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EDITORIAL

It is my proud privilege to welcome you all to the Research World International Conference at Berlin, Germany. I am happy to see the papers from all part of the world and some of the best paper published in this proceedings. This proceeding brings out the various Research papers from diverse areas of Science, Engineering, Technology and Management. This platform is intended to provide a platform for researchers, educators and professionals to present their discoveries and innovative practice and to explore future trends and applications in the field Science and Engineering. However, this conference will also provide a forum for dissemination of knowledge on both theoretical and applied research on the above said area with an ultimate aim to bridge the gap between these coherent disciplines of knowledge. Thus the forum accelerates the trend of development of technology for next generation. Our goal is to make the Conference proceedings useful and interesting to audiences involved in research in these areas, as well as to those involved in design, implementation and operation, to achieve the goal.

I once again give thanks to the Institute of Research and Journals, Research World & TheIIER for organizing this event in Berlin, Germany. I am sure the contributions by the authors shall add value to the research community. I also thank all the International Advisory members and Reviewers for making this event a Successful one.

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★★★

ARTIFICIAL INTELLIGENCE MEDIA ART: NEW Era

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Abstract - Significant advances have occurred in artificial intelligence (AI) image generation models over the past year. "AI art" has exhibited great influence in the art industry as works created by AI have won several prestigious art competitions. Currently, barriers toward creating art are crumbling, and anyone can become an artist; AI can be used as a tool for creating art. Accordingly, this paper suggests that AI can serve as a turning point in changing the current paradigm of art by transforming images generated by AI models into works of art.

Keywords - Artificial Intelligence, Media Art

I. INTRODUCTION

The arts have long been considered as unique to humans [1]. Although the shifting paradigms in art have expanded its scope, only humans have been able to express a specific subject or object with images from a different perspective of the world. However, the advent of artificial intelligence (AI) along with developments in technology have made it difficult to continue to believe that art, once considered to be the exclusive domain of humans, belongs to humans alone.

In the last two years, AI image generation models have made remarkable progress, and various opinions regarding them are emerging across the industry. In August 2022, a video game designer's entry won first place in the digital art category at the Colorado State Fair Art Competition. The work in question was created by Midjourney, an AI image generating model; the judges were unaware of this and awarded the prize. The controversy began to intensify when the creator later revealed on social media that the work was generated by an AI model [2].

The emergence of AI image generation models has been perceived as a threat to existing artists, and the negative stance toward AI generation models has become increasingly entrenched with the rise of movements such as "No to AI" [3] at the end of 2022. In this study, we focused on a positive direction toward the use of AI generated models. Through New Era, which consists of the products of an AI image generation model, we seek to discuss AI art.

II. WORK PRODUCTION

New Era was created using Disco Diffusion [4], one of the most popular text-to-image models. This model was selected because it can output sequence images and images of various styles in one image. AI image generating models generate images of different styles depending on the dataset, algorithm, and function used for training. Moreover, the user can adjust parameter values to change styles. Disco Diffusion requires users to perform a total of four steps: setting values for AI models, setting animations, inputting text prompts, and the outputlisted in fig.1. After entering the desired resolution, the AI model inputs the step value to produce a detailed result by taking the output image through several steps. The default value is set at 250 and a value between 250 and 300 provides ideal details, but if it exceeds beyond 260 step value, adding further details becomes meaningless. Cutn_batch is an integer value in which details are input by cutting the output image a certain number of times. For example, If the integer value is 2, cuts in half of the resolution and add details by each so the Disco Diffusion can put more details in to the image. A higher value results in a higher video quality; however, video random access memory usage increases as well. Values from 4 to 8 take a reasonable amount of time which is depending on users, and the output details were also of a value that was not disappointing. Showing on fig.2, the value of 6 showed more excellent details than 1. Subsequently, the Range Scale, TV_Scale, and Sat_Scale values set the color domain of the output image; the lower these values, the more limited the colors used by the model; however, when the values were too high, the colors invaded the image and normal results could not be obtained. The recommended range of Range Scale and Sat_Scale values are 1000 to 5000, TV_Scale is recommended in 1 to 10. In addition, the original image or video to apply the input text prompt can be used as a kind of sketch, allowing the user to break down the desired screen composition and details within the output image.

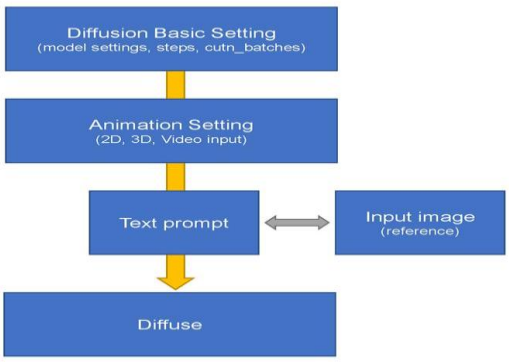

Fig. 1 : the process of Disco Diffusion

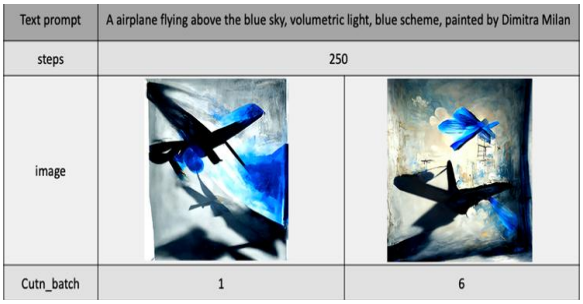

Fig. 2 : Detail compared by Cutn_batch integer value

Three animation modes—two dimensional (2D), three dimensional (3D) and video input—can be selected for animation settings to set the value in the format of the image rather than a single image. The 2D mode can impart planar motion on the screen, whereas the 3D mode can apply dynamic screen motions, such as rotation. Video input is determined by the presence of the video that the user has previously input. In this case, because the screen motion is taken from the video, a separate value setting is not required. Coherency settings, which set the consistency for front and rear frames, are divided into 10 unit values from 40 to 80. The higher the value, the higher the association of each frame; however, adding new details becomes increasingly difficult.

When the basic AI image generation model setting is completed, the output image is input through the text prompt. Users can freely write text using their imagination, and satisfying images can be produced when the text pertains to the strengths of Disco Diffusion shown in fig.4. The strength of Disco Diffusion are 'landscape, portrait, single subject, and abstract stuff'. In New Era, the prompt was written specifying the highest quality and detailed detail values were provided for all text prompts. Using the prompt "8K resolution photorealistic conceptual art, immaculate highly detailed render," Disco Diffusionwas provided the maximum quality and every detail that it could derive. Conversely, testing how different the quality, detail, and similarity of the written prompt would be compared with the result when the user entered all the details was necessary. The resulting prompt is "symmetrical features, ominous, magical realism, texture, intricate, ornate, royally decorated, skull, skeleton, whirling smoke, embers, red adornments, red torn fabric, radiant colors, fantasy, volumetric lighting, micro details, 3D sculpture, ray tracing, 8k." By dividing all items such as form, props, and lighting, a text prompt that was closely related to the expected result by the user was created and input. In addition, the text value regarding how a specific word or value will be drawn in which style was also created in various ways. In this case, several paintings by various artists were borrowed. For example, images are derived in van Gogh's style through a prompt such as "detailed by Vincent van Gogh." compared in the fig.3. Thus, including various artists names such as Yoshitaka Amano, JohfraBosschart, Thomas Kinkade, Ellen Jewett, Tomasz Alen Kopera, and Justin Gerard were input.Disco Diffusion does not search the web data for images. But, the neural networks that Disco Diffusion uses were trained by images and captions.

Fig. 3 : Comparsion of orginal painting and Disco Diffusion image

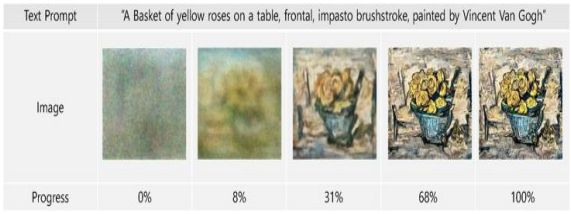

Fig. 4 : Progress of Disco Diffusion

When 2D, 3D, or video input was used for animation mode instead of none, the text prompt can be applied to each section while writing it by dividing the frame section of the output video. This not only expands the user's choice by outputting more colorful styles and frames but also increases the ease of defining specific frame sections to obtain results close to the user's intention. However, an excessively long frame section setting is influenced by the coherency setting as discussed above, leading to a gradual decrease in distance from the first frame. Therefore, distributing the details of the user's appropriate coherency setting and text prompt according to the frame section is recommended.

III. ARTWORK EXHIBITION

New Era is scheduled to be exhibited online at the Advanced International Film Festival (AIFF) hosted by Chung-Ang University's Graduate School of Advanced Imaging Science, Multimedia and Film from November 3 2022 to October 31, 2023, and can be viewed on the AIFF website, www.aiif.com.

