop personalized treatment plans.

- **Entertainment:** Deepfakes could be used to create new and immersive forms of entertainment. For example, deepfakes could be used to bring historical figures back to life or to create virtual actors that could perform in movies and TV shows.
- **Communication and understanding:** Deepfakes could be used to improve communication and understanding between people from different cultures. For example, deepfakes could be used to translate spoken language in real time or to create personalized sign language avatars.

Recent research on deepfake has focused on developing methods to detect and prevent them

One promising approach is to use artificial intelligence (AI) to identify patterns and inconsistencies in deepfake videos. For example, researchers at the University of California, Berkeley, have developed a system that can detect deepfakes by looking for subtle inconsistencies in the way that the audio and video are synchronized.

Another approach to detecting deepfakes is to use AI fingerprinting. AI fingerprinting is a technique that can be used to identify the AI model that was used to generate a particular piece of content. By identifying the AI model, researchers can determine whether a piece of content is likely to be a deepfake.

Researchers are also working on developing ways to prevent deepfakes from being created in the first place. One approach is to use watermarking to embed hidden information into images and videos. This watermarking could be used to identify the

source of a deepfake and to prove that it is not authentic.

In addition to these technical approaches, researchers are also exploring the ethical and social implications of deepfakes. For example, researchers at the University of Oxford have developed a set of ethical guidelines for the development and use of deepfakes. Overall, the research on deepfakes is still in its early stages, but significant progress has been made in recent years. Researchers are developing new methods to detect and prevent deepfakes, and they are also exploring the ethical and social implications of this technology.

Current deepfake detection methods:

Contemporary efforts in Deepfake detection primarily revolve around the identification of face-swapping videos, which constitute the majority of Deepfake content proliferating on the internet. These detection methodologies are typically framed as frame-level binary classification challenges. There are a variety of deepfake detection methods that have been developed, which can be categorized into three main groups:

- **Physical and physiological incongruities:** These methods detect deepfakes by identifying inconsistencies in the physical and physiological aspects of the videos, such as the absence of natural eye blinking, discordant head poses, and inconsistent behavioral traits.
- **Signal-level anomalies:** These methods detect deepfakes by identifying artifacts introduced during the synthesis process, such as splicing artifacts or inconsistencies in the audio and video signals.
- **Data-driven analytics:** These methods train deep neural networks on a combination of genuine and deepfake videos to learn to distinguish between the two.

Data-driven analytics methods are generally the most accurate, but they require a large amount of training data. Physical and physiological incongruity-based methods are relatively simple to implement, but they can be fooled by sophisticated deepfakes. Signal-level anomaly-based methods are more robust, but they can be computationally expensive and require access to the original video or audio files.

Current deepfake detection methods are predominantly tailored to target face-swapping videos, but researchers are developing new methods to detect deepfakes that involve other types of manipulations, such as voice cloning and video editing. Here are some example of different approaches to deepfake detection:

The 2-Phase Learning Approach:

It leverages the power of Siamese Networks and Cross-Entropy Loss to train a high-performance end-to-end classifier. In the first phase, a ResNet18-based CNN, called the Common Fake Feature Network (CFFN), is trained as a Siamese Network using triplet loss. This forces the CFFN to learn feature-level distinctions between fake and real images.

The triplet loss function is defined as follows:

$$L(A, P, N) = \max(0, \|f(A) - f(P)\|_2^2 - \|f(A) - f(N)\|_2^2 + \alpha)$$

where:

A is the anchor image,

P is the positive image (from the same class as A)

N is the negative image (from the other class)

f is the CFFN

α is a hyperparameter

The triplet loss function minimizes the distance between the encodings of the anchor and positive images while maximizing the distance between the encodings of the

anchor and negative images. This forces the CFFN to learn feature representations that are discriminative between fake and real images. The 2-phase learning approach has been shown to achieve state-of-the-art results on deepfake detection benchmarks. It is a promising approach for developing robust and effective deepfake detection systems.

In the second phase, a small CNN, called the Classifier Network, is appended to the end of the CFFN and trained with cross-entropy loss to classify deepfakes based on the feature representations learned by the CFFN. The cross-entropy loss function minimizes the difference between the predicted and true class probabilities. This ensures that the Classifier Network learns to classify deepfakes accurately.

Transfer Learning Neural Network Techniques:

Transfer learning is a machine learning technique where a model developed for one task is reused as the starting point for a model on a second task. This can be useful for tasks where there is a limited amount of labeled data available, or where the task is similar to a task that has already been solved. In the context of deepfake detection, transfer learning can be used to train a model to detect deepfakes by using a model that has already been trained on a large dataset of real and fake images. This can be done by either fine-tuning the pre-trained model, or by extracting features from the pre-trained model and using them to train a new model.

One approach to transfer learning for deepfake detection is to use a pre-trained convolutional neural network (CNN). CNNs, a category of neural networks, excel especially in tasks involving image recognition. CNNs work by extracting features from images using a series of convolution and pooling layers. These features are then used to train a classifier to predict the class of the image.

To use a pre-trained CNN for deepfake detection, the classifier layer of the CNN is removed and replaced with a new classifier layer that is trained to predict whether or not an image is a deepfake. The pre-trained CNN weights are then frozen, so that only the new classifier layer is trained. This approach is known as fine-tuning.

Another approach to transfer learning for deepfake detection is to extract features from a pre-trained CNN and use them to train a new model. This approach is known as feature extraction. To extract features from a pre-trained CNN, the CNN is run on the images in the training dataset and the outputs of the last few convolution layers are extracted. These extracted features are then used to train a new model, such as a support vector machine (SVM) or a random forest classifier.

Both fine-tuning and feature extraction can be used to achieve high accuracy in deepfake detection. However, fine-tuning is generally more computationally expensive than feature extraction. Here we can use transfer learning to train a deepfake detection model using fine-tuning. Once the model is trained, it can be used to detect deepfakes in new images. To do this, the image is simply passed through the model and the output of the classifier layer is used to predict whether or not the image is a deepfake.



Figure 3: The deepfake dataset sample image analysis with the assigned label

Transfer learning is a powerful technique that can be used to train deepfake detection models with high accuracy. By using a pre-trained model, we can avoid the need to train a model from scratch, which can be time-consuming and computationally expensive.

Discussion:

In the worst-case scenario, deepfake could be used to create a world where it is impossible to tell what is real and what is not. This could have a devastating impact on democracy, trust in institutions, and social cohesion. In a world where deepfakes are indistinguishable from real media, it would be very difficult to know what to believe. This could lead to a loss of trust in traditional media sources and make it difficult to form informed opinions about important issues. It could also make it easier for people to be manipulated and controlled.

Conclusion:

Deepfakes are a powerful new technology with the potential to change the world. It is important to be aware of the potential dangers of deepfake, but it is also important to be optimistic about their potential benefits. Deepfake could be used to create new forms of art and entertainment, to improve education and training, and to develop new medical and scientific applications.

The key is to develop and use deepfake technology responsibly and ethically. We need to ensure that deepfakes are not used to spread misinformation, damage people's reputations, or commit fraud. We also need to protect people's privacy and ensure that deepfakes are not used to exploit or manipulate them.

Deepfakes are a complex and challenging issue, but it is one that we need to address. By working together, we can develop the tools and policies that we need to protect ourselves from the dangers of deepfake and to harness their potential benefits.

NON-INVASIVE WILDLIFE MONITORING AND ANOMALY DETECTION WITH DEEP LEARNING

Anindya Mitra
CSE (AI & ML), 2021-2022
The Neotia University

Sudip Dhara
CSE (AI & ML), 2021-2022
The Neotia University

Ripan Purkait
CSE (AI & ML), 2021-2022
The Neotia University

Abstract:

Wildlife conservation is a critical global concern, as the threats to biodiversity continue to escalate. Monitoring and protecting wildlife populations are essential for maintaining the ecological balance of our planet. This research paper introduces an innovative approach to wildlife monitoring and anomaly detection utilizing YOLO, a state-of-the-art deep learning model for object detection. Our study addresses the challenge of automatically identifying abnormal behaviors or events among wildlife species and resources, contributing to the early detection of potential threats to their well-being. Our results demonstrate the superior capabilities of YOLO in accurately detecting anomalous behaviors, including poaching activities, animal grazing and habitat disturbances with high precision and minimal false alarms.

Keywords:

YOLO, poacher detection, anomaly detection, wildlife monitoring, wildfire prevention.

1. Introduction:

Wildlife anomaly detection and monitoring refer to the use of advanced technology such

as cameras, sensors, and surveillance drone to observe and analyze the behavior and activities of wildlife in their natural habitats. These systems help zoologist and conservationists detect unusual or unexpected events, behaviors or intrusions such as poaching, habitat disturbances, or invasive species presence. Traditional wildlife monitoring methods often rely on invasive techniques or human presence in the field, which can inadvertently disrupt natural behaviors and lead to incomplete or biased data collection. In response to these challenges, this research paper introduces an innovative approach to non-invasive wildlife monitoring and anomaly detection using YOLO (You Only Look Once) deep learning models.

This system leverages aerial views, drone imagery, and camera trap images to monitor wildlife assess their behaviors, identify habitat disturbances, and promptly respond to poaching activities. Crucially, this monitoring system respects the principle of non-invasiveness by refraining from physically interfering with wildlife or embedding any sensors within their bodies.

2. Methodology:

The YOLO (You Only Look Once) algorithm revolutionizes real-time object detection in images and videos using convolutional neural networks (CNNs). YOLO's unique strength lies in its ability to predict class probabilities and bounding box coordinates simultaneously in a

single neural network pass, ensuring remarkable efficiency. It offers a range of variants like YOLOv2, YOLOv3, YOLOv4, YOLOv5, YOLOv6, YOLOv7, YOLOv8, and YOLO-NAS, significantly impacting the AI field. YOLO employs residual blocks, enhancing its capacity to learn intricate object representations. Essential to its accuracy is the Intersection Over Union (IOU) metric, which measures the overlap between predicted and ground truth bounding boxes, aiding in precise object localization and false-positive elimination. The concept of intersection over union (IoU) is illustrated in Fig. 1.

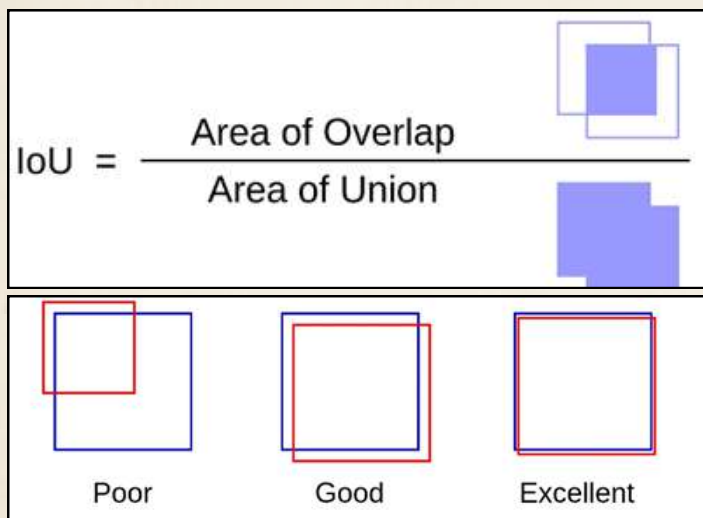


Fig. 1: Concept of Intersection over Union (IoU)

Overall, YOLO's significance lies in its ability to deliver exceptional speed and accuracy in object detection, making it a crucial tool in a wide range of applications, including surveillance, autonomous vehicles, and wildlife monitoring, where real-time and efficient object recognition, detection and segmentation are essential. The general architecture of the Yolo model is illustrated in Fig 2.

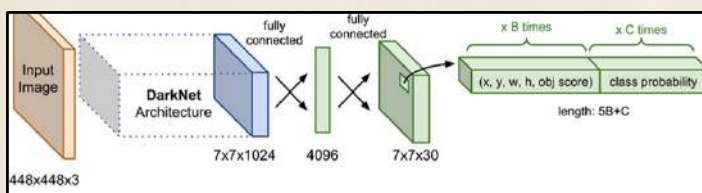


Fig. 2: YOLO model general architecture

3. Proposed Methodology:

3.1. Data Preprocessing:

In data preprocessing, our main goal was to standardize annotation labels into a YOLO-compatible TXT format, enabling seamless integration into our wildlife monitoring system. We meticulously aligned these labels with our desired categories for dataset consistency. Additionally, we enhanced data quality by excluding object-free frames, applied filtering to eliminate inconsistencies and outliers, and organized the data into a structured folder format for efficient management.

3.2. Model Training:

In the model training phase, we conducted comprehensive testing of various YOLO models, including YOLOv4, YOLOv5, YOLOv8, and YOLO-NAS, encompassing different versions and sizes. We assessed their performance using key metrics like precision, recall, mean average precision (mAP), and latency. Following thorough evaluation, YOLOv5 emerged as the most suitable choice for our wildlife monitoring project due to its proficiency in mitigating overfitting and underfitting issues while delivering effective results.

To further enhance its performance, we executed a meticulous fine-tuning process, known as hyperparameter evolution. This step aimed to tailor the model's settings to our specific project requirements, ensuring optimal functionality. The deliberate selection and refinement of the YOLOv5 model played a pivotal role in enhancing the accuracy and efficiency of our wildlife monitoring system.

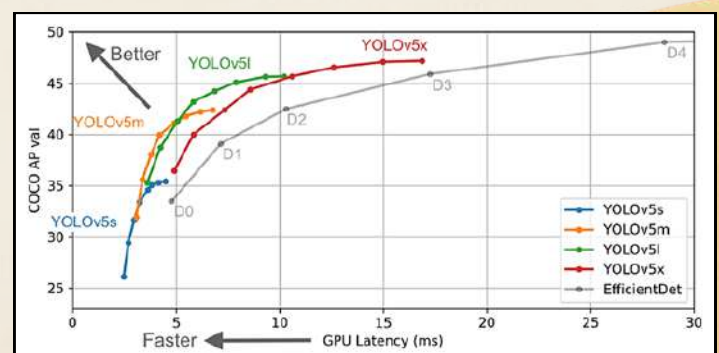


Fig. 3: YOLOv5 variants characteristics graph

3.3. Model Testing and Fine - tuning:

In the model testing phase, we rigorously evaluated our AI models using a wide range of aerial and ground view wildlife videos, including both daylight and night vision scenarios. While most videos produced positive outcomes, we identified instances of overfitting in certain classes. To bolster the model's robustness, we undertook a retraining process, introducing new data variations that offered fresh perspectives and scenarios. This iterative refinement effectively improved the model's ability to generalize and reduced occurrences of false negatives. Ultimately, this approach significantly enhanced the accuracy and reliability of our wildlife monitoring system.

4. Experimental Results:

In our experimental setup, we adopted the YOLO (You Only Look Once) architecture, more precisely opting for the YOLOv5 variant. This choice allowed us to harness the cutting-edge capabilities of YOLOv5 in our research. During the training phase, we meticulously fine-tuned the model over the course of 50 epochs, each comprising a batch size of 16 input samples. To facilitate the learning process, we initiated the training with an initial learning rate of 0.001. This learning rate setting was instrumental in guiding the model towards optimal convergence and fine-tuning its internal parameters effectively. Furthermore, in order to augment our dataset and enhance the model's ability to generalize patterns, we implemented a range of data augmentation techniques. Among these, we applied random flips,

which involve mirroring input images horizontally or vertically, and color jitter, which introduces subtle variations in color to the training data.

It is worth noting that this intensive training and data augmentation regimen was conducted on Tesla T4 GPUs, which are known for their exceptional computational power and efficiency in handling deep learning workloads. This powerful hardware infrastructure ensured that our model had the necessary computational resources to learn and generalize effectively throughout the training process.

Mode	Model	Precision	Recall	Epochs	metrics/mAP_0.5	metrics/mAP_0.5-0.95
Daylight	YOLOv5l	0.95093	0.97057	50	0.98347	0.64957
Night Vision	YOLOv5l	0.98506	0.9751	50	0.99049	0.82556

Table 1: Training Result of Both YOLOv5 model

Our analysis of the YOLOv5 model's loss graph revealed a consistent decrease in loss values as training progressed, signifying effective learning and adaptation to the dataset. This reduction in loss demonstrates the model's capability to minimize errors in object detection and classification. The graph visually depicted the optimization process, emphasizing the model's convergence towards an optimal state, which is essential for accurate predictions in wildlife monitoring and anomaly detection.

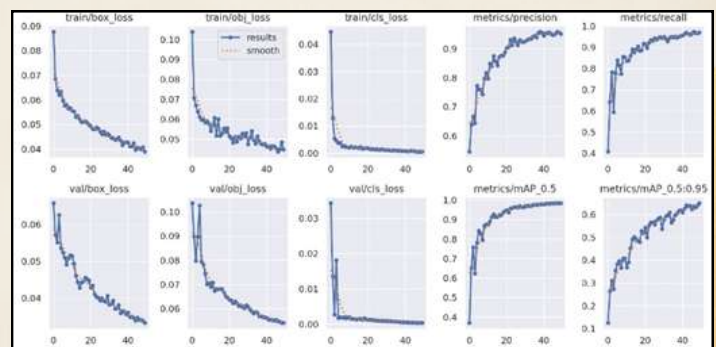


Fig. 4: Training curves of night vision thermal imaging YOLOv5 model

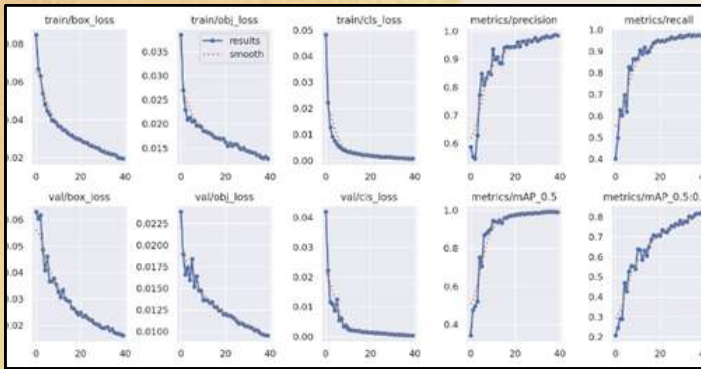


Fig. 5: Training curves of Daylight YOLOv5 model

5. Discussion:

In our research, YOLO-based models proved effective for real-time wildlife monitoring and anomaly detection. We carefully collected and preprocessed data to ensure quality and representation. YOLOv5l was chosen for its robustness and mitigating overfitting, further optimized through hyperparameter evolution. While some overfitting occurred during testing, iterative retraining with additional data improved model robustness. Our user-friendly web interface, featuring real-time map visualization, enhances accessibility for practical wildlife conservation applications.

6. Conclusion:

In conclusion, our research developed a powerful wildlife monitoring system using YOLO models and real-world data. We meticulously collected diverse datasets, trained robust models, and created a user-friendly web interface for seamless interaction. By addressing overfitting and optimizing our models, we achieved accurate and efficient results. Our system combines technology and conservation efforts, making it a valuable tool for safeguarding wildlife and ecosystems. It demonstrates the potential for AI to aid in wildlife conservation while offering a user-friendly interface for practical implementation.

Acknowledgement:

We extend our heartfelt gratitude to the esteemed Head of the Department (HOD) of Computer Science and Engineering (CSE) specializing in Artificial Intelligence and Machine Learning (AIML), Dr. Madhu Sudan Das, for his invaluable contributions to our project. His visionary suggestion to incorporate interactive result visualization significantly enriched the user experience and project functionality. Furthermore, Dr. Das shared his profound insights into the fundamental architecture of YOLO, which proved instrumental in our research journey. His unwavering support and mentorship have been crucial in shaping our project's success, and we deeply appreciate his guidance throughout this endeavor.

References:

1. Adrian Carrio, Carlos Sampedro, Alejandro Rodriguez-Ramos, Pascual Campoy, "A Review of Deep Learning Methods and Applications for Unmanned Aerial Vehicles," Article ID 3296874, pp.1-13, 2017.
2. David J. Klein, Matthew W. McKown, Bernie R. Tershy, "Deep Learning for Large Scale Biodiversity Monitoring", Bloomberg Data for Good Exchange Conference, 2015.
3. Redmon, J., Divvala, S., Girshick, R., Farhadi, A.: "You only look once: unified, real-time object detection", In: CVPR (2016).
4. Shreya Shivaji Gaikwad, Cyril Silvester Dabre, Pranit Mohan Mhatre, Dr. Nazneen Ansari, "Proposed Research for Detecting Poachers", IJAR, ICESTMM 2019, Pp.226 – 230.

REVOLUTIONIZING HEALTHCARE: ADVANCED ROBOTICS IN THE MEDICAL FIELD

Snehendu Patra

Department of Robotics and
Autonomation, 2022-2023,
The Neotia University

Kushal Maity

Department of Robotics and
Autonomation, 2022-2023,
The Neotia University

Introduction:

The intersection of robotics and medicine has given rise to a new era of healthcare. Advanced robotics in the medical field is not a mere trend but a groundbreaking technological revolution. Robots are now playing pivotal roles in diagnosis, surgery, rehabilitation, and even drug delivery. This article delves into the incredible innovations and their impact on the medical world.

The Robotic Surgeon: Precision Beyond Human Capability:

Robotic-assisted surgery has become a cornerstone of modern medicine. Da Vinci Surgical System, for instance, allows surgeons to perform minimally invasive procedures with unmatched precision. The system's articulated robotic arms provide greater dexterity, reducing incision sizes and recovery times. Surgeons control these robots with remarkable precision, amplifying their skills and enabling complex procedures that were once deemed impossible.

The advantages of robotic surgery are evident in various fields, from gynecology to urology. Robotic systems offer 3D

visualization, tremor reduction, and greater maneuverability, making surgeries safer and more efficient. Patients benefit from less pain, reduced scarring, and quicker recovery, setting new standards for surgical outcomes.

Robotics in Diagnostics: The Future of Early Detection:

Robotic innovations have also transformed diagnostic procedures. The development of robotic arms equipped with advanced sensors and artificial intelligence algorithms allows for faster and more accurate sample analysis. For example, robots can perform repetitive tasks like sorting and processing samples in laboratories, reducing human error and increasing the efficiency of diagnostic processes.

Furthermore, robots are increasingly being used in diagnostic imaging. They can precisely position patients for MRIs, CT scans, and X-rays, ensuring the highest quality images while minimizing radiation exposure. This level of precision aids in early disease detection, enabling doctors to diagnose and treat conditions at their earliest stage.

Rehabilitation Robots: Restoring Independence: Challenges and Ethical Considerations:

Recovery from injuries and surgeries often involves extensive physical therapy. Here, robotic splints play a critical role in rehabilitation. Devices like the exoskeleton help patients regain mobility and strength. These wearable robots are programmed to mimic natural movements and provide support where needed. They are particularly beneficial for patients with spinal cord injuries, stroke survivors, and those recovering from orthopedic surgeries.

Another area where robotics shines in rehabilitation is in prosthetics. Advanced robotic prosthetic limbs have made significant strides in replicating natural movement, providing users with increased functionality and comfort.

Robotic Drug Delivery: Precision Medicine in Action:

In the realm of drug delivery, robotics is making strides towards personalized medicine. Microbots, tiny robots that can navigate the human body, are being developed to deliver drugs to specific locations with unprecedented accuracy. This precision minimizes side effects and maximizes the therapeutic effects of medications.

Moreover, robots are helping pharmacists by automating the preparation and dispensing of medications. These automated systems reduce medication errors and free up pharmacists to focus on patient consultations and more complex tasks. Patients can also benefit from robot-assisted medication management, ensuring they take their medications on time and in the correct dosage.

As advanced robotics becomes increasingly integrated into the medical field, several challenges and ethical considerations must be addressed. Data security and patient privacy are of utmost concern, given the sensitive health information that robots may handle. Additionally, there is the question of liability in cases where robots are involved in medical procedures or diagnosis.