IV. CONCLUSION

Recently, negative views on AI art have become predominant. New Era focuses on the positive aspects of AI art in accordance with the changing paradigm of art. AI art is distinguished from the process with a certain type of algorithm wherein humans create art but has created works of art through a similar process. We sought to provide an opportunity to look forward to the development and various possibilities of an AI

artist who can collaborate with humans.

The Disco Diffusion Model used to produce the work in this research paper is an image generation model capable of sequence images, and images were generated by finely adjusting several parameter values. An image close to the artist's intentions can be obtained with a more detailed the explanation on the prompt. However, there were some difficulties in producing the work. Although several prompts were input, the results for some could not be derived. It appears that the model was not proficient in expressing figures, multiple objects, and light tone colors. Thus, the obtained result was difficult to use as the author had intended.

In the case of DALLE2, another AI image generation model, further modification of images generated through the outpainting function is possible [5], suggesting that usability can be expanded in combination with existing digital content creation tools. Future research will explore the expansion of the usability of AI image generation models and will conduct projects under the theme of collaborative use with other tools.

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CROSSING THE BOUNDARY OF HUMANITY: A POST HUMAN READING OF CINDER BY MARISSA MEYER

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Abstract - The focus of this research is the post human subject and discourse as represented by Marissa Meyer's work Cinder. This study will contribute to the theory of Post humanism and its growing prominence. It explores the post human discourse and the ways of looking at the post human and the possible implications that come from a future of scientific and technological advancements. The findings from this research provide evidence that the novel explores different representations of the posthuman. A hierarchy is created with the Lunars at the top; followed by Humans, Cyborgs, and Androids. Lunars are an example of genetically evolved humans. Cinder is a good example of a post human subject of the cyborg, who starts as an underprivileged citizen, cyborg, and an heir to the Lunar throne resulting in challenging anthropocentricism and stressing out the position of the cyborg in a post human world. Lunars and Androids offer an insight into possible states of being. This hierarchy is deconstructed by examining different representations of the post human.

Keywords – Post human, Cyborg, Anthropocentricism, Hybridity

I. INTRODUCTION

This paper aims at exploring the posthuman subject and posthuman discourse in Melissa Meyer's novel Cinder. Cinder is the first installment in Meyer's quartetThe Lunar Chronicles, in which she introduces a futuristic world where the human struggles against the evolved posthuman. She explores a future where prosthetics are perfected, leading to stronger humans. She also explores power relations and class discrimination in a world where the question of when the human crosses the boundary of humanity is the dominating theme. The choice to work on this paper is triggered by an enthusiasm to examine Posthumanism. The novelist does a good job in building the posthuman world. The characters are well developed. Each installment further develops the characters and answers questions of equality and humanity of the cyborgs and lunars. Posthumanism is a relatively new field that appeared by the end of the 1990s and early 2000s. In her paper "Posthumanism, Transhumanism, Antihumanism, Metahumanism, and New Materialisms Differences and Relations", Francesca Ferrando clarifies that the first recorded use of the term posthuman is found in postmodern literature, specifically in Ihab Habib Hassan's "Prometheus as Performer: Toward a Posthumanist Culture?" and Ihab Habib Hassan's The Postmodern Turn: Essays in Postmodern Theory and Culture. (Ferrando 26-27) She argues that the term Posthumanism has created a methodological and theoretical confusion. According to her, the term is a generic term under which many perspectives fall. She states: Posthuman has become an umbrella term to include (philosophical, cultural, and critical) Posthumanism, transhumanism (in its variants as extropianism, liberal and democratic transhumanism, among other currents), new materialisms (a specific feminist development within the posthumanist frame), and the heterogeneous landscapes of antihumanism, posthumanities, and metahumanities. (26)

Posthumanism does not disregard humanism entirely, but rather challenges the view that man is superior to other beings. It focuses on the subject of the cyborg, whose very existence challenges the traditional qualities associated with the basic definition of the human as composed of biological matter, tissue and flesh, and as a part of nature. Many theorists debated the use of the word 'post' with humanism as they wonder how can we be post human, and the possibility of being posthuman while maintaining the qualities of autonomy and individuality. Nevertheless, Posthumanism rejects aggression against the nonhuman. It operates within the frame of Jacques Derrida's deconstruction as well as feminism. Post humanism rejects human exptionalism and instrumentalism (The view that humans should control the natural world). It regards the human as "co-evolving, as sharing eco-systems, life processes and genetic material, with animals and other life forms."(Nayar 8) the human is situated in an environment where he co-exists and interacts with plants, animals, and machines. Hence, the human state is a result to the exposure to other life forms in the environment. Donna Haraway argues that we have always been posthuman as we have always existed alongside animals "as fellow creatures" (Wolfe qtd. in Bertes et al 101) Kathrine Hayles refers to HnasMoravec's test in the prologue of her book How We Became Posthuman. She comments that Moravec's test suggests that the human identity is made up of informational pattern rather than an embodied enaction. In other words, since the human consciousness is made up of informational patterns, it can be downloaded to a computer. Therefore, the machine acts as a depository of human consciousness. What matters here is not the human, the machine, or the cyborg. What matters is consciousness. Other

prominent figures like Neil Badmington criticized the notion of downloading consciousness onto computers. (Roden 9) An intriguing example of how consciousness could be downloaded in another entity can be found in Get Out (2017), a film directed by Jordan Peele, where consciousness is downloaded in another body through brain transplant and hypnosis. The question is ifconsciousness can be downloads into machines, why not other humans?

Badmington introduced alternative Posthumanism, which deconstructs humanism from within by examining its tensions and concepts. However, the issue with Badminton's analysis is that it combines two types of futuristic assumptions: one is related to Transhumanism – that we should try to enhance the human abilities through technology, and the other is Speculative Posthumanism, which regards the posthuman as endangered species due to technology and are no longer humans. While the former hold ethical claims to enhance through technology, the latter does not regard Posthumanism as an improvement of the human. (Roden 9)

Posthumanism also regards technology as integral to the human identity. So, as a philosophical approach, it reinvestigates the idea of subjectivity. It views subjectivity as co-evolving with machines and animals. Posthumanism connects and challenges the traditional anthropocentricism of humanism and race, gender, and animal studies. Critical Posthumanism traces the origin of said issues to the inclusive definition of the human. It attempts to reexamine the human. In addition to the inclusive definition of humanism, Posthumanism investigates the subjectivity, which allowed the categorization of life forms into categories. Critical Posthumanism adopts from biology, cognitive sciences, and philosophy and sees the complex system of the human and its cognitive processes and consciousness as a consequence to "its openness to the environment." The human is" multispecies" who survived due to the symbiotic relations with multiple forms of life. So, the determining conditions of Posthumanism are coevolution, symbiosis, and feedback rather than autonomy, competition, and isolation. (Nayar 8-9) This is in line with N. Kathrine Hayles' notion that our intelligence is coproduced with the machines we work with. (Qtd. in Bertens 218)

Posthumanism aims to deconstruct the human /machine binary opposition where the boundary is crossed. Donna Haraway tackles the consciousness and the material body of the cyborg. In her widely recognized essay 'A Cyborg Manifesto: Science, Technology, and Socialist- Feminism in the Late Twentieth Century' (1985)[1] She demonstrates that a cyborg is in fact a combination of cybernetic and organism – a hybrid that is neither fully human nor fully machine. She argues that we are all cyborgs - figuratively or literally, 'We are all chimeras, theorized and fabricated hybrids of machine and organism. In short, we are all cyborgs' (Haraway 150) On the other hand, for N. Kathrine Hayles, Posthumanismis connected to the use of intelligent technology that becomes a part of our own intelligence. She focuses on how informational patterns develop through interaction with the nonhuman. The quality of the interaction with the nonhuman as well as the medium through which knowledge and skills are acquired make us posthuman. Hayles goes as far as to say that reading electronic texts makes the reader a cyborg, so by her definition, we are all posthuman. She describes the posthuman subject as "an amalgam, a collection of heterogeneous components', a material – informational entity whose boundaries undergo continuous construction and reconstruction." (3) In her book, she researches the history of cybernetics through scientific and literary texts. She examines how information came to be considered a disembodied entity. According to her, matter and information are not separate.

Many literary texts introduce bodies that cross boundaries of gender, species, race, and consciousness. Cinder crosses most of these boundaries. She is a female, posthuman, Lunar, and cyborg. In his book Posthumanism, Paramod K. Nayar deeply discusses Posthumanism, the posthuman subject, the cultural representation and the philosophical and political questions of the posthuman. According to Nayar, critical Posthumanismis: "The radical decentering of the traditional sovereign, coherent and autonomous human in order to demonstrate how the human is always already evolving with, constituted by and constitutive of multiple forms of life and machines."(2) Nayar points out that advancements in science and medicine blur the boundaries between man, animal, and machine resulting in a new organism. . Humans are subjected to bodily modifications and enhancements, which make them not fully human. So, the question is whether these humans who are in many occasions supported by technology and function day to day through technology be regarded as fully humans. Some scientists claim that our physiology is changing due to technology. Maybe it will produce better humans. The novel presets a future where both nature and technology play a part in the human revolution. The change in Cinder, the main character, is technological but in Lunars, it is biological. Nayar tries to explain the term under two frames. First, it might simply refer

[1]The Essay is published in Donna Haraway's Book *Simians, Cyborgs, and Women: The Reinvention of Nature* (1991)

to the ontological condition where many humans live with bodies that are modified chemically, surgically, or technologically; in addition to machines or other organic forms. Second, it looks at how the cultural representation, power relations and discourses place the human as superior to other life forms. Humans, then, are regarded as hybridized life forms from a philosophical, political, and cultural perspective. (3) Stefan Hebrechter defines Posthumanism in his book Posthumanism: A Critical Analysis as a "cultural malaise or euphoria" that results from considering the idea of post-anthropocentricism, and the ability to consider "the end of the human" without giving it a sense of "transcendence" or "apocalyptic mysticism." It is the ability to envision a future of post-humanity without a sense of doom. (8)

According to him, Posthumanism should not be looked at as after humanism but as a deconstruction of humanism. So, in his words, we need a Posthumanism that is "not post-human but post-human (ist)." He advocates for a Posthumanism which looks at the posthuman from historical not ideological effects (12). In contrast, he illustrates what Jean-Francois Lyotard points out in his bookPostmodern Fables(1997) the possibility of transformation through technological evolution by the time the solar system is dying. (9) So, Lyotard sees the posthuman condition as a necessity for survival in a changing environment. However, he does not specify whether the human will survive or the human brain. However, technology and the Lyotardian concept could be the way to achieve that.

In Postmodern Fables, Lyotard speaks of whatever is called human at that time, and whether it is eventual or obligatory .There are satellites launched into space, spaceships are being built today, and humans are aware that there will be a time when the sun explodes. So, the focus is on their survival in such an environment. According to Lyotard, the survival of the brain itself might be in the form of human or a cyborg or something that is entirely different. It is unclear.However, he stresses out that they will eventually survive, they have to do it. (84) This notion is explored in the novel by introducing the idea of Lunars, the evolved humans who developed the ability to manipulate bioelectricity due to exposure to sun rays. They survived through physical mutation. In her world, the sun does not explode but does contribute to the evolution of Homo sapiens. Whether this depiction is scientifically possible or not and the extent of this mutation remain a subject for debate.

The first Lunar was Cyprus Blackburn, whose DNA was damaged due to prolonged sun exposure.[2] As a result, he was able to implant ideas in other people's minds. This gene was found in the royal bloodline only, but due to the many illegitimate children, it spread. However, it remains resilient in the royal bloodline. Another mutation appeared which cannot send or respond to bioelectric manipulation. They are referred to as Shells, which is a derogatory term. This has led to their marginalization and exploitation. The government treats them as test subjects and views them as unable to feel and respond to human emotions. They are shunned due to their lack of this gene not their humanity. This could be the next challenge facing these posthumans. All is not bad for shells as they are not prone to bioelectrical manipulation. Having this ability is dangerous as the queen uses it to control her people, so they are ostracized and loathed. Lunars are dependent on Earth for resources. It is the main reason which drives

Queen Levana to give permission to establish a genetically modified army in order to conquer Earth and use its resources.[3] She also allows the Shells, carriers of Letumosis, to escape to earth in order to spread the disease. She has the cure and uses it to force emperor Kai to marry her.The concept of mutation has been used in film and fiction throughout the years to explore different scenarios as to how mutation might come to be. The X-Men[4]franchise explores the concept of genetic mutation both through genetic engineering and genetic mutation. The film The Fly (1986) depicts a scientist whose genes merge into a fly's, and he turns into one. Spider-Man (2002) shows a young man whom a genetically engineered spider in a genetic laboratory bit. All these movies provide a scenario where humans physically cross the boundary of humanitythrough genetic mutation or genetic engineering. Lunars managed to survive on the moon through genetic mutation.

Cinder is not the only novel which necessitate physical removal of the human beings from Earth in order for the physical mutation to occur. In The Knife of Never Letting Go, Patrick Ness presents a planet called New World, which humans colonized. The events echo to some extent the European immigrants who colonized America and oppressed the natives. Humans seem to do the same thing in New World. Humans oppress and marginalize the Spackle, the humanoid natives of New World. Although it is not presented as a favorable trait, males developed the capacity to communicate through Noise. Anyhow, in both cases, mutation resulted in oppression and supremacy of the race. There are instances when the future of humanity is not portrayed in conjunction

[2] Marissa Meyer provides the history of the Lunars in her official website http://www.marissameyer.com/extras/lunar-extras/

[3] Levana sends her genetically modified army to earth in the second novel *Scarlet*.

[4]Based on the American comic books published by Marvel.

with technological advances. There are instances where the opposite scenario prevails.

Ahmad Khalid Tawfeeq depicts in his book Like Icarus a future where humanity has physically and morally degraded. The roles are reverse. There are giant cockroaches inhibiting the surface of the earth and feed on humans while humans retreated to nature and abandoned civilization. humanshave lost the ability to communicate through language. They howl and shout. Their first priority is survival. In the novel, Mahmood Alsamnoodi has gained the knowledge of the past and the future and is plagued by this knowledge. By taking a glimpse of the future, he is faced by a scene where humans are trying to hide from the giant cockroaches and the baby is crying in his mother's arms:

The baby is still crying. The cockroaches will feel his screams. They possess a very sensitive nervous system. This thing must shut up. The mother has no choice but to hold the baby by his feet and smash his head against the rocks. Now, it is quite. Such a wise decision; she knows it is not precious. She could get another one from any other male at any time as long her uterus remains intact. (218)[5]In Cinder's world, as in ours, there is constant interaction with intelligent machines. Cinder's best friend is an Android-Iko. It is an Android with artificial intelligence, desire, and imagination. This alone questions the anthropocentric stand of traditional humanism. There are also less intelligent Androids in the lunar chronicles world, which are more machine- like than Iko. Iko seems to display human's ability to form bonds and establish relations. It has preferences and a sense of humor. Iko is an artificially conscious machine.[6]

Cinder is a retelling of the classic folktale Cinderella. She is a cyborg living in a futuristic New Beijing and operates a mechanic booth. She is under the guardianship of her foster mother, LinhAdri. After World War IV, the world is governed by the union of six countries, and it is suffering from an outbreak of letmosis, a cureless disease of seemingly unknown origin. In this world, Cyborgs are treated as second-class citizens. Lunars are genetically evolved humans who colonize the moon, a figurative and physical detachment from earth. They possess the ability to manipulate bioelectricity. It is believed that Lunars who escaped to earth were the carriers of the virus. It does not affect their bodies but onlyearthern human beings. Letmosis, also known as the blue fever, is manufactured by the Lunar government under the consent of queen Levana in order to weaken and conquer the earthen countries.[7] Cinder's stepsister, Peony, falls victim to it. The emperor and empress of the eastern commonwealth die of Letmosis as well.

The novel starts by introducing the posthuman subject and protagonist of the novel Cinder. She is introduced as a cyborg replacing her prosthetic foot. The novel also ends with her losing her prosthetic foot, which is when Cinderella loses her glass slipper. Her leg and arm are mechanical, which sets forth the posthuman atmosphere of the novel. Cinder meets Prince Kai in the booth. He brings his android to be fixed. Cinder is not forthcoming about her cyborg nature with him and tries to hide it throughout the novel. The novel ends with Cinder setting of in her journey to reclaim her throne and rid the world from the tyranny of Queen Levana. In this novel, Cinder undergoes triple oppression as a cyborg, a female, and a lunar.

In a world where dystopian literature thrives, fairytales retellings rise to the surface. Most of these retellings feature young women. Jill Elizabeth Coste examines fairytale tropes in contemporary YA dystopian literature. Coste examines in her thesis "Horror and Hope: Fairy Tale Tropes in Contemporary Young Adult Dystopian Literature "how fairytales function within a post-apocalyptic world, and how, when introduced with dystopian literature, they prove to be a fertile ground for subversion. Her thesis examines how Marissa Meyer's retelling of Cinderella reflects a postmodern role model for contemporary young women. Cinder is a cyborg who operates a booth and the sole bread winner of the family. Cinder's booth is the main source of income. She functions with the aid of technology. It puts her in an advantageous position in a world which technology is an inseparable part of. Coste also notes how Cinder deconstructs the passive feminine archetype: The Cinderella character, Cinder, in Meyer's novel embodies this modern-day approach to femininity. Gone is the passive archetype who waits for her prince and takes abuse with endless good grace. In her place is a savvy, sharp, and sarcastic heroine who works in the traditionally unfeminine position of mechanic. (32)

Cinder's difference becomes her source of power. She is only able to go on her journey and overcome obstacles with the aid of her modifications. Her seeming vulnerability becomes her leverage.