The cost of implementing advanced robotics in healthcare can be prohibitive, limiting access for some patients and healthcare facilities. Ethical dilemmas also arise when considering the role of robots in end-of-life care and decision-making processes.

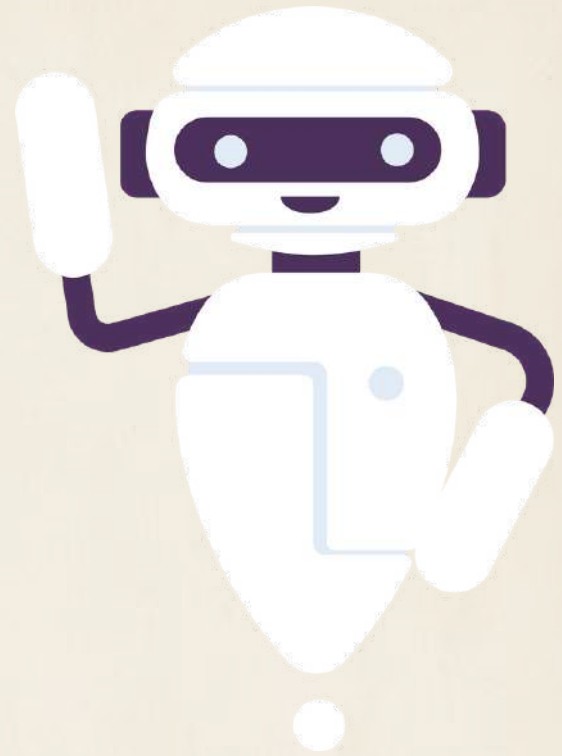
Conclusion:

Advanced robotics has unquestionably revolutionized the medical field. Robots are now indispensable in surgery, diagnostics, rehabilitation, and drug delivery, offering unparalleled precision and efficiency. These innovations have the potential to improve patient outcomes, reduce healthcare costs, and increase accessibility to quality care.

As we continue to witness remarkable advancements in the field of advanced robotics in medicine, it is crucial for healthcare professionals, policymakers, and society as a whole to navigate the challenges and ethical considerations to ensure that these technologies benefit all and uphold the highest standards of medical care. The future of healthcare is undoubtedly intertwined with the progress of robotics, promising a healthier and more promising world for us all.

References:

- **Books:**
- 1: "Medical Robotics" by Jacob Rosen and Blake Hannaford.
- 2: "Robotics in Genitourinary Surgery" by Prokar Dasgupta and Inderbir Gill'
- **Academic Journals:**
- 1: IEEE Transactions on Robotics
- 2: Journal of Medical Robotics Research 3: Journal of Healthcare Engineering
- **Government and Industry Reports:**
- Reports from organizations such as the FDA, WHO, and the International Federation of Robotics can provide valuable statistics and insights on the adoption and regulation of medical robotics.



ROLE OF DATA SCIENCE IN ROBOTICS

Jit Mandal

CSE (Data Science),
2022-2023,
The Neotia University

Abstract:

Robotics is undergoing a revolution thanks to data science, which is expanding its applications. These self-driving machines, which replicate human behaviour, are increasingly pervasive in fields including business, medicine, and space exploration. Robots are now more adept at complex jobs, can adapt to changing situations, and can operate autonomous cars, mobile robots, and drone delivery systems. Although there are many moral quandaries and unrealized possibilities in technology, prudent technology usage is still crucial. Robotics, which is quickly developing, has the potential to significantly alter industries and lifestyles.

Keywords:

Robotics, Data Science, Artificial Intelligence, Automation, Ethical Considerations .

Introduction:

Do you imagine a futuristic metallic humanoid when you hear the word "robot," or a gloomy future where robot overlords' rule? Or do you see robots working on a production line? Robots are undoubtedly here to stay. Thankfully, rather than total control, their employment is more likely to include risky or repetitious activity. Let's examine robotics, its relationship to AI, its potential, and how it might affect our daily lives.

- **What is data science?**

Data wisdom is the study of data to prize meaningful perceptivity for business.

- It's a multidisciplinary approach that combines principles and practices from the fields of mathematics, statistics, artificial intelligence, and computer engineering to assay large quantities of data. This analysis helps data scientists to ask and answer questions like what happened, why it happened, what will be, and what can be done with the results.

- **What Is Robotics?**

- Robotics is a branch of engineering that focuses on building, configuring, and using machines that autonomously carry out tasks that are traditionally performed by humans. The look of robots can vary, from "androids" that resemble humans to those made for certain tasks, such those on auto assembly lines. Even though some people find human-acting robots disconcerting, designers frequently aim for human resemblance to facilitate human connection.

- **Robotics application of data science:**

Data science has given robotics the essential push, and it has also opened up a world of new applications that were previously limited to science fiction.

- **Autonomous Vehicles:**

In the world of driverless vehicles, data science is essential for accurate navigation and environmental awareness. It combines information from LiDAR, radar, cameras, and GPS through sensor data fusion to present a thorough picture of the surroundings. By processing this data, machine learning algorithms improve item detection and categorization. Predictive maintenance avoids problems, high-definition maps guarantee precise location identification,

data-driven algorithms foresee other drivers' behaviour to help with decision-making. Data science also improves safety, route effectiveness, and traffic analysis, supporting the effectiveness and safety of autonomous transportation.

- **Robotic delivery:**

Robotic delivery systems have completely changed how items are moved, providing convenience and efficiency. These self-driving robots efficiently navigate urban surroundings thanks to their advanced sensors and AI systems. They eliminate the need for human couriers by being able to deliver parcels, groceries, and even meals to clients' doorsteps. This technology has been developed by businesses like Amazon and Starship Technologies, offering contactless and quicker delivery possibilities. Robotic delivery is an environmentally favourable option because it increases speed while lowering operational expenses and carbon emissions. But it also prompts concerns about job loss and safety laws, sparking continuing discussions about the future of last-mile deliveries.

It still has many uses such as mobile robots, paper filling robots.

Source: <https://www.analytixlabs.co.in>

- **Is Data Science Essential for Robotics?**

Both data science and robotics are developing quickly. Similar to robotics, data science is a synthesis of mathematical, statistical, and programming techniques. To fully enable data-based decision-making, future forecasts, AI and machine learning are required.

Robotics, on the other hand, has difficulties when performing real-time, vision-focused tasks when working with complicated data. Data science can help with this. Robots can learn new behaviors more quickly and easily by using labeled data, artificial intelligence, and machine learning algorithms, and they can easily carry out activities that require vision.

- **Future Of Robotics and Data Science:**

- Robotics has advanced substantially since its humble beginnings, when machines were used to complete menial chores like welding and painting. Thanks to the incorporation of data science, robots are now independent, intelligent beings who are able to learn, adapt, and solve problems. However, this development raises significant ethical issues. In order to assure a successful future, we must be mindful of the ethical implications of data science and robotics. We must work toward a responsible and educated use of this potent technology. Only with such devotion can we be certain that these developments lead to a better and safer world.

Discussion:

- For robots to advance, achieve autonomy, and do difficult tasks, data science is essential. Machine learning and data analytics provide improved vision and real-time decision-making in areas including robotic deliveries, mobile robots, and driverless autos. Despite negatives like cost and job displacement, data science enhances robot performance and encourages human-robot collaboration, reducing difficulties.

Conclusion:

- Data science is essential in the rapidly changing field of robotics. It enables robots to go beyond their conventional functions and develop into intelligent, flexible agents. Data science will be the driving force behind robotics in the future, promising creative solutions in many fields.

However, in order to ensure that these technologies are used for the benefit of society and usher in a safer and more responsible future for robotics, ethical considerations must direct this advancement.

Acknowledgement:

I would like to express my sincere gratitude to my renowned instructors Usha Rani Gogui for her essential advice and unflinching support, which allowed me to write this article.

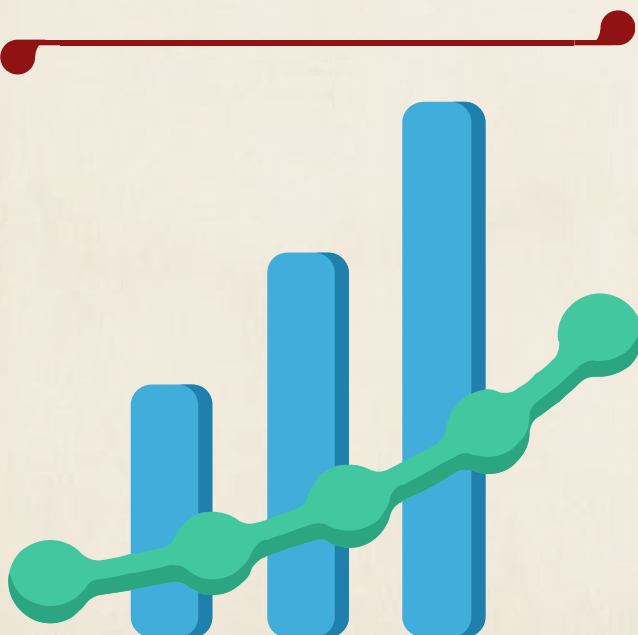
I'm particularly appreciative of The Neotia University's committed faculty, whose expertise and encouraging work atmosphere have helped me advance academically. I want to express my gratitude to my friends and family for their constant support, which has motivated me to persevere.

Finally, I want to express my gratitude to everyone who helped our initiative succeed in many ways. Your encouragement and support were incredibly helpful.

References:

<https://www.Simplilearn.com>

<https://www.analytixlabs.co.in>



OBSTACLE AVOIDING ROBOT

Promita Das

Department Of Robotics and Automation,
2023-2024,
The Neotia University

Abstract:

Nowadays world Robotics is fast growing and interesting field. Obstacle Avoiding Robot is an intelligent device that can automatically sense the obstacle in front of it and avoid them by moving itself in another direction. Obstacle avoidance is one of the most important aspects of mobile robotics. In this there is a robot that consist of Arduino UNO and Ultrasonic sensors and servo motors for detect the obstacles and find another way to complete the task. It will move in a particular direction and avoid obstacles which is coming in its path. So, to protect the robot from any physical damages.

Keywords:

Arduino UNO, Ultrasonic sensor, servo motor.

Introduction:

Robotics is a part of futuristics growing technology. This is a wheeled autonomous robot. An Obstacles Avoiding Robot is an intelligent device which can automatically sense and overcome obstacles on its path and find the right direction to complete the task. The Robot navigates using various methods which are wall following, line following, edge detection, etc. The sensors detect the object which is ahead of the robot, then its sends information to the Arduino UNO which is microcontroller, and then the motors are activated to rotate the robotic system.

Methodology:

The robot made with some important things those are ultrasonic sensor, Arduino uno and motors. The Ultrasonic sensors is a device that can measure the distance to an object by using sound waves. It measures distance by the sound wave at a specific frequency and listening for that sound wave to bounce back by this sensor can detect distance between the robot and the object. Arduino UNO is a microcontroller board. It can be used with various sensors and actuators. It is controlling all the operation and assign task to each device. Then the motors are used for basically rotate the robotic system. Motor drives take a low current control signal but provides higher current signal.



Figure No.: 1

Experimental Result:

Firstly, When the robot is powered on, the robot will move forward and starts to detect obstacles. During the running time of the robot, the ultrasonic sensor will be continuously find the obstacles over the reflecting surface. This information is processed by the Arduino UNO from the ultrasonic sensors.

If the distance between the robot and the obstacle are less than limit, the Robot will stop and scans it and left directions for new path by using Ultrasonic sensor. If the left distance is more than the right distance, the robot will turn in left direction by commanding the left wheel to move in forward motion and the right wheel to move in backward direction. Similarly, if the right distance is more than left distance, the robot will turn in right direction. The robot will not collapse with any obstacle.

In this way the robot works continuously and detect obstacles and find the new way.