In a study titled "The Adolescent Female Body in Mythopoetic YA Fantasy", Leah Beth Philips discusses the female adolescent body, and how in the Young Adult literature, especially in the books of Tolkien, Pierce Tortell, and Meyer, the focus is not on identity formation, as in most YA novels, but more on the embodied subjectivities as they provide a way of perceiving the self in relation to the body and the others. YAL that is concerned with Posthumanism is a very rich field, particularly Cinder's cybernetic body. These bodies, "glamoured", shapeshifting,

[5]Translation mine.

[6]Artificial consciousness entails an ethical dimension. For more information, see *Machine Ethics* by Michael Anderson,Susan Leigh Anderson(2011)

[7]The backstory is provided in *Fairest*, the Prequel to the quartet

cross-dressing, reject the established parameters and indicate qualities of multiplicity and change. (60-61) Philips points out how these types of bodies offer "an alternative discursive space-the secondary world- in which bodily instability becomes not just possible but also empowering."(65) Whereas Philips' study looks at the adolescent body and the embodied subjectivities, this research embarks on a Posthuman quest to understand the representations in Cinder of the posthuman subject. To sum up, Cinder introduces a posthuman world in which androids and cyborgs exist as a part of society but are regarded with discrimination. Lunars are the next stage in human evolution and scientific advancement. Cinder is the rightful heir to the throne despite being a cyborg. Being a cyborg does not root out humanity. It is a state of existence that is to be expected and accepted in the postmodern world. Although Cinder explores themes of identity formation and subversion, Cinder explores different representations of the posthuman. This research reinforces the Posthumanity of Cinder, and adds to the existing research by exploring the different representations of the posthuman thatare embodied through Cinder, humans, the Lunars, and Androids.

II. THE POSTHUMAN SUBJECT

A. Characterization

The eponymous heroine is a strong character living in a futuristic New Beijing. She is the adopted child of LinhGaran. She undergoes extensive surgery to save her life, but she loses both an arm and a leg as well as severe damage to her nervous system, which is salvaged by Garan. As a result, she is provided with prosthetic limbs as well as bodily modifications.

The story opens with Cinder in her mechanic booth. The booth is a reflection of her, it is not approached by people which reflects her ostracizing. She is replacing her prosthetic foot, which is a very good way of introducing cinder as a post human subject: "The screw through her ankle had rusted"(Cinder 3). The language used in the first few paragraphs makes the reader conscious of the artificiality of cinder's body and world: "Cinder gripped her heel and yanked the foot from its socket. A spark singed her fingertips and she jerked away, leaving the foot to dangle from a tangle of red and yellow wires."(3) The fact that she is a mechanic gives her agency and control over her own body. She does not need to let someone else observe or examine her body. However, this is not the case throughout the novel as she is taken as a subject in the cyborg draft. Cyborgs are treatedinhumanely and are subject to testing in the novel.

Cinder's booth does not have a sign. However, one can identify her trade by looking at it. This reflects her own identity in the beginning of the novel. The reader has no idea who she is, not her name, age, or ethnicity. The only thing the reader notices about her is her cyborgian nature, her Posthumanity, and her otherness. She is a subject of discrimination and dismay. This is clearly the case as the baker, Sacha, warns her son, Sunto, not to play so close to Cinder. The public discriminates against cyborgs, and so does the government. Cinder tries to hide the fact that she is a cyborg: "the fewer people who knew she was a cyborg the better" (10). However, she is not considered to be a weak character as she stands up for herself and puts up with the abuse from her stepmother and sister.

Cinder takes good care of herself. In a discussion with Iko, she reveals that she would rather spend money on something useful to her rather than a dress. She even considers getting skin grafting to hide her prostatic parts. (P31) Cinder interacts with humans, cyborgs, Lunars, and Androids. She is generally met with discrimination in the first novel except by Prince Kai. However, all is not well when shee turns out to be a cyborg and a Lunar. Her stepmother volunteers her for the plague research. The stepmother detests Cinder and blames her for every hardship that afflicts the family. She is taken for the cyborg draft and injected with Letmosis. But she proves to be immune to the virus. The leading scientist, Dr. Dimitri Erland, begins to investigate her immunity, physical alterations and history. Cinder has a sarcastic sense of humor. She answers Dr. Erland's question regarding her lack of tear duct:" What? Really? And I thought I was just emotionally withdrawn."(117) The layers of her identity unfold as the plot progresses, and the reader comes to understand and sympathize with her.

Cinder grows up in a house that regards her as an object. Her stepmother and one of her stepsisters hate her regardless of the fact that she is the sole provider of the family. The money she makes is her stepmother's money not hers. She has no rights as a human. This is further supported by the government who also regard cyborgs as half humans, therefore; they do not enjoy equal rights. The only person in her family who genuinely likes her and considers her a member of the family is her stepsister Peony. She does get jealous of her sisters sometimes: She was usually able to ignore the jealousy she had toward her stepsisters- how Adri doted on them, how soft their hands were- especially when peony was the only human friend she had. But she could not swallow the twitch of envy at seeing Peony in that dress. (Cinder 35)

On the other hand, Lunars seem good-looking yet cold and cruel. Their power has made them arrogant. They feel superior to the human race: "Their unnatural power has made them a greedy and violent race." (43) Levana is portrayed as breathtakingly beautiful due to her glamour. The fact that Lunars manipulate the way they are perceived makes them not trustworthy. When Levana reaches earth for the peace alliance discussion, her breathtaking beauty seems foreign and strange to Kai. Hardly anyone is naturally that beautiful: She was indeed beautiful, as

if someone had taken the scientific measurements of perfection and use them to mold a single ideal specimen. Her face was slightly heart-shaped, with high cheekbones barely flushed. Auburn hair fell in silken ringlets to her waist and her unblemished ivory skin shimmered like mother- of- pearl in the sunshine. Her lips were red redred , looking like she's ust drunk a pint of blood. A chill shook kai from the inside out. She was unnatural. (184) She is ready to do whatever it takes to reach her goal of conquering earth even if she transgresses moral norms and principles. Levana insists on a marriage alliance with prince kai after the death of his father only as a way to control the Commonwealth She abhors androids, mirrors and reflective surfaces as they do not reflect glamour and show her disfigured body. Her ability only affects humans. That is why she refuses to be greeted by the press for fear of exposure when she reaches earth. She is easily irritated. At the dining hall, someone left a small mirror in her plate. She takes it out on the servant. She addresses the servant as if she is a superior being: "Speak you disgusting Earthen! How dare you insult me?" (270) she then asks Sybil Mira, her head thaumaturage and ambassador, to punish the servant. She does not care to be fair as long as her orders are followed. Her cruelty allows her to make the servant carry out her own punishment: "The servant's hands trembled and slowly lifted the knife until the glistening edge was poised at the corner of her eye. "No", she whimpered. "Please." (271) She is far from mercifulness and compassion. The servant was only saved by Kai's claim that he did it as a friendly joke.

At the annual ball, everything is revealed regarding Cinder's Cyborgian and Lunar nature. She is arrested for trying to kill Levana. Levana's head thaumaturge, Sybil Mira, is a faithful subject who obeys her every command. She seems to be naturally beautiful:"…with waist length black hair and warm, honeyed skin." (108) she does not hold back from using her ability even on emperor Kai:" her image seems to shudder before him like a mirage. Whispers filled his head…" (109) she also hardly ever displays any emotion. In fact, she carries out Levana's plans immediately; no questions are asked. And she is very faithful to her. Humans constantly interact through netscreen and port screens. Netscreenare used to transmit videos and sound. They also project holographic images. A port screen is a gadget which sends and receives comms as well as access the internet and other apps. Technology is advanced ,and it is an integral part in the Lunar Chronicles' world. By Hayles definition, this alone would make them posthuman.

B. The Post human Body and Hybridity

When we think of Posthumanism, we inevitably discuss the issue of hybridity, and hybridity is used here both to refer to a person whose background is the blend of two diverse cultures and traditions and the result of two species merging as Cinder is both Lunar (Lunar and Earthen identity) and a Cyborg. This crossing of species, namely man and machine, results in the posthuman body. Posthumanismis built around the subject of the body and bodily modifications as well as the use of technology. N. Kathrine Hayles explains in How We Became Posthuman: Central to the construction of the cyborg are informational pathways connecting the organic body to its prosthetic extensions. This presumes a conception of information as a (disembodied) entity that can flow between carbon-based organic components and silicon-based electronic components to make protein and silicon operate as a Single system.(2)

We are dealing here with an organic entity that is connected to – or interacts with- inorganic mechanism. The fusion of the two transcends the boundaries of gender, class, and race. She points out a flaw in the loop that is created in the process by clarifying that information could be accessed as it flows between the two.

She adds that our bodies are the original prostheses we all learn to manipulate. (3) If we accept the fact that the human consciousness is separate from the organic body, then this particular statement makes perfect sense. Humans take time to learn how to control their bodies. Similarly, Individuals who undergo surgery to replace a body part need time to adjust. After that, it becomes so integral to the body that it regards it as a natural part of it. Cinder's body is no exception.

Cinder's posthuman body makes her a target for discrimination. It is treated as an object and the fact that someone could claim ownership of her speaks volumes. Society despises her for her body. It is exposed to examination and the subject of fascination with disregard to her humanity and emotions. The machine and flesh intertwine:" The girl's hands and wrists had been fastened with metal bands, her left hand was steel, tarnished and dark between the joints as if it needed a good cleaning. Her pant legs had been rolled up her calves, revealing one human leg and one synthetic."(47) The lab makes her face her cyborgian nature heads on. It allows her to see herself not as self, but as other as well. "She was not looking at a girl in the mirror. She was looking at a machine." (78) She is stripped bare to her cybernetic composition and made to face it. The following scene is one of the most emotionally intense for her:

Her heart galloped as the android undid the latch in the back of her head…two metal prongs being inserted into her control panel-her brain….her retina display informed her that she was now connected to Ratio detector 2.3. … (80) She is faced with the reality that this has been done to her as a child: "Someone had altered her brain. Someone had altered her… Someone was in her head. Inside her. An invasion. A violation. She tried to jerk away, but the

android held her firm."(80-81) Her feelings afterwards are those of violation; as if she is experiencing the psychological effects of rape: "Cinder lay trembling, her heart crushed against her ribcage. The med-droid didn't bother to close the panel in the back of her head."(81) It is a feeling of exposure. Cinder views her cybernetic modifications as a part of her identity and an extension of her body, which is clearly not what society or at least the physicians think.

Cinder does not emotionally distinguish between her human and cybernetic makeup. She sees them as a whole. There are occasions when she is ashamed of it like when the prince knows of her condition; otherwise, she seems to accept it. Her external struggle is the reason behind her internal conflict. Displayed on a netscreen on a wall are her ID number and a holographic diagram of her body. It looked like an image from a medical text book. Her body as well as the modifications are described side by side: "Her heart, her brain, her intestines, her muscles, her blue veins. Her control panel, her synthetic hand and leg, wires that trailed from the base of her skull all the way down her spine."(82) The realization of her artificial parts hits her: "She was 36.28 percent not human."(82) The assistant, Fatten, talks about Cinder as if she is a machine and her modifications could be sold as spare parts. She comments on Cinder's control panel: "The sales from her control panel alone will cover the family payoff."(87). Once again, her prosthesis are not regarded as a natural extension of her body. Unlike what Hayles believes regarding the posthuman: The posthuman view thinks of the body as the original prosthesis we all learn to manipulate, so that extending or replacing the body with other prostheses becomes a continuation of a process that began before we were born. (3)

Cinder has a chip plugged into her nervous system to suppress her lunar gift so that she could hide from Queen Levana. Dr. Dmitri, who knows about Cinder's secret identity, tries to hide this from his assistant, by telling her that her nervous system has experienced traumatic damage. This chip is Garran's prototype.

After Dr. Erland admires the complexity of the work on Cinder's body, he comments that:" Your reproductive system is almost untouched. You know, lots of female cyborgs are left infertile because of the invasive procedures."(116) Maintaining her ability to reproduce is crucial for her role as the future sovereign of Luna as she is expected to produce an heir to the throne. It would also allow her to wed emperor Kai in the future. This greatly threatens Queen Levana as she wants her bloodline to rule.

She is also incapable of blushing as her brain regularly balances her temperature and hormone levels and forces her to cool down if she gets warm too fast. There are two chambers in her heart which are made of silicon mixed with bio tissue. She could view any discrepancy and detect lies through her retina display. She is also able to access the internet and view news feed. Diagnostic test can be displayed as well. It usually shows as a green light at the base of her pupil. It is the perfect combination of body and machine.

Adri clearly does not acknowledge her humanity and regard her as an abomination. She condemns her for her outward appearance. Linh-Adri treats Cinder as the cause of her misfortune, and she is disgusted by her. Adri does not believe that Cinder is capable of compassion and processing human emotions. She asks her before she volunteers her for the plague research:" Do your kind even know what love is? Can you feel anything at all, or is it just…programmed?" (63) She clearly expresses that even though her husband has adopted Cinder, she neverwanted her. She says:

It has been five years since you became a part of this household, Cinder. Five years since Garan left you to me. I still don't know why he felt obligated to travel to Europe, of all places, to find some… mutant to take care of. He never explained to me. Perhaps he would have someday. But I never wanted you. You Know that. (64) Adri defines humans in terms of their natural bodies and qualities: "No Cinder, Humans cry."(279) It is a reductive, discriminatory, anthropocentric remark. From a Posthumanist perspective, the body, whether organic or inorganic, is not necessarily an indicative of a person's humanity.

Cinder is constantly worried about Kai finding out that she is a cyborg. She hides it from him. Dr. Dmitri Erland picks up on this and tells Kai when he takes Cinder to him after fainting:" Miss Linh was complaining of a bothersome pain in her neck."(123) she is also worried about him seeing the holographic image of her body: "A girl. A machine. A freak."(126) She is an orphan girl; a cyborg orphan girl. And soon to be ostracized for more. Moreover, she hides her synthetic limbs when she runs into him. She is afraid of how she will be perceived.

When Cinder meets Kai she tries to hide he limbs:" …checking that her left glove was pulled over her wrist. ."(156) she tensed when Kai reached for her hand in Dr. Erland's office: "Cinder tensed, terrified that he would feel the hard metal even through her gloves…she mentally urged the robotic limb to go soft, to be pliant, to be human."(163) Steel and wires are inorganic parts, thus regarded as evil in the cyborghuman binary of Meyer's world.

Cinder wonders if a person's identity could be stolen as she listens to the doctor's explanation of how ID chips are stolen from the deceased patients and sold. This is ironic as her own identity as a Lunar and a princess is stolen by her aunt, Queen Levana, and replaced by her identity as a cyborg and an orphan, and later a fugitive. The revelation of her Lunar nature took her by surprise: "I'm not Lunar"…"I'm cyborg. You don't think that's bad enough."(176) "To

be Cyborg and Lunar, one was enough to make her a mutant, an outcast, but to be both."(175) When Species Meet(2008)focuses on companion animals. It is represented by Haraway's dog. However, it includes all nonhuman companions. The companion species relate the human to the nonhuman and blurs the boundary between them. Through their interaction, we can understand the evolution of our culture. Iko exists as a companion specie in the novel. Her relationship with Cinder mimics the master/slave dynamic of the human /animal. Cinder's self-consciousness is realized through both her work and her relationship with Iko as almost everyone she meets regards her as inferior. Iko is equipped with a personality chip which makes changing its android body easy as shown in later sequels. Iko is intelligent and seems to have the faculty of imaginations. Iko comments on the idea of going to the junkyard: "It sounds dirty and stinky." Said Iko. "How would you know? Said Cinder: "You don't have scent receptors" she replies "I have a fantastic imagination" (36) Also, she possesses the ability to appreciate and understand nonverbal communication; challenging anthropocentric notions. In one occasion, Peony gives her a velvet ribbon from the bodice of her dress and wraps it around her wrist joint. Iko replies that: "It's lovely."(35) Both Peony and Cinder treat Iko as a person not as a machine. In addition to Nainsi, who has a mock feminine shape, "a spherical head top and pear-shaped body and a glossy white finish."(8) There are other types of androids acting as helpers, attendants, waiters…etc., Androids generally exist to assist humans. However, the antagonist of the quartet, queen Levana, despises androids as they are immune to the lunar ability of manipulating bioelectricity. She even requests emperor kai not to have androids around during her visit. Medical droids are in direct contact with Letumosispatients and are dispatched to test and bring victims of letumosis. They are described as having yellow sensors and red crosses on their heads. They scan Cinder's ID. They are equipped with pronged hand which appears from its torso with a syringe. The Androids in this novel do not seem to pose a threat as artificially intelligent machines nor reflect a post-apocalyptic world where humans are inferior to machines. In contrast, they occupy positions of attendants, assistants ….etc. Later sequels do touch lightly on the issue of Robot Ethics. Lunars fit into the postmodern Lyotardian concept although the human body remains intact. The doctor explains the lunar gift:" Well, the lunar gift is nothing more than the ability to manipulate bioelectric energy- the energy that is naturally created by all living things. For example, it is the same energy that sharks use to detect their prey."(172) Lunars have the unique ability to not only detect bioelectricity in others, but also control it. They can manipulate it so that people see what the Lunar wishes them to see. A glamour is what they call the illusion of themselves that they project into the minds of others. (172) The novel explores the future course of human evolution; whether technology will be a hindrance or an advantage or whether other elements will come into play. Lunars represent a seeming reversion to the cycle of discrimination and prejudice. As a nation, they are ruled by a dictator, Queen Levana.. She is feared and never opposed publicly, at least in the first installment. Levana tries to force the evolutionary concept of survival of the fittest. She has a vision of ruling both Earth and Luna. From the perspective of the novel, Artificial Intelligence will not be sufficient to overthrow humans. Machines will not pose a threat to human existence. Evolved humans will. Cinder presents a narrative where both evolved humans, cyborgs, and humans struggle. It is only through humanity and compassion that we can survive .In Meyer's narrative, we are our own plague and remedy.