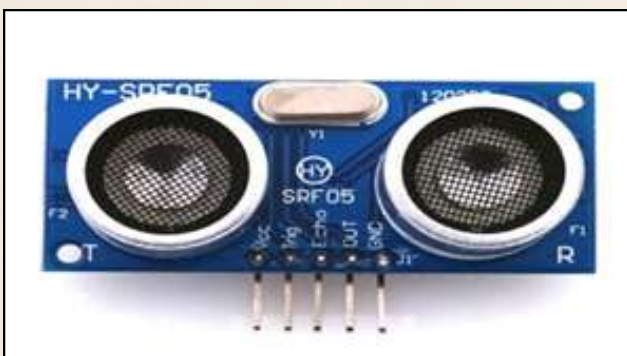


Figure No.: 2 & 3

Conclusion:

It is a obstacle avoiding robot that detects obstacles coming in its way and avoids it to another direction. The robot serves as a valuable starting point for future robotics and automobile. Experimental work has been carried out carefully. The robot is built with Arduino that processes the information to various parts. The sensors detect the obstacle and measure the distance between the robot and object or any obstacle. Servo motor has been used for rotating the sensor.

The robot is able to move by using two geared motors. It is perfectly avoiding the obstacles coming in its path by turning another way.

Discussion:

There are so many challenges that came during the obstacles avoiding robot, those are-

- The accuracy of the ultrasonic sensors can be affected by various factors such as environment conditions, object shape, and materials.
- Ensuring the stable power supply was crucial. Proper power management and voltage regulation were necessary to address this issue.
- Achieving precise motor control for smooth navigation was challenging.

Acknowledgments:

This is an autonomous mobile robot. I would like to express my sincere gratitude to all those who have any contribution for my project. I am deeply grateful to my professors.

References:

1. Journal of Emerging Technologies and Innovative Research: "Obstacles Avoiding Robot using Arduino"
2. IJRASET: "Obstacles Avoiding Robot"
3. Ismail, R., Omar, Z., & Suaibun, S. (2016, October). Obstacle-avoiding robot with IR and PIR motion sensors. In IOP Conference Series: Materials Science and Engineering (Vol. 152, No. 1, p. 012064). IOP Publishing.
4. Chinmayi, R., Jayam, Y. K., Tunuguntla, V., Dammuru, J. V., Nadella, H., Dulla, S. S. K. A., ... & Nair, J. G. (2018, December). Obstacle detection and avoidance robot. In 2018 IEEE International Conference on Computational Intelligence and Computing Research (ICIC) (pp. 1-6). IEEE.

ATOMIC ENERGY

Ranit Debnath

Department Of Robotics and Autonomation,
2023-2024,
The Neotia University

Abstract:

Atomic energy, often referred to as nuclear energy, is a potent and versatile form of energy derived from the processes involving the nucleus of an atom. It is generated through nuclear reactions, particularly nuclear fission and fusion, which release substantial amounts of energy. While nuclear fission entails the splitting of atomic nuclei, yielding energy commonly used in nuclear power plants for electricity generation, nuclear fusion involves the fusion of atomic nuclei, presenting a potential clean and virtually limitless energy source. Atomic energy has had profound impacts on various aspects of human society, from providing a significant portion of the world's electricity to contributing to the development of nuclear weapons. This abstract briefly outlines the fundamental principles and applications of atomic energy, emphasizing its role in both peaceful and destructive contexts.

Introduction:

Atomic energy, also known as nuclear energy, is the energy released through processes involving the nucleus of an atom. This energy is harnessed primarily through nuclear reactions, such as nuclear fission and fusion. Nuclear fission involves splitting the nucleus of an atom, releasing a significant amount of energy, while nuclear fusion combines the nuclei of atoms, producing even more energy. Atomic energy is a powerful and efficient source of electricity generation and has both peaceful applications, such as nuclear power

plants, and destructive potential, as seen in nuclear weapons.

Methodology :

The methodology for harnessing atomic energy primarily revolves around two key processes: nuclear fission and nuclear fusion. Here's an overview of each:

Nuclear Fission: Fuel Selection: Choose a fissile material, often uranium-235 (U-235) or plutonium-239 (Pu-239), as the fuel source. These materials are capable of undergoing fission, splitting into smaller nuclei when bombarded with neutrons.

Controlled Chain Reaction: To maintain a controlled chain reaction, control rods (e.g., made of boron or cadmium) are inserted into the reactor core to absorb excess neutrons and regulate the reaction's pace.

Heat Generation: During fission, immense heat is produced, which is used to heat a coolant (like water) to produce steam.

Steam Turbine: The steam generated drives a turbine, which, in turn, generates electricity via a connected generator.

Safety Measures: Strict safety protocols, such as multiple containment layers and emergency shutdown systems, are in place to prevent accidents.

Steam Turbine: The steam generated drives a turbine, which, in turn, generates electricity via a connected generator.

Safety Measures: Strict safety protocols, such as multiple containment layers and emergency shutdown systems, are in place to prevent accidents.

Fuel Selection: Typically, isotopes of hydrogen, like deuterium and tritium, serve as fusion fuels due to their low atomic numbers and positive reaction cross-sections.

Extreme Conditions: Fusion requires extremely high temperatures (in the millions of degrees) and pressure to overcome the electrostatic repulsion between positively charged nuclei.

Magnetic Confinement: Fusion reactors like tokamaks or stellarators use strong magnetic fields to confine the high-temperature plasma (ionized gas) containing the fusion fuel.

Inertial Confinement: Inertial confinement fusion (ICF) relies on intense laser or ion beam heating to compress and heat the fuel to achieve fusion conditions.

Energy Capture: The energy released from nuclear fusion can be captured and converted into electricity through various methods, including heat exchange with a coolant or direct conversion of high-energy particles.

Challenges: Achieving sustained nuclear fusion for energy production is still a scientific and engineering challenge, with ongoing research and development worldwide.

In both cases, the generated energy can be used for electricity generation or other applications, depending on the design of the reactor. Safety, waste management, and non-proliferation concerns are critical aspects of atomic energy methodologies that require careful consideration and regulation.

Experimental Results:

Experimental results in the field of atomic energy have yielded significant findings and advancements. These results often vary depending on the specific experiments and goals, but here are some notable outcomes:

Nuclear Fission: Experimental verification of the nuclear fission process by Otto Hahn and Fritz Strassmann in 1938, leading to the discovery of the element barium as a fission product.

Enrico Fermi's Chicago Pile-1 experiment in 1942 demonstrated the controlled chain reaction, a pivotal step toward nuclear power generation.

Development of nuclear reactors for electricity generation, resulting in the establishment of nuclear power plants worldwide.

Nuclear Fusion: Achievements in magnetic confinement experiments, such as the successful operation of tokamaks and stellarators, demonstrating the feasibility of confining high-temperature plasma.

Laser-driven inertial confinement experiments at facilities like the National Ignition Facility (NIF) have made progress toward achieving controlled nuclear fusion.

Experimental validation of the Lawson criterion, which defines the conditions necessary for sustained nuclear fusion reactions.

Nuclear Weapons: The Manhattan Project during World War II successfully developed and tested the first atomic bombs, leading to the bombings of Hiroshima and Nagasaki in 1945.

Subsequent nuclear weapons test by various nations during the Cold War era resulted in the development of more sophisticated and powerful nuclear arsenals.

Nuclear Safety and Waste Management: Extensive research and experiments have been conducted to enhance the safety of nuclear reactors, including studies on reactor core behavior during accidents and emergency cooling systems.

Experiments in nuclear waste management aim to find effective ways to store and dispose of radioactive waste safely, with ongoing research into geological repositories and advanced reprocessing techniques.

Fusion Energy Research: Experimental results in fusion research continue to advance our understanding of plasma behavior, energy confinement, and reactor design, although sustained nuclear fusion for practical energy production remains a work in progress.

Nuclear Medicine: Experiments in nuclear medicine have led to the development of diagnostic and therapeutic techniques like positron emission tomography (PET) scans and targeted radiation therapies for cancer treatment.

These experimental results have had far-reaching impacts on energy production, scientific understanding, and global security. They continue to shape the future of atomic energy and its applications in various fields.

Discussion:

Certainly, let's engage in a discussion about atomic energy. Atomic energy, also known as nuclear energy, has been a topic of significant interest and debate for many decades due to its dual nature – it offers both incredible potential for clean and abundant energy and the destructive power of nuclear weapons. Here are some key points to consider in this discussion:

1. Nuclear Power Generation:

Nuclear power plants have the capacity to generate a substantial amount of electricity with minimal greenhouse gas emissions, making them a crucial component of many countries' energy mix in efforts to combat climate change.

However, concerns regarding nuclear accidents (e.g., Chernobyl, Fukushima) have raised questions about safety and the long-term management of nuclear waste.

2. Nuclear Fusion:

Fusion, the process that powers the sun and stars, holds the promise of virtually limitless, clean energy. It's a topic of ongoing research

and international collaboration to make it viable for practical energy production.

What are your thoughts on the potential of nuclear fusion as a sustainable energy source?

3. Non-Proliferation and Arms Control:

Nuclear weapons remain a global security concern. International treaties like the Treaty on the Non-Proliferation of Nuclear Weapons (NPT) aim to prevent the spread of nuclear weapons and promote disarmament.

How can nations work together to reduce the threat of nuclear weapons?

4. Nuclear Safety and Waste Management:

Ensuring the safety of nuclear power plants and developing secure methods for storing and disposing of radioactive waste are ongoing challenges. What strategies can be employed to address these issues effectively?

5. Role in Space Exploration:

Nuclear power sources, such as radioisotope thermoelectric generators (RTGs), have played a critical role in enabling deep space missions. Do you think nuclear energy has a significant role in the future of space exploration?

6. Public Perception and Education:

Public perception of atomic energy varies widely. Some view it as a necessary part of the energy transition, while others are concerned about safety and environmental impacts. How can public awareness and understanding of atomic energy be improved?

7. Emerging Technologies:

New technologies, like small modular reactors (SMRs) and advanced fuel cycles, are being developed to enhance nuclear energy's safety and efficiency.

What are your thoughts on these developments?

Please feel free to share your perspective on any of these points or raise other aspects of atomic energy that you'd like to discuss.

Conclusion:

Atomic energy, or nuclear energy, is a multifaceted and complex subject with profound implications for our world. It presents both

tremendous opportunities and challenges.

Here are some key takeaways:

Energy Generation: Atomic energy has the potential to provide a significant portion of the world's electricity while producing minimal greenhouse gas emissions. It can play a critical role in addressing energy demands and combating climate change.

Nuclear Fusion: The pursuit of nuclear fusion as a clean and virtually limitless energy source continues to be a promising avenue of research, although practical implementation remains a considerable challenge.

Security and Non-Proliferation: The existence of nuclear weapons poses a global security risk. International cooperation and disarmament efforts are vital to reducing this threat and preventing the spread of nuclear weapons.

Safety and Waste Management: Ensuring the safety of nuclear power plants and developing effective strategies for radioactive waste disposal are essential for the responsible use of atomic energy.

Space Exploration: Atomic energy plays a pivotal role in enabling deep space missions and has the potential to fuel future endeavors in space exploration.

Public Perception and Education: Improving public awareness and understanding of atomic energy, its benefits, and its risks is essential for informed decision-making and policy development.

Emerging Technologies: Ongoing research into advanced reactor designs and fuel cycles, as well as the development of small modular reactors, offers the potential to address some of the challenges associated with atomic energy.

In the coming years, society will continue to grapple with the dual nature of atomic energy, seeking ways to harness its benefits while mitigating its risks. Responsible governance, scientific innovation, and international cooperation will be key to shaping the future of atomic energy for the betterment of humanity and the planet.