C. Othering

Post humanism deconstructs the man-machine and human- nonhuman dualisms. The other is opposite to self. It denotes someone who is different and alien to the self. In this case, Cyborgs are treated as the other and regarded as inhuman, inorganic, and inferior. Although Cinder is a productive individual, she is an outcast in her society. The government gives the guardian the right to deal with the Cyborg as a property. Cyborgs are treated in a manner that is very much similar to the way a slave wastreated. In the lab, the assistant expresses her personal and social perspective on the cyborg draft: "It's better than testing on people."(70) She only sees the machine part of their makeup. Cinder does not assimilates her society's view of herself as inferior to humans although she is distressed by it. The novel ends with Cinder starting her journey to self-discovery, reclaiming her throne, and standing up for the marginalized in her society. Her body is fragmented just like her identity. Her otherness becomes her source of power. There is a cycle of othering going on in the novel. The Cycle begins with Lunars who other Earthens and Shells; in turn, Earthens other cyborgs and the Lunars. The other could ignite fear and stir up unrest, like the Lunars and Levana, or be represented as a lower class that is a victim to humanity's ignorance and Prejudice; namely the cyborgs. In the former, humanity is a victim, in the later, it is a victimizer. Although letumosis seems to be the reason behind the conflict in Cinder, it only fuels the existing prejudice. It has not been a smooth sailing for the Shells. Being on the opposite end to Queen Levana made them a target. They cannot stand for themselves. Their inferior status for both humans and Lunars makes it very difficult for them to fit. Levana uses the Shells for testing just like humans use the cyborgs for the draft. They are introduced to the readers in the first book. However, in the third installment Cress, a Shell character named Crescent Moon, or Cress for short, is introduced. She is a

programmer and a hacker who works for Queen Levana and her Thaumaturg Sybil. She is the one who hacked Kai's Android to leak Levana's plans to Kai. She plays a major part later on as a member of Cinder's team to restore her throne. Meyer creates characters who are born into misfortune but provides them with the skill to forge their own path toward agency. At the bottom of the hierarchy is the Androids. They do not inflict change on their own but do pave the way toward it. They fit into the second half of the man-machine binary. This pushes them further down despite nearly perfecting artificial consciousness in some Androids. The hierarchy in the novel is deconstructed by trying to break this cycle.

II. THE POSTHUMAN TEXT

A. Digital and Nonlinear Types of Narration

When we think of the post human text we think of digitations, the hypertext, nonlinear narration, and digital narration. Narratives are no longer inclusive to print. Stories can rely on sound effects, recordings, and images. The emergence of hypertext environments allowed the proliferation of interactive content as well as digital storytelling. There are documents which exist only as electronic files. Nonlinear narratives could also be found in film, hypertext websites and other forms. Chorological order is not followed. The story begins in Medias Res. Many films and video games start in medias res; for instance, the Videogame Uncharted 4: A Thief's End (2016) begins from the middle then goes in flashbacks to the past until the middle then continues to the end. We Need to Talk about Kevin (2011) starts fromthe middle ; after the imprisonment of her son.[8] Cinder begins from the middle as well. Hypertext is projected in Cinder's retina and Feedback. By doing this, the hypertext is creatively used within the text. The posthuman text parallels digital media and traditional text, human and machine, as well as produce augmented reality.

B. Intertextuality

Adaptation and intertextuality are closely linked specially in the discussion of adaptations. The term was coined by Julia Kristeva in 1966. It describes the interdependency of a literary text with other literary texts that come before it. To her, a literary text is a mixture of different quotations. (Cuddon 424) It is the idea of a text borrowing ideas from other works and concepts. It involves referring to another book's title, characters, scenes, or a story line. (What is Intertextuality? 1). Every text is arguably a variation of different texts. Kristeva argues that literature connects all various traditions and experiences that are shared in the past and present. James Paul Gee comments in his book An Introduction to Discourse Analysis: Theory and Method: "This sort of cross-reference to another text or type spoken or written text alludes to, quotes, or otherwise relates to another one." (Gee 29-30) Whether originality is privileged over intertextuality is of no importance as T.S. Eliot was probably the first to point out that the most original parts of an author's life are probably the ones where his ancestors are the most present. . (Qtd. in Martine 11) From an intertextual perspective, either authors or readers should not celebrate Originality as a trait. T. S. Eliot was probably the first to mention that the most individual parts of an author's work may be those in which his/her ancestors are more present. (270)

The idea of an author's influence by his predecessors can also be found in Harold Bloom's model Anxiety of Influence where a poet is influenced by his poetic forefather. Only in intertextuality, the attempt to surpass forefathers is not there as much as the transference of concepts and characters for a specific purpose. Meyer's adaptation, Cinder, relies on some elements of the original plotline and characters of the folktale and seems to be based on Disney's version of it as it is the most popular; unlike Grimm's version where Cinderella's father is alive and brings gifts for her sisters and only a twig for her, or Anne Sexton's version, which is considered closer to the Grimm Brother's version but mocks it. The ball is held for three days and Cinder is assisted by the dove. The roles of the evil stepmother, the prince, the maltreated stepdaughter, and marriage to save the crown are the same. However, this is mostly as far as the similarities go. Whereas Cinderella is told as a folktale in the brothers Grimm version, and as a poem by Sexton, and adapted into a movie by Disney, having written a quartet, Meyer has more space to explore the characters, their motives, actions, and relationships. Meyer has introduced a posthuman fairy tale. Cheryl Lee explores fairytales modern variants. She comments that many of the modern adaptations are in fact longer and more complex than the older versions. She also states:" … many are combined with other genres of stories, becoming hybrids with those other genres and moving farther away from the traditional stories." ("Fantasy versus Fairy Tale" 27) The title clips Cinderella's name and uses the noun Cinder, which is both an allusion to the folktale and a reference to her job as a mechanic and her cyborgian nature. Although when you think of cinders you think of something brittle or flameless coal, it also inspires a creature born again form the cinders like the Phoenix, a rebirth, which exactly describes Cinder's case having survived the fire when she was burned by her aunt Levana. The motif of the shoe plays an important part as it reflects the character. Cinderella's slipper is made of glass and glass is fragile whereas Cinder's feet is made of steel. Cinderella is not as strong of character as Cinder.

[8] The film is an adaptation of Lionel Shriver's *We Need to Talk about Kevin* (2003).

Meyer's characters play more realistic roles and reflect their posthuman nature. She prophesies a posthuman world where machinery and technology are advanced but are not enough for the survival of mankind as a new species evolves and threaten their existence. Posthumanity here regards both technology and evolution as an inevitability in the future.

Cinder is more subversive than Cinderella. She does not need the help of the prince to sweep her of her feet to his castle nor the assistance of the fairy godmother to help her escape her situation although she is assisted by other individuals and an android to achieve her goal; however, she remains her own savior. Both grow up in a house where the father is dead or out of the picture. Cinderella works hard as a housekeeper for her family whereas Cinder is the provider of her family and the housekeeper. Her role as a housemaid makes her docile and dependent on her stepmother while being a mechanic gives her more autonomy and means to secure sustenance.

She is more or less in charge of her own body. She does have her insecurities, which are mostly related to her cybernetic makeup and social prejudice, but she is a realistic character which behaves like a young adult. This allows the readers to sympathize with her and adapt a positive stand when it comes to cyborgs. Both are infatuated with the heir to the throne but Cinder ends up saving the emperor Kai. She is also a royalty herself. Cinder is more independent and reflects a more identifiable role for the twenty first century reader. She does not only cook and clean but goes out in the market and earns a living. She defies the conventional idea of looking beautiful in order to secure happiness and status. She shows up to the ball in a terrible yet grand manner as she is pronounced the emperor's personal guest:

Perhaps the crowd would have turned away a moment later, indifferent, if they hadn't' found the emperor's personal guest to be a girl with damp hair and mud splatters on the hem of her wrinkled silver dress. As it was, the gazes halted, pinning Cinder to the top of the stairs. Her mismatched feet stuck to the landing as if concrete had hardened around them. (336) It is a manner that is both subversive of Cinderella's elegant appearance and assertive of Cinder's Posthumanity. The sisters, however, do fall into the conventional extreme roles of angel and devil where Linh Pearl is the cruel sister and Linh Peony is kind. There is not much difference between the folktale and the adaptation. Coste believes that the stepmother's hatred is not out of envy of her stepdaughter's purity, sweetness, and beauty but because of her disgust with her otherness. (42) Cinderella has to stand up against her stepmother and evil sisters only whereas Cinder has to rise up against two female characters, namely LinhAdri and Queen Levana, social injustice, and her own insecurities. As a posthuman text. Instead of magic there is science and machinery .The story begins and ends with an important motif in the Cinderella's story, the shoe. Only here it is a prosthetic foot. . Meyer comments when she was asked about choosing a futuristic China as a setting for her novel that it is believed that the earliest tale of Cinderella came from the 9th century china where the tradition of foot-binding was encouraged, hence the glass slipper. Meyer chose a futuristic city to place her cyborg. This implies that her vision of the cyborg will probably take many decades to see the light.