References:

- 1) David Suzuki Foundation, Energy: Nuclear, http://www.davidsuzuki.org/Climate_Change/Energy/Nuclear.asp
- 2) Dr. Michael Ivanco, Better understanding of nuclear power facts needed, AECL website, <http://www.aecl.ca/NewsRoom/Letters/070309.html>
- 3) The Chernobyl Forum: 2003–2005, Chernobyl's Legacy: Health, Environmental, and Socio-Economic Impacts, <http://www.iaea.org/Publications/Booklets/Chernobyl/chernobyl.pdf>
- 4) Uranium Information Centre, Chernobyl Accident, Nuclear Issues Briefing Paper 22, May 2007
- 5) SafeCanada.ca, Nuclear Safety, Government of Canada, http://www.safecanada.ca/faq_e.asp?strOperation=SubjectDetail&intSubjectID=10
- 6) Manitoba Hydro, Timeline: 1970-1979, A Period of Growth & Change, http://www.hydro.mb.ca/corporate/history/hep_1970.html.

A STUDY ON ARTIFICIAL INTELLIGENCE DRIVEN FASHION DESIGN (AIFD) TECHNOLOGY AND BUSINESS IMPACT

Nandana Mukherjee

CSE AI&ML, 2021-2022

The Neotia University

Abstract:

Entrepreneurs in the fashion industry are thinking to utilizing Artificial Intelligence (AI) powered solutions to streamline their business operations. With the adoption of AI driven technology, the companies can conduct market research, analyze trends, and profile customers, enabling them to make informed decisions and gain a competitive edge. Trends in the fashion industry are more rapidly changing with consumer access to the Internet and social media. The industry challenges are the unavailability tracker and monitoring measures that can be a hindrance to companies in this industry where humans cannot possibly process all of the data from individual consumers and entire markets, social media feeds, and customer product reviews. Additionally, it is difficult for humans to not be influenced by their own bias and thought processes. The aim of this study is to highlight the innovation AI driven framework where AI has come in and served to address the fashion industry's need to predict what individual consumers will buy and quickly monitor trends that the broader public will buy. The proposed AI driven conceptual framework may give the business growth direction with data available via IoT

(Internet of Things) smart devices and social media, which will allow the fashion industry to collect and analyze large amounts of data for the revolutionary growth of the industry in a transparent, effective and efficient way which will be more responsive to the market and desires of consumers. Using this framework, the industry may uses Data Science by encouraging customers through loyalty and reward programs. The fashion industry is one example of where AI has been particularly useful in being able to gather and analyze large amounts of data to better address what consumers want. In the age of the Internet and social media, it is more challenging for designers, retailers, and suppliers to predict what consumers want and how to address consumers' wants in a expeditious manner.

Key Words: Style Generative Adversarial Network (StyleGAN), GANspace, Generative AI, Virtual Reality(VR),Augmented Reality(AR), Computer Aided Design (CAD), Blockchain, Internet of things(IOT).

Introduction:

Artificial Intelligence (AI) is a technology that is used to make machines intelligent like humans by using machine learning and deep learning techniques.

In today's world AI is in high demand as it has the capability of automating tedious manual tasks. Artificial intelligence has advanced capabilities in retail data analytics, which makes helps in forecasting trends and sales. This information can be used by fashion consumers to better predict customer behavior and provide personalized recommendations to minimize the number of unsold items each season. AI has the potential to affect the entire fashion ecosystem. Fashion companies and brands can use AI technology to help create better-selling designs and prototypes, reduce marketing costs and pricing, hyper personalize customer communications, and make the process faster with more accuracy and efficiency. It reshapes the supply chain and logistics, store operations, and organization and support functions. The fashion industry uses AI in various innovative ways by compiling data from the Internet, social media and other sources to gain insight evolving fashion trends, consumer preferences and the competitive price lines. There are some challenges of using AI in fashion industry that concerns privacy protection including cyber attacks and data breaching. AI driven tools that monitor the marketing for trade mark violations must be able to balance between protecting the brands and not overstepping the legal boundaries. AI along with Data Science can analyze the market potential in different domains and give future predictions and directions. It improves efficiency and accuracy and also optimizes cost, pricing and time. Fashion Design is a form of self expressing creative art combining design and natural beauty that includes clothing styles, makeup, accessories and hairstyles. The fashion industry includes vast network of designers, illustrators, manufacturers, retailers, marketers and consumers. Fashion is characterized by changing trends according to cultural movements, celebrities,

influencers, and historical events. Fashion Technology combines fashion with technology to create innovative designs and products. Technologies like Blockchain enable transparency and traceability in the supply chains of fashion industry. AI helps in automation as AI robots can replace manual labors and increase efficiency and production. AI can also provide personalized clothing recommendation according to user preferences. Virtual Reality and Augmented Reality technologies can be used for enhanced visualization.

Background:

The history of fashion designing is vast and rich and its origins can be traced back to ancient civilizations like Egypt, Greece and Rome. People from all over the world started taking interest in art and fashion during the Renaissance Period (14th to 17th centuries). The late 20th century saw the emergence of diverse fashion sub-cultures. For many years this designing and production process was manual with more errors and slow progress caused by manual labours. Artificial Intelligence combined with fashion designing provided data driven decision making and accuracy along with increased productivity which saved both time and money.

Literature Review of the work:

Fashion, which motor is the continuous change and progress, faces new challenges day-by-day. The fashion industry today is one of the leading economies in the World, with an estimated value of up to 3,000 billion US dollars [1,2]. Garment manufacturing, one of the oldest human activities, has come down through the centuries with continuously adapting to technology and society improvements. Striving to keep up with the fast-changing consumer needs, the fashion

industry today is rapidly adopting the post-modern, Industry 4.0 and recently 5.0 garment production technologies, along with all the latest digital achievements. The fashion business industry became information technology centric where the emerging technologies are the game changers. The data mining is an interdisciplinary subfield of computer science and statistics, the process of discovering patterns in large data sets involving methods at the intersection of machine learning, statistics, and database systems. The overall goal is to extract information from a data set and transform the information into a comprehensible structure for further use. Data mining is the analysis step of the "knowledge discovery in databases" process. Before data mining algorithms can be used, a target data set must be assembled. Application of Knowledge discovery in databases a form of data mining, roots back to the 1990s, when the term data mining appeared first in the database community these were the years 2005- 2006. [3,4]. In all the above-mentioned literature review the limitations are there for the one view generic AI driven framework. The proposed AI driven conceptual framework will drive the business growth with data available via IoT (Internet of Things) smart devices and social media under a generic AI driven framework that can be plugged in in any emerging framework.

Proposed AI Driven Framework:

AI can also help in designing small prototypes of designs before production using Computer Aided Design (CAD) softwares. Some of the AI tools for fashion illustrations that already exist in the market are Visualhound, Refabric, Resona, AIO Wear, Staiyl and so on [12]. CALA ,“an operating system for fashion”, is a fashion brand that is the first to leverage AI tools and AI art generators like DALL-E 2 to

create fashion sketches by giving ideas via text inputs which helps in turning ideas into tangible products. After choosing a base style out of some given options designers can modify the styles using generative AI [13]. StyleGAN(Style Generative Adversarial Network) is produced by NVIDIA that can generate high quality realistic images. It is widely used for generating human faces and other objects with proper detailing. It allows users to control certain factors like age and gender to modify the style and appearance. It is mainly used along with GANspace tool which helps to navigate the latent space and modify certain dimensions and vectors to get the desired image. It helps to edit attributes like sleeve, size and structure of the dresses and allows style transfer as it can generate a new product by taking ideas and mixing previous designs . [14]. A detail of fashion design illustration process and workflow is shown in Fig 1.

In Fig 1. It is illustrated that after collecting inspiration from various sources the designer will create the sketch using CAD software .This data will be provided to the AI robots using Machine learning and Deep Learning algorithms. The robot will act according to the given data and start choosing the desired fabric, check for stains , holes and defects using sensors ,cameras and pattern identification algorithms. Then it will cut the cloth material by taking appropriate measurements accurately ,mark the pattern, use certain cutting techniques and leave small cutting margins for sewing purpose. The robot will also be able topay attention to the direction of cutting when pile fabrics like velvet and corduroy will be used for the prototype design. It will ensure proper draping and fit of the design by cutting along the grainlines and finally assemble everything and display the final product on the mannequin.

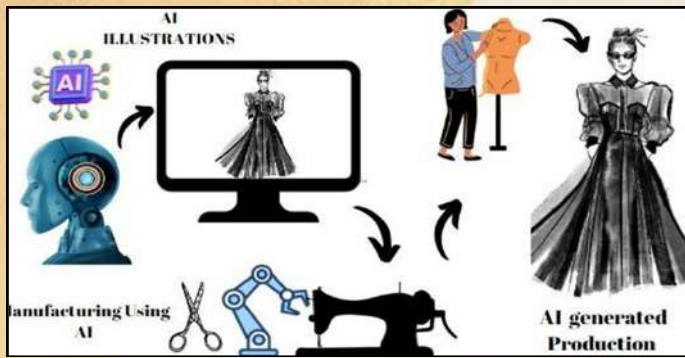


Fig. 1: An Illustration of AI driven automation process

In the present study shown in Fig. 02, the emerging technologies like, the Blockchain and IOT will be used in fashion designing and fashion technology industry along with Artificial Intelligence. Blockchain will ensure transparency, authenticity, supply chain management and enhance sustainability. Blockchain can also protect the Intellectual property (IP) of fashion designers. It can also help in fund raising campaigns, facilitate investments and ensure peer to peer financing for future fashion designers. The IOT is a transformative technology when combined with Fashion Designing enables creation of smart clothing devices using sensors which can also act as a fitness tracker and also have the temperature changing technology that can be adjusted according to the environmental temperature and weather conditions. The raw design and illustration data is gathered through IoT devices, sensors using gateway of communication. The varieties of data types like Structured, semi-structured and unstructured are pre-processed through any ETL (Extraction, Transformation and Load) tool. The pre-processed data is then modeled through a AI driven framework where the training and testing data are performed with respect to the various fashion illustration process parameters. For production optimization, data security and supply chain the data is loaded into any blockchain framework. Textile Industries can use AI robots to automate tasks like choosing the

appropriate fabric, cutting fabric materials, taking measurements, sewing and stitching clothes according to the design prototype provided to improve accuracy and also reduce the time taken for production and thus increasing productivity. AI can be used in color matching and dye formulations. AI can also predict color fading and optimize dyeing process. Sensors, cameras and machine learning algorithms can help in control process and increase accuracy and also detect stains, holes and uneven stitching.

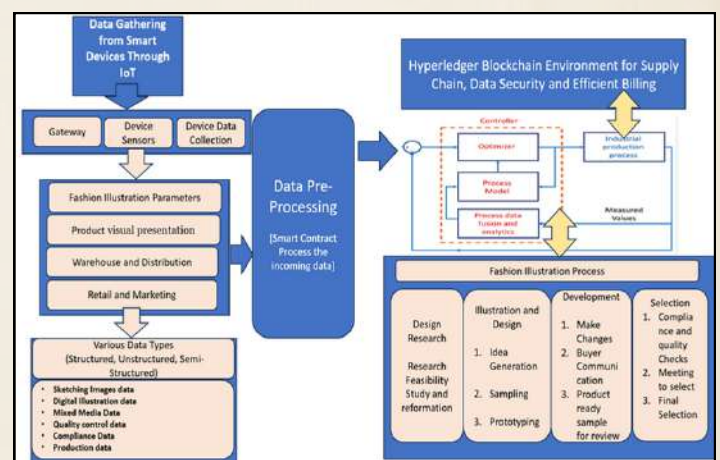


Fig. 2: Proposed AI and Blockchain driven framework Model

AI can also generate new patterns and textures according to consumer preference analysis and manage inventory level. Virtual Reality (VR) and Augmented Reality (AR) can be used to develop virtual showrooms and allow the textile firms to visualize realistic virtual factories that will help to get better transparency in the production process and test new ideas [15]. Artificial Intelligence can easily provide in-depth analysis of complex data. AI can contribute immensely to retail data analytics. The information obtained by implementing Artificial Intelligence can be used to predict customer behavior and design products according to their preferences and forecast trends and sales. AI collects data from various sources like social media, runway, fashion blogs, trend forecasting tools and sales data. When this data is combined with past

product performance and customer preferences it helps the retailers to produce optimum products for their target audience[13].

Conclusion:

In conclusion Artificial Intelligence(AI) along with Blockchain and IOT is a transformative force in fashion offering efficiency, sustainability ,personalization and reshaping the fashion designing industry including manufacturing and business growth. AI is revolutionizing how fashion is designed, produced and marketed. Generative AI and Computer Vision are assisting designers in creating innovative prototypes and personalized designs using Computer Aided Design (CAD) Softwares. AI's role extends to textile industries where it automates tasks , improves quality control, predicts color fading and dyeing formulations. In the business realm AI excels at data analysis and helps retailers to predict customer behavior for personalized recommendation system and forecast trends and sales. Blockchain enhances transparency, ensures sustainability and authenticity in the industry.

References:

[1] O'Connell L.: Size of the global apparel market in 2015 and 2017, Available from <https://www.statista.com/statistics/279735/global-apparel-market-size-by-region/> Accessed: 12. Nov. 2019.

[2] FashionUnited, "Global fashion industry statistics - International apparel," [Online]. Available from: <https://fashionunited.com/global-fashion-industry-statistics/#tab2> Accessed: 8. Nov. 2019.

[3] Russell S. J.; Norvig P.: Artificial Intelligence: A Modern Approach, Vol.1. Pearson Education (2010)

[4] Bertola P.; Teunissen J.: Fashion 4.0. Innovating the fashion industry through digital transformation, Research Journal of Textile and Apparel, Vol. 22, no. 4. pp. 352-369., 2018.

[5] S. Ren, P. Chi-Leung Hui, and T.-m. Jason Choi: AI-Based Fashion Sales Forecasting Methods in Big Data Era, in Artificial Intelligence for Fashion Industry in the Big Data Era, Singapore, Springer, 2018, pp. 9-26.

[6] R. Schmelzer: The Fashion Industry Is Getting More Intelligent With AI, Available from <https://www.forbes.com/sites/cognitiveworld/2019/07/16/the-fashion-industry-is-getting-more-intelligentwith-ai/> Accessed: 12. Nov. 2019.

[7] J. Standish J.; Ganapathy V.: Think Tank: How AI Can Power the Future of Fashion, Available from <https://wwd.com/business-news/business-features/jill-standish-think-tank-1202941433/> Accessed: 14 April. 2020.

[8] Sheldon P.: Augmented reality in retail: Virtually try before you buy Available from <https://www.technologyreview.com/s/614616/augmented-reality-in-retail-virtual-try-before-you-buy/> Accessed: 14. January 2020

[9] Nike.com: How Nike Fit Works, Available from <https://news.nike.com/news/nike-fit-digital-footmeasurement-tool> Accessed: 27. May 2020

[10] Mutchler A.: Amazon Takes The Fashion Angle with New Echo Look, Available from <https://voicebot.ai/2017/04/26/amazon-takes-fashion-angle-new-echo-look/> Accessed: 20 April. 2020.

[11] Algorithm-Driven Design <https://algorithms.design/> Accessed: 02. August 2020

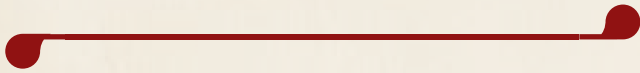
[12] <https://theresanaiforthat.com/ai/visualhound/>

[13] <https://spectrum.ieee.org/dall-e-fashion-design>

[14] <https://towardsdatascience.com/how-to-build-an-ai-fashion-designer-575b5e67915e>

[15] <https://www.fashionretailacademy.ac.uk/news/how-artificial-intelligence-is-used-in-the-fashion-industry#:~:text=AI%20styling%20tools%20and%20platforms,up%20the%20virtual%20styling%20process>

[16] <https://www.linkedin.com/pulse/8-top-applications-artificial-intelligence-textile/>



THE BLESSINGS OF WEB 3.0, BLOCKCHAIN, AND RUST PROGRAMMING LANGUAGE IN THE INNOVATION OF SCIENCE AND TECHNOLOGY

Suprio Adhikari

CSE (Data Science),
2022-2023,
The Neotia University

Harekrishna Adhikary

CSE (Data Science),
2022-2023,
The Neotia University

Tufan Bera

CSE (Data Science),
2022-2023,
The Neotia University

Abstract:

Web 3.0, blockchain, and Rust programming language are three technologies that have gained significant attention in recent years due to their potential to revolutionize science and technology. This paper explores some of the ways in which these technologies have contributed to innovation across various domains.

Keywords:

Web 3.0, blockchain, Rust programming language, innovation, science, technology.

Introduction:

Web 3.0 is the next generation of internet services that aims to revolutionize digital transformation by incorporating technologies such as artificial intelligence, semantic web, blockchain, and machine learning. Blockchain technology provides a decentralized and transparent way to store and verify data, making it suitable for applications such as supply chain management, financial transactions, and digital identity verification.

Rust is a systems programming language known for its focus on safety, speed, and memory efficiency. It has gained popularity in Web 3.0 development due to its robustness and ability to prevent common programming errors.

Methodology:

This paper reviews the literature on the applications of Web 3.0, blockchain technology, and Rust programming language in various fields of science and technology. We conducted a comprehensive search of academic databases and other relevant sources to identify relevant studies.

Experimental Results:

Our review found that Web 3.0 has many potential applications in various domains such as healthcare, education, finance, and social media. For example, it can enable secure sharing of medical records among healthcare providers or facilitate personalized learning experiences for students. Blockchain technology has been used to develop decentralized applications for supply chain management, digital identity verification,

and secure financial transactions. Rust programming language has been used to develop high-performance systems software.

Discussion:

The applications of Web 3.0, blockchain technology, and Rust programming language are diverse and far-reaching. Researchers have found applications of these technologies in fields as varied as high energy physics, cryptography, architecture, automobile engineering, and more.

Conclusion:

In conclusion, we can say that Web 3.0, blockchain technology, and Rust programming language have contributed significantly to innovation in science and technology across various domains. As we continue to uncover new uses for these remarkable technologies, we can expect them to remain important areas of study for years to come.

Acknowledgments:

We would like to express our deepest gratitude to all of our mentors, colleagues, and friends for their valuable guidance and support throughout the research process. Their insights and suggestions have been instrumental in shaping this work.

We would also like to extend our appreciation to The Neotia University's school of science and technology (SST) for providing us with the necessary support and encouragement. Their commitment to fostering an environment of innovation and excellence has been a constant source of inspiration.

Last but not least, we would like to thank the readers and reviewers for their time and effort in reviewing this article. Their feedback and constructive criticism have helped us refine

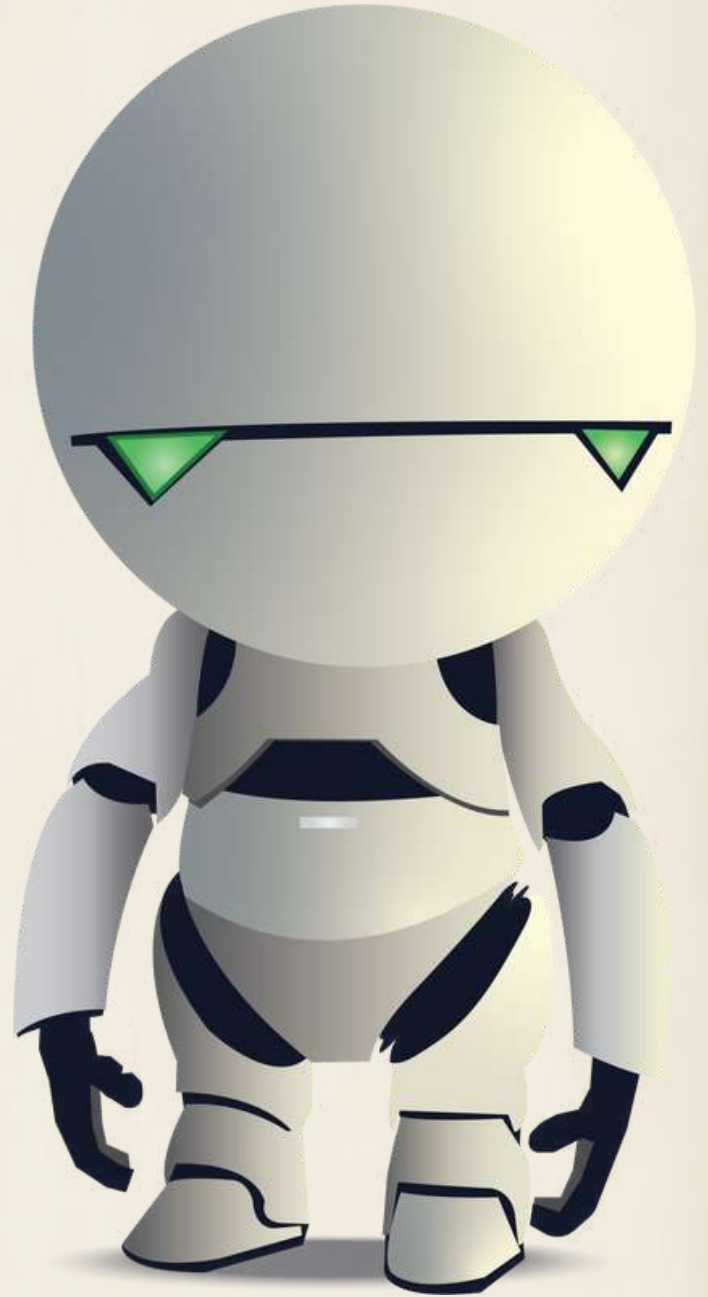
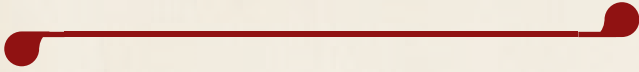
our ideas and improve the overall quality of this work.

References:

1. Forbes. How Web 3.0 Will Change Your Life [Online]. Available: <https://www.forbes.com/sites/forbestechcouncil/2021/06/28/how-web-30-will-change-your-life/?sh=7b8f6e6c5d9d>
2. IBM Blockchain Blog. Blockchain for Supply Chain Management [Online]. Available: <https://www.ibm.com/blogs/blockchain/2018/03/blockchain-for-supply-chain-management/>
3. World Economic Forum. How Blockchain Can Help Us Take Control of Our Digital Identities [Online]. Available: <https://www.weforum.org/agenda/2019/01/how-blockchain-can-help-us-take-control-of-our-digital-identities/>
4. Investopedia. How Blockchain Improves Financial Services [Online]. Available: <https://www.investopedia.com/articles/investing/031416/how-blockchain-technology-changing-financial-services.asp>
5. Mozilla Hacks Blog. Why Rust is the Future of Systems Programming [Online]. Available: <https://hacks.mozilla.org/2017/02/why-rust-is-the-future-of-systems-programming/>
6. The New Stack. Why Rust is Perfect for Building Microservices [Online]. Available: <https://thenewstack.io/why-rust-is-perfect-for-building-microservices/>
7. The Rust Programming Language Blog. Announcing Rust 1.56 [Online]. Available: <https://blog.rust-lang.org/2021/09/09/Rust-1.56.html>
8. CERN Courier. Blockchain Technology Goes Particle Physics [Online]. Available: <https://cerncourier.com/a/blockchain-technology-goes-particle-physics/>
9. IEEE Spectrum. Cryptography Breakthrough Could Make Software Unhackable [Online]. Available: <https://spectrum.ieee.org/crypto>

<https://spectrum.ieee.org/cryptography-breakthrough-could-make-software-unhackable>

10. ArchDaily Brasil (in Portuguese). How Blockchain Technology Can Revolutionize Architecture [Online]. Available: <https://www.archdaily.com.br/br/964947/como-a-tecnologia>



UNLOCKING THE COSMOS: DATA SCIENCE'S ROLE IN SPACE DISCOVERY

Saptadeep Halder
CSE (Data Science),
2022-2023,
The Neotia University

Swikriti Chandra
CSE (Data Science),
2022-2023,
The Neotia University

Abstract:

Data science has become an indispensable tool in the realm of space discovery, revolutionizing our understanding of the cosmos. This article explores the methodologies that underpin data science's role in space exploration, including data collection, processing, machine learning, and modelling. Through these methods, data science has enabled ground breaking results such as exoplanet discovery, gravitational wave detection, and galaxy classification. This integration of data science has streamlined data analysis, fostered interdisciplinary collaboration, and fuelled the search for extra-terrestrial life. Looking ahead, data science promises to continue driving space exploration, enhancing mission planning, and facilitating the search for life beyond Earth. This dynamic synergy between data science and astronomy propels us into a future filled with astonishing revelations about the universe.