IV. CONCLUSION

Post humanism is still evolving as a field with changes in culture, science, technology, and social and cultural studies. And with the notion of posthuman bodies, virtual reality, gaming, online personas, the body is still under question and inspection. The characters represent different views on the posthuman. First, we are introduced to the first view of the posthuman as a hybrid of human and machine; a cyborg. Second, the humans who through necessity for survival evolved and refer to themselves as Lunars. Another representation is the humans who interact with technology on a daily basis; and technology is considered to be an inseparable part of their lives.

There are also androids who exist as companion species and are used as servants, attendants, and workers. Finally, another posthuman who crosses the boundaries of both humanity and species is introduced in her next installment Scarlet, exemplified by Z Kesley who is known as Wolf. He is a genetically modified former special operative. He crosses the boundary of humanity for being a lunar, and the boundary of species by being genetically modified; appearance-wise, he looks mostly human apart from sharp canine teeth.

Today, the posthuman bodies, as culturally constructed, are a topic of inspection and speculation. The maternity of surrogate mothers is questioned. There are questions of identity, rights, and policies to be legislated. The posthuman world is worth contemplating especially when it comes to ethical implications. Meyer's posthuman world exemplifies a world where humanity does not learn from its history and repeats the cycle of discrimination and inequality. She attempts to showcase how a world that is ruled by fear, prejudice and oppression is the result of making the same mistakes. She places hope in the hands of the posthuman who is capable of bringing change, speaking truth to power, and aspiring to make the world a better place for future generations.

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EXAMINING THE FORMATION AND ENACTMENT OF TEACHER' EXPECTATIONS OF LEARNERS' READING HABITS: IMPLICATIONS FOR THE CURRICULUM

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Abstract - Teacher expectations can be understood as a teacher's belief in the ability of their learners to achieve set goals successfully. The importance of this feat lies in the fact that they can determine both the level of educational content and how it is delivered. Although teacher expectations have been studied for decades in the developed countries, little research has been done in countries like South Africa, the focus of this paper presentation. Subsequently, the current study's goal is to examine how teachers form expectations about the reading habits of their learners in one rural school in South Africa. The study was qualitative in nature and a case study design was followed. A purposively selected sample of eight teachers were selected based on being English First Additional Language teachers teaching reading in Grades 3 to 9. Semi-structured interviews were used to collect data and content analysis was used to analyse data. The results of the study revealed that teachers' expectations concerning their learners' reading habits were low and determined by several socio-economic factors like government policies, school quintile, lack of resources and curriculum. The authors recommended that teachers' knowledge of the significance of their expectations in determining their learners' reading practices is significant. This is in view of the fact that teachers are more likely to adjust their expectations on their learners' prospective reading habits if they have this knowledge and awareness.

Keywords - Teachers' Expectations, Reading Habits, Socio-Economic Factors, Reading Instruction

I. INTRODUCTION

Recent developments in teacher expectation research include the impact of teacher expectations on learners, the formation of expectations, differential treatment of learners by teachers, and learner responses to teacher expectations (Johnson, Wildy, & Shand, 2019). Based on these new developments in teacher expectation research, learners are likely to be affected by what teachers expect of them. According to Rubie-Davis, Peterson, Sibley, and Rosenthal (2015), expectations can become powerful self-fulfilling prophecies when teachers base their interactions with learners on those expectations.Rubie-Davies (2004) defines teacher expectations as derived judgments that teachers make, based on their knowledge of learners, about whether, when, and what learners can achieve in school. Friedrich, Nagengast, Jonkmann, and Trautwein (2015) explain that teachers' expectations have been measured by teachers' predictions of learners' future performance in school or by teachers' beliefs about learners' current ability to succeed academically.They further argue that higher teacher expectations lead to higher learning outcomes.This view is supported by Weinstein (2008), who argues that when teachers set high expectations, their learners follow suit, and unfortunately, when teachers set low expectations, learners can follow suit.

Subsequently, many years of research on teacher expectation effects have provided strong evidence that expectations exist in normal situations and that they can positively and/or negatively affect student performance and success (Good & Brophy, 2003). Such expectations can be epitomized in the learning opportunities created by the sentimental atmosphere created by the interactive content and classroom context. Weinstein (2002) categorized teacher expectation effects as sustained expectation effects or self-fulfilling prophecy effects. He explains that sustained effects occur when teachers expect learners to continue acting or performing according to predetermined patterns and can ignore conflicting evidence of change. On the other hand, he argues that self-fulfilling prophecy effects occur when an originally false belief leads to its fulfillment. Furthermore, Good (1987) argues that self-fulfilling prophecies bring about change in learning performance, while sustained expectations defeat the hopes of the potential for change.

Research shows that the formation of teachers' expectations about their learners' academic performance is influenced by individual learner characteristics (Johnson, Wildy & Shand, 2019; Rubie-Davis, Huttie & Hamilton, 2006; Keogh, 2000). For that reason, several individual learner characteristics have been identified as possible elements influencing teacher expectations. These are prior academic achievement, effort, ethnicity, socio-economic status, gender, stereotypes, language style, physical attractiveness, age, personality and social skills, learner background. For example, there is a strong perception among teachers that learners from economically and socially disadvantaged backgrounds do not learn well (Gupta & Sampat, 2021). Gupta and Sampat further note that these beliefs have a negative impact on what teachers do in the classroom and how much learners learn and grow. After defining the two categories of teacher expectation and examining the factors that play a role

in the formation of teacher expectations, the current study attempted to examine teachers' expectations of their learners' reading practices and the formation of such expectations. This study was informed by the poor performance of South African learners compared to their peers in other countries around the world (McBride, 2019; du Plessis & Mestry, 2019; Rule & Land, 2017) and the results of the Progress in International Reading Literacy Study (PIRLS) (2006, 2011 & 2016) testify to this challenge.

Recent research has found that teachers' awareness of student achievement and their individual learning resources is crucial to fostering student learning, particularly reading, as this knowledge is the basis for effective teaching decisions and enables teachers to provide sufficient support for individual learners (Clair-Thompson, Graham & Marsham, 2017).

Although there is an overwhelming body of literature making connections between teacher expectations and learners, too little work has been done to reconcile teacher expectations with learners' reading practices, particularly in the South African context. Knowing this, teachers are likely to recognize the impact of their expectations on learners' current reading habits, and then adjust their goals and teaching methods so that all learners can achieve high levels of learning. Therefore, this paper aims to help teachers adjust their expectations to create a space for learners' reading improvement. In order to achieve this important goal, the following research questions are addressed:

- What are teachers' expectations regarding learners' reading habits?
- Which factors contribute to the teachers' formation of their habits?

II. METHODOLOGY

Research approach and design

This work followed a qualitative research approach. Denzin and Lincoln (2005) state that qualitative research aims to study phenomena from a person's point of view, paying close attention to the context in which they occur. Because the focus of this study was teachers' expectations of their learners' reading practices and the formation of such expectations, the approach was deemed appropriate. The study followed a case study design. Hammarberg, Kirkman, and de Lacey (2016) point out that qualitative techniques are used to answer questions about experience, meaning, and perspective, mostly from the perspective of the participants

Research participants and sampling methods

Five high school teachers we involved in the study. These teachers were purposively selected on the basis that all of them were teaching English First Additional Language. There were two males and three females, and their ages ranged between twenty four and fifty two years old. They were all holding Bachelor of Education degree. Individual face-to-face interviews lasting 50 – 60 minutes were conducted with the teachers. Content analysis was used to analyse transcribed data.

III. PRESENTATION OF FINDINGS

The results that emerged from the analysis of the transcripts of the interviews conducted with 5 teachers are discussed below under the following headings:

1. Teachers' expectations regarding learners' reading habits;factors influencing such factors. Codes like T1, T2, T3, T4, and T5, were used to ensure the anonymity of the 5 participants.

The results of the study indicated that the five sampled teachers had low expectations of the reading practices of their learners. Factors for such low expectations were 1. Government policies, 2. School quintile, 3. Lack of resources, and 4. Curriculum. These factors are presented below one by one.