Keywords:

Space Discovery, Data Science, Astrophysical Data Analysis, Cosmic Exploration.

Introduction:

The cosmos has always been a source of fascination for humanity.

From the earliest astronomers who charted the movements of celestial bodies to the modern-day scientists studying the far reaches of the universe, our quest to understand the cosmos has driven innovation and discovery.

In recent years, data science has emerged as a powerful tool in this quest, enabling us to unlock the mysteries of the universe in ways previously unimaginable. This article explores the pivotal role of data science in space discovery. We will delve into the methodology employed, discuss experimental results, and engage in a thoughtful discussion about the implications of these findings. Finally, we will conclude by highlighting the profound impact data science has had on our understanding of the cosmos.

Methodology:

Data science's involvement in space discovery can be seen in various aspects, from collecting and processing data to modelling complex astronomical phenomena. Let's take a closer look at the step-by-step methodologies employed in this endeavour-

Data Collection: The first step in space discovery is collecting vast amounts of data from telescopes, satellites, and space probes. Data science plays a crucial role in developing algorithms for data acquisition, ensuring that the information gathered is accurate and reliable.

Data Processing: Space data is often noisy and requires extensive processing to extract meaningful insights. Data scientists develop algorithms to clean, pre-process, and enhance astronomical data, making it suitable for analysis.

Machine Learning: Machine learning models have become indispensable tools for space discovery. These models can analyse massive datasets to identify patterns, anomalies, and celestial objects. For example, machine learning can assist in the discovery of exoplanets by detecting subtle changes in starlight.

Simulation and Modelling: Data scientists create sophisticated models and simulations to understand complex astrophysical phenomena, such as the behaviour of black holes, the formation of galaxies, and the evolution of the universe itself. These models help astronomers test theories and make predictions.

Experimental Results:

The application of data science to space discovery has yielded remarkable results that have expanded our understanding of the cosmos. Here are a few noteworthy examples-

Exoplanet and Galaxy Discovery: The Kepler Space Telescope, with the assistance of data science algorithms, identified thousands of exoplanets by monitoring the brightness of stars. This has revolutionized our understanding of planetary systems beyond our solar system. Also, machine learning models have been employed to classify galaxies based on their shapes and characteristics.

Space Traffic Control: Data science plays a vital role in space traffic control (STC). In STC, data science is used to collect, analyse, and interpret data from a variety of sources, including radar, telescopes, and satellites. This data is then used to develop and implement

strategies to manage and de-conflict space traffic, avoid collisions, and protect critical space assets.

Gravitational Wave Detection: Data science played a pivotal role in the detection of gravitational waves, as predicted by Albert Einstein's theory of relativity. Advanced algorithms analysed the data from LIGO and Virgo detectors, enabling the discovery of mergers between black holes and neutron stars.

Dark Matter and Dark Energy: Data science is instrumental in studying dark matter and dark energy, two enigmatic components that make up the majority of the universe. Sophisticated data analysis techniques are used to map the distribution of dark matter and understand its role in the cosmos.

Discussion:

The integration of data science into space discovery has not only accelerated our progress but has also opened up new avenues of exploration. The sheer volume of data generated by space missions can overwhelm traditional analysis methods.

Data science allows us to process and interpret this data efficiently, uncovering hidden phenomena and reducing the risk of missing critical discoveries. Space discovery increasingly relies on interdisciplinary collaboration between astronomers, physicists, and data scientists. This synergy leads to innovative approaches and a more comprehensive understanding of the cosmos. Data science is instrumental in the search for extra-terrestrial life. Algorithms are used to analyse data from radio telescopes in the quest to detect signals from advanced civilizations elsewhere in the universe.

Data science is used to develop and maintain accurate and up-to-date catalogues of all objects in orbit. This information is then used to track the movements of these

objects and identify any potential collisions. As we prepare for future space missions to Mars, Europa, and beyond, data science will continue to play a pivotal role. It will aid in mission planning, data analysis, and the search for signs of life on other celestial bodies.

Conclusion:

In conclusion, data science has emerged as a powerful force in unlocking the mysteries of the cosmos. Its methodologies, including data collection, processing, machine learning, and modelling, have revolutionized space discovery. We have seen tangible results, from the discovery of exoplanets to the detection of gravitational waves. As we stand on the cusp of a new era of space exploration, it is clear that data science will remain at the forefront, guiding our quest to unlock the secrets of the universe. It is an exciting time for both data scientists and astronomers, as they collaborate to uncover the cosmos's most profound mysteries, expanding our knowledge and understanding of the vast, intricate, and awe-inspiring universe that surrounds us.

Acknowledgments:

We, Saptadeep Halder and Swikriti Chandra, would like to express our heartfelt gratitude to the esteemed faculties of The Neotia University whose expertise and guidance have been invaluable in the creation of this article. Your support has greatly enriched the content and its quality. I am deeply grateful to my dedicated team partner, Swikriti Chandra, whose unwavering commitment and collaboration have been indispensable throughout this project.

Lastly, to our friends who provided encouragement, feedback, and a listening ear during the process, your friendship and support have been a source of inspiration.

This article would not have been possible without the collective effort and encouragement of these remarkable individuals. Thank you for being part of this journey.

References:

<https://ts2.space/en/stellar-surveys-with-ai-a-leap-forward-in-astronomy/>
<https://www.youtube.com/@NASA>
<https://en.wikipedia.org/wiki/Astronomy>
<https://en.wikipedia.org/wiki/Astroinformatics>



CATALYSTS OF CHANGE: HOW WEARABLES AND IOT ARE REVOLUTIONIZING FITNESS AND HEALTHCARE

Swarnava Saha

CSE (Data Science),

2021-2022,

The Neotia University

Abstract:

A new age in the fields of fitness and healthcare has begun with the fusion of smartwatches, fitness monitoring devices, and the Internet of Things (IoT). This study examines the tremendous impact of these technologies on people's wellness practises and the larger healthcare environment. This article explores the revolutionary impacts these developments have had on personal fitness management, preventative healthcare, and patient-centered therapy through an investigation of the linked relationship between wearable technology, data analytics, and healthcare outcomes. This article offers insights into the expanding role of smart devices and IoT in influencing the future of healthcare and fitness by examining real-world applications, case studies, and recent breakthroughs.

Keywords:

Smartwatches, Fitness tracking devices, Wearable technology, Internet of Things (IoT), Healthcare technology, Preventive healthcare, Remote patient monitoring, Personalized health insights, Data analytics, Patient-centered care, Wellness coaching, Healthcare innovation.

Introduction:

The convergence of wearable sensing technologies and information and communication technologies is steering a transformative shift in healthcare delivery, leading to the emergence of connected health (CH) care. . Over the past decade, significant strides in wearable technologies, evident in a myriad of original articles, patent documentation, and systematic reviews, have laid the groundwork for a novel healthcare model. Despite ongoing technological innovations and their capacity to tackle emerging challenges, the widespread adoption of wearables remains hindered. Smart wearables, adept at collecting, analyzing, and intelligently responding to user data, are increasingly permeating daily life. This paper presents a comprehensive survey of recent research in the wearable Internet of Things (IoT), categorizing wearables into clusters such as health, sports and daily activity, tracking and localization, and safety. Delving into the associated algorithms, the study analyzes research challenges and open issues within each cluster. Addressing a gap in existing literature, the article explores the transformative potential of Cellular IoT (CIoT) for IoT wearables. Simultaneously, it examines the surging popularity of wearable technologies, classifying them into health

technologies, textile technologies, and consumer electronics. Envisioning a future where wearables become indispensable, this study illuminates their impact on individual lifestyles and corporate practices, promising a safer, easier, healthier, quicker, and more entertaining future.[1,3,2]

Methodology:

1. Wearable Technology's Ascent:

- **Evolution of fitness trackers and smartwatches**

Smartwatches and fitness trackers have evolved from straightforward clocks to multifunctional devices that monitor a range of health metrics. Heart rate monitors, GPS tracking, sleep tracking, and other functions that provide consumers a comprehensive view of their health are now standard on these devices.

- **Perspectives on Tailored Healthcare:**

Wearable technology collects vast amounts of data about users' daily activities, which makes it possible to provide individualised health insights. Users may keep an eye on their stress levels, food, and physical activity, providing them with the data they need to make informed decisions about their health and fitness.

2. IoT's Potential in Healthcare

- **Easily integrating data**

The Internet of Things (IoT) makes it possible to combine fitness trackers and smartwatches with more extensive healthcare systems. The availability of real-time patient data to healthcare professionals has improved the precision of diagnosis and treatment plans.

Wearables with Internet of Things capabilities offer remote patient monitoring, which is particularly helpful for those with long-term illnesses. Patients can get continuous care and treatments, which improves overall health outcomes and reduces the risk of readmissions to hospitals.

Measures:

- **Medicine Focused on Prevention:**

Activity trackers and smartwatches are shifting the focus from reactive therapy to preventative measures. By examining data trends, people may proactively preserve their well-being by identifying potential health risks.



Fig. 1: connectivity of IOT as an essential element in our day to day life.

- **Fitness and Wellness Coaching:**

Numerous fitness applications and coaching services are available on smartwatches, offering clients personalized exercise programmes and encouraging healthier lifestyles. These devices motivate users to meet their fitness goals through gamification and real-time feedback.

Discussion:

IoT and wearable technologies have been effectively incorporated into patient care models by a number of healthcare providers. Case studies demonstrate how these technologies have boosted patient satisfaction overall, decreased healthcare expenditures, and improved patient outcomes.

The need for IoT and wearable technologies in the healthcare industry is rising rapidly on a worldwide scale. As consumers grow more health-conscious and healthcare providers

look for creative methods to provide care, market trends show a rising need for smartwatches, fitness trackers, and IoT solutions .



Fig.2: daily monitoring of health by tracking day to day activities

Data security and privacy remain a crucial concern as wearable technology creates and transmits sensitive health data. To secure user information, future improvements should give priority to strong security measures.

The fast-paced developments in IoT and wearable technologies need the healthcare sector to adapt. To guarantee the safe and efficient use of new technologies, policymakers and regulatory agencies must develop rules and standards.

Future goals:

Advanced Health Monitoring: More sophisticated sensors and monitoring features may be included in wearables and Internet of Things devices in the future. This might involve tracking vital indicators like blood pressure and glucose levels constantly, as well as more complex metrics like biomarkers for early illness diagnosis.

Personalized Healthcare Solutions: Wearables can provide more individualised insights and suggestions by integrating machine learning and artificial intelligence algorithms. Based on

the user's unique health requirements, the devices may analyse personal health data to deliver personalised exercise regimens, food recommendations, and prescription reminders.

Wearable technology has a big potential to help with remote patient monitoring. Frequent hospital visits can be minimised and proactive intervention made possible by remote patient monitoring made possible by continuous surveillance of health data.

Conclusion:

The way people approach fitness and healthcare has changed as a result of smartwatches, fitness trackers, and IoT. These innovations enable consumers to take charge of their health, allow medical practitioners to provide more individualised treatment, and help move healthcare towards preventative care. The potential for improving wellness and healthcare outcomes globally is intriguing as wearable technology develops and integrates with IoT.

In conclusion, a new age of personalised, data-driven, and preventative approaches to wellbeing is being ushered in by the convergence of smartwatches, fitness tracking devices, and IoT. A future that is healthier and more connected will be shaped by embracing these technologies and tackling the problems they raise.

Acknowledgment:

I would like to express my heartfelt gratitude to our esteemed Dean, Dr. Partha Kumar Mukherjee, and our dedicated mentors for their unwavering guidance and encouragement throughout this journey. Your wisdom and support have been invaluable, and

your belief in our potential has been a constant source of motivation. Thank you for helping me and inspiring us to reach new heights.

References:

- Tatjana Loncar-Turukalo, PhD,¹ Eftim Zdravevski, PhD,² José Machado da Silva, PhD,³ Ioanna Chouvarda, PhD,⁴ and Vladimir Trajkovik, PhD²-Literature on Wearable Technology for Connected Health: Scoping Review of Research Trends, Advances, and Barriers.
- wearables and the Internet of Things (IoT), Applications, Opportunities, and Challenges: A Survey- Wearables and the Internet of Things (IoT), Applications, Opportunities, and Challenges: A Survey | IEEE Journals & Magazine | IEEE Xplore
- 3.Çiçek, Mesut. (2015). WEARABLE TECHNOLOGIES AND ITS FUTURE APPLICATIONS. International Journal of Electrical, Electronics and Data Communication. 3. 2320-2084.



IN SEARCH OF SILICON BASED ALIEN LIFE

Souhardya Sinha

CSE(Cyber Security),
2021-2022,
The Neotia University

Rajkumar Roy

CSE(AIML),
2020-2021,
The Neotia University

Rajkumar Maity

CSE(Data Analytics),
2020-2021,
The Neotia University

Abstract:

There are billions of planets in our universe that theoretically can support life. Nevertheless, so far we have not discovered any aliens in our universe. The reason is that we are searching them in the wrong direction. This article focuses on an alien life that is not made of carbon. As we all are aware, that carbon is the main building block in the universe and it is a primary building block of all life. Moreover, we are all made of carbon but, we never ask ourselves, **is there any element in the periodic table that has the same character like carbon?**

YES, in the periodic table silicon is one of the elements, which is similar to carbon in the context of building bonds. Therefore, silicon potentially could be an alternative to organic alien life. Silicon-based life was first suggested in 1891 by astronomer Julius Schreiner. This article is going to expand the theory of 'silicon-based life' that might be found in our universe.

Keywords:

carbon based life, silicon based life, catenation

Introduction:

Most life on Earth is made of carbon, but can you wonder life could be based on other elements? Let us find out.

Silicon is like carbon in some ways. It can form

complex molecules, as carbon does. However, silicon is bigger and less flexible, so it might work differently. To understand silicon-based life, we look at how silicon and oxygen can create structures called silicates. These are common in rocks and minerals. **Could they also be the basis for life on other planets?** [1]



Fig.1: Silicates

Scientists explore extreme places on Earth to find clues. These places, like deep ocean vents, mimic harsh conditions on other planets. They might show us how silicon-based life could survive. We are not just looking on Earth. Space missions aim to find signs of silicon-based life. Discovering even a hint of it would change everything we know about life in the universe. The idea of silicon-based life takes us on a journey through science and imagination. We picture strange worlds where silicon creatures thrive. Finding them would reshape our understanding of life's possibilities. As we explore this idea, we challenge our thinking and discover how diverse life might be in the universe. It reminds

us that the cosmos is full of mysteries, waiting for us to uncover them. So, let's explore the adventure of the world of silicon-based life, where science and imagination meet, and the universe reveals its secrets.[2]

Life as we know it:

Carbon is essential for life on Earth because it is the building block of living things. It forms strong connections with other elements, creating the complex structures needed for life. These structures can be long or branched, providing the foundation for many different molecules in living organisms. Carbon's ability to make various forms of molecules from the same elements increases life's diversity. It's stable and doesn't easily break down, which is crucial for maintaining living systems. Carbon compounds dissolve in water, allowing for important chemical reactions in our bodies. Carbon's reactivity helps with tasks like releasing energy, enabling life processes. DNA, the genetic material of living things, is made up of carbon based molecules and carries our genetic instructions. The variety of carbon compounds, like proteins and carbohydrates, supports the complexity of life. Carbon-based life can adapt and thrive in many environments, making it well suited for our planet's diverse ecosystems.[3]



Fig. 2: Carbon based life

Why is carbon the primary element for life on Earth?

- Carbon is the primary element for life on Earth because of its unique chemical properties. It can form stable and versatile covalent bonds with other carbon atoms and various elements, allowing for the creation of complex and diverse organic molecules essential for life processes.[4]

What makes carbon more suitable for life than other elements?

- Carbon's versatility in bonding and its ability to form long chains and isomers provide the molecular diversity necessary for biological complexity. It also has a stable covalent bond with hydrogen, which is essential for energy storage and transport in living organisms.

Are there other elements that can support life as effectively as carbon?

- While other elements like silicon have been considered as potential alternatives, carbon stands out because of its unique combination of properties. No other element exhibits carbon's level of versatility, stability, and compatibility with water, making it the best candidate for life as we know it.

Could life based on another element, such as silicon, exist on Earth?

- While the idea of silicon-based life has been explored, Earth's conditions and chemistry heavily favour carbon-based life. Silicon, while similar to carbon in some ways, lacks the versatility and stability needed to support complex life forms in our environment.

Life as we do not know it?

- We live in a world where carbon is the main building block but we cannot limit our imagination to carbon-based life only also, our definition of what is habitable and what is not for life might not be true always. If we explore the universe, we might see other elements also forming lives.

Until date, we have tried to look for alien life as carbon based but we might be missing crucial possibilities too. It arises many more important questions like what if the alien life does not need water or oxygen. What if it can withstand incredibly high temperatures or sustain in highly acidic environment? Can life be anything other than carbon-based? Carbon based ?

Yes, there is a possibility of “silicon based” life formation, as we all know chemically silicon behaves similar as carbon. In periodic table, we know that Carbon has a unique property called catenation, which act as the building block of life cycle. [5] Although Silicon has a larger atomic mass than carbon and its bonds are not as strong as carbon. However, in extreme temperatures it can form carbon like bonds. It is to be also noted, that normal organic elements that we find on earth like Hydrogen, Carbon, Nitrogen, Phosphorus, Oxygen and Sulphur may not be present on these extreme conditioned .[6] Moreover, if silicon came in contact with oxygen, it will form Silicon Dioxide or Silicate which is a hard crystalline rock , from which life cannot exist in that state. In some planets, the environment may also be incredibly hot and they might use liquid methane as their elixir of life. As Silicon is one of the most abundantly found element in the universe, recent researches shows that it can be a plausible alternative which we can assume to be a building block for organic alien life.[7]

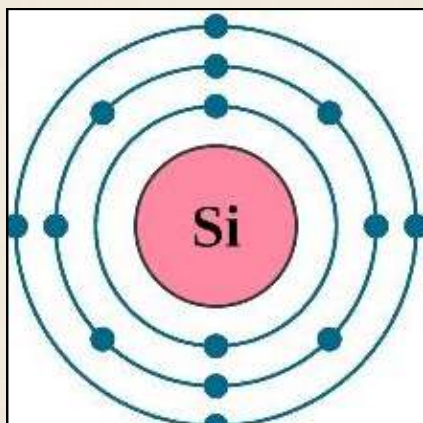


Fig. 3: Silicon

in our solar system, Titan, a moon of Saturn has a possibility of Silicon life existence. There is some few reasons like the surface temperatures, which reaches -197 degree Celsius, and core temperature is 175 degree Celsius. The atmosphere mainly consists of 95% Nitrogen, 5% Methane and 0% free oxygen. Therefore, scientist assumes Titan as a possible candidate for silicon-based life forms. [8]

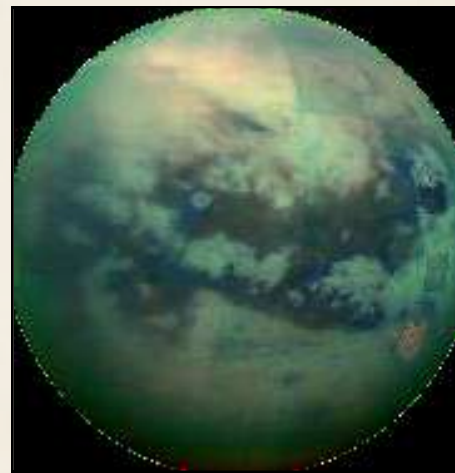


Fig. 4: Titan

Possible Planets where Silicon based life can exit:			
Orbiter	Host	Habitable zone distance (AU)	Potential solvent
Titan	Saturn	0.95 - 1.22	Methane
Kepler-186f	Kepler-186	0.37 - 0.47	Liquid water
TRAPPIST-1e	TRAPPIST-1	0.039 - 0.049	Liquid water
LHS 1140b	LHS 1140	0.09 - 0.11	Liquid water

Table 1: Possible planets where silicon based life can exist

Conclusion:

In summary, while carbon is the foundation of life as we know it on Earth, the possibility of silicon-based life challenges our understanding of habitability in the universe. Silicon's presence in space suggests alternative life forms might exist.[10] Exploring places like Titan raises intriguing prospects for silicon-based life. This quest for diversity in the cosmos reminds

cosmos reminds us to remain open-minded, as we explore the universe's endless mysteries at the intersection of science and imagination.

Observation:

In this extremely fascinating voyage of finding silicon based life, we have ample plausible reasons to believe that silicon based life exists. We might be inches apart from finding remarkable discoveries, which will transform the entire quest for alien life, which encourages us to be optimistic in finding silicon-based life form

In searching of life beyond our imagination, we came to know that there is a hope that silicon based life could exist but we can say that there could be endless possibilities for life to sustain. According to many research papers, our end observation is that silicon-based life can be proved theoretically, but not practically possible for now. However, as per some researcher's observation this imagined alien life might be found some day.

Reference:

[1]https://www.youtube.com/watch?v=4GmGO__75NY

[2]
<https://www.scientificamerican.com/article/could-silicon-be-the-basi/>

[3]
<https://www.nbcnews.com/mach/amp/ncn-a748266>

[4]
<https://www.futurelearn.com/info/courses/the-biology-of-bugs-brains-and-beasts/0/steps/68848>

Silicon [fig 3]

Titan [fig 4]

[5]<http://plutao.sid.inpe.br/col/dpi.inpe.br/plutao@80/2010/06.29.20.11.27/doc/SearchF>

<https://www.indianjournals.com/ijor.aspx?target=ijor:bpasch&volume=41c&issue=1&article=007> [7]

<https://link.springer.com/article/10.1007/s12633-014-9254-7> [8]

<https://www.space.com/6886-exotic-life-sprout-titan-chemistry.html> [9]

<https://www.quora.com/Could-silicon-based-life-technically-survive-on-an-Earth-like-environment> [10]

<https://www.scientificamerican.com/article/could-silicon-be-the-basi/>

[Figure:1]<https://www.google.com/search?q=silicates+in+png&tbm=isch&ved=2ahUKEwiCn5is9MiBAxV5x6ACHXKBD1oQ2-cCegQIABAA&bih=778&biw=1536&client=firefox-b->

[d#vhid=ARDw7aNQE69AAM&vssid=3981:rcQYSDPIffGStM](https://www.google.com/search?q=silicates+in+png&tbm=isch&ved=2ahUKEwiCn5is9MiBAxV5x6ACHXKBD1oQ2-cCegQIABAA&bih=778&biw=1536&client=firefox-b-d#vhid=ARDw7aNQE69AAM&vssid=3981:rcQYSDPIffGStM)

[Figure 1]: <https://tinyurl.com/3snzrncx>

[Figure 3] <https://tinyurl.com/mr9pzk5f>

[Figure 4]

<https://tinyurl.com/byk38ecbd#vhid=ARDw7aNQE69AAM&vssid=3981:rcQYSDPIffGStM>

[Figure 1] : <https://tinyurl.com/3snzrncx>

[Figure 3] <https://tinyurl.com/mr9pzk5f>

[Figure 4] <https://tinyurl.com/byk38ecb>

THANK

Hello Readers!!

I would like to express my heartfelt gratitude to everyone who contributed to the creation and publication of this e-Magazine. It is through the collective effort, support, and inspiration of these individuals that this project has come to fruition.

Lastly, I want to extend my deepest appreciation to the readers who have chosen to embark on this intellectual adventure with us. Your interest and engagement fuel our passion for writing and inspire us to continue exploring new horizons.

You