Government policies

With regards to government policies teachers complained that these policies promote learner irresponsibility. They indicated that there are learners who do not work hard in class because they know that according to government policy, they are not supposed to fail a grade twice, this is, even if they fail they are promoted to the next grade and learners take advantage of this policy. Therefore, under such conditions teachers do not have expectations regarding their learners' reading habits. In this regard, T5, who is a grade 3 female teacher said: "Do you know that there are learners who study up to Grade 12 without passing a single grade on their own? They are aware of the government policy that does not allow them to fail a grade twice and they take advantage of that policy. Such learners do not bother themselves by working hard, they simply wait for the end of the second year so that they are promoted to the next grade even if they fail. It pains my heart to see such learners progressing to the next grade even if they have poor marks. You will find that there are learners whose marks are close to the pass mark but are not promoted to the next grade because they fail the grade for the first time. Now, here is a learner with very low marks promoted to the next grade by virtue of avoiding repeating a grade for the second time"

Also addressing this issue, T3 who is a Grade 6 male teachers indicated:

"The problem here is the Department of Basic Education policy on progression which prohibits a learner to repeat a grade twice in each phase of their schooling. This, therefore means that even if the learner is poorly performing and even not committed to their school work, the policy forces the teacher to allow the learner to progress to the next grade merely

because the learner cannot repeat a grade for the second time"

The second factor that teachers mentioned in the school quintile. They indicated that the lack of resources was linked to various other factors like the type of school quintile, school condition and environment. They indicated that teachers who work in such environments had low expectations with regards to their learners' reading habits.

Answering a question, T1 who is a Grade 4 female teachers said:

"Teachers who teach in the privileged school might have high expectations of their learners due to the fact that the school grade and environment are conducive. However, those who teach in the quintile 1-3 schools, which are no-fee schools find it hard to have higher expectations. The learners we teach are from poor families, hence they are exonerated from paying school fees. Although this is good for them, the government takes time to allocate funding to such schools. You will find that in such schools there is no money to buy even the basic material like paper and chalk. Due to the poor surrounding, you will find that learners do not do homework because their parents expect them to do house chores after school".

Another factor that came up prominently is the lack of resources which is also linked to the socio-economic status of the school and the surrounding, including the parents. The teachers indicated that such school environments are characterised by school disruptions, learner absenteeism, high dropout rate, teenage pregnancy, lack of basic resources like water and sanitation. Teachers indicated that learners who learn under such suffocating conditions are not likely to display good reading habits and the current situation is not likely to raise teachers' expectations. In this regard, T2 who is a Grade 9 male teacher said:

"My school does not have appropriate learning and teaching resources. You will find out that you have only four books out of fifty learners in your class. Sometimes I am forced by the circumstances to buy some material or make photo copies out of my own pocket. Learners share books and sometimes books get lost and the learners' parents do not afford to replace them".

Another factor that was mentioned by the teachers is the curriculum. They indicated that the curriculum was vague for some teachers and this could lead to teachers losing confidence. They further indicated that once you lose confidence you cannot have high expectations of your product. The teachers further complained about the amount of work they were expected to finish within a short space of time. Responding to the question, T4 whom is a Grade 4 female teacher said:

"We feel that the amount of quantity of work allocated to be taught per term as per Annual Teaching Plan is far above the actual available teaching time. This, therefore impacts negatively on the quality of work that is being done. Each day has its own work and there is not enough time for revision for reinforcement purposes. This might lead to teachers having low expectations of their learners' performance"

IV. CONCLUSION

The aim of the study was to examine the formation and enactment of teacher' expectations of learners' reading habits. The findings indicated that teachers had low expectation of their learners' reading practices. The contributing factors identified are government policies, school quintile, lack of resources and curriculum.

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INTERACTION OF UREASE/DOPC HYBRID SYSTEM AT AIR-WATER AND AIR-SOLID INTERFACE

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Abstract - Understanding the interactions of proteins at the interface of lipid structures is important for biological systems and subsequently the topic has become of widespread interests in a variety of fields such as in biomedical and biochemical research, biosensing and food science.[1],[2]In the present study, the protein-lipid interactions between water-soluble metalloenzyme urease and the water-insoluble phospholipid, 1,2-dioleoyl-sn-glycero-3-phosphocholine (DOPC)were investigated at the air-water interface using the Langmuir-Blodgett (LB) technique. Surface pressure-molecular area (Π – A) isotherms were measured for the DOPC monolayer in presence of urease in the water subphase (Figure 1a) and a strong conjugation was found between urease and DOPC. The compressibility of the DOPC monolayer was reduced with the incorporation of urease (Figure 1b).The Atomic Force Microscopy (AFM) shows strong conjugation between urease and DOPC in hydrophilic surface (see Figure 1c). However, in hydrophobic surface the urease molecules denatured rigorously probably due to exposure of the tryptophan moiety towards hydrophobic air environment.

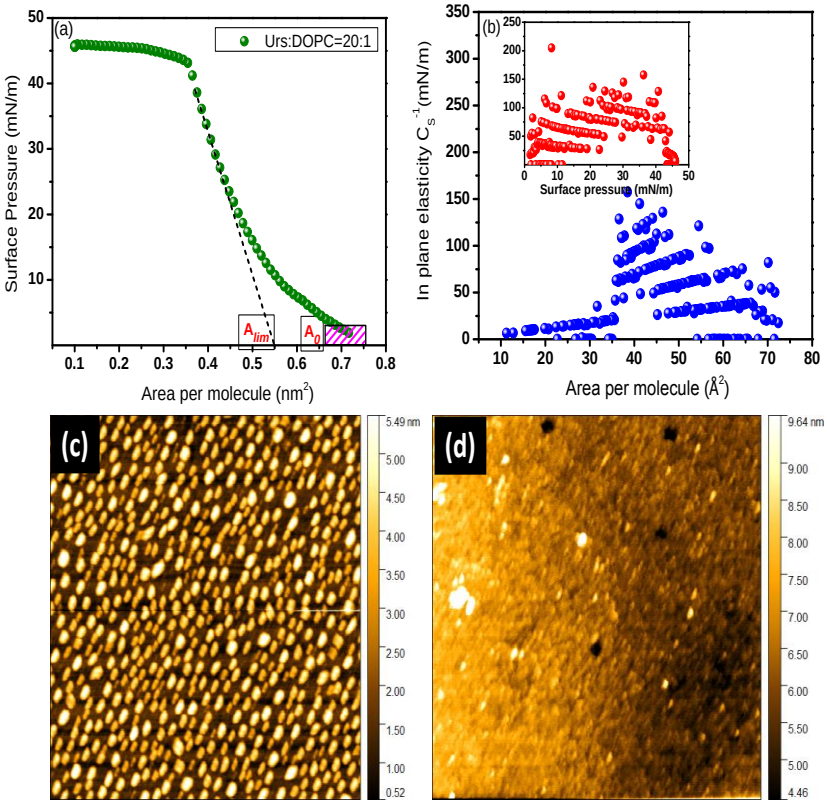

Figure 1.(a) Surface pressure (π) – area/molecule (A) isotherm of Urease: DOPC = 20:1, (b) In-plane elasticity (C_S^{-1}) vs A and C_S^{-1} vs π (see inset) of Urease: DOPC = 20:1, (c) AFM image of LB film of Urease: DOPC = 20:1 mixed system deposited on hydrophilic Si(100) and (d) hydrophilic Si surface.

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THE IMPACT OF FISCAL AND MONETARY ON THE MANAGEMENT OF COVID-19 PANDEMIC IN 2 OECD COUNTRIES.AN EXPLORATORY STUDY OF PRE AND POST PANDEMIC EFFECT

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Abstract - This study seeks to explore the impact of effective fiscal and monetary policy in relation to the management of Covid -19 pandemic in 2 selected OECD countries during the pre and post pandemic era. It also seeks to examine how the economic implication of the effectively managed fiscal and monetary policy of the mentioned countries, Canada and Australia during the period of pandemic contributes positively to their economic recovery. The macroeconomic policies used to influence the economic downtime during and after the pandemic applied different measures to check the short and long-run impact of the economy in the selected OECD countries. This study will adopt a time series method analysis, and data from World Bank, IMF, UNDP as well as hospital record data to examine the causality and effect towards the impact of the covid-19 pandemic in relation to fiscal and monetary policies. This recommends among others, government in the selected countries should monitor the inflationary impact of the fiscal and monetary measures applied for long run benefits. Other countries with poor monetary and fiscal policies should mitigate the current fiscal and monetary policies adopted by the understudy selected countries on how they manage the long run impact.

Keywords - Fiscal Policy, Monetary [Policy, Covid-19 Management, OECD Countries, Pre and Post Pandemic

DETERMINING COMPETITIVENESS OF PAKISTAN SPORTS GOODS INDUSTRY USING REVEALED COMPARATIVE ANALYSIS

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Abstract - This paper attempts to investigate the comparative advantage of Pakistan's sports goods industry in the global market using both the static revealed comparative advantage and the dynamic comparative advantage. The top 10 sporting goods from Pakistan have been chosen for this purpose and combined revealed comparative advantage and dynamic revealed comparative advantage for critical analysis. The product positioning of the specific products was also determined by this study. The data has been collected from the ITC trade map for the period 2005 to 2019 and is categorized using the Harmonized System (HS). The revealed comparative advantage was calculated using the average RCA. The results indicates that China and India have a strong comparative advantage for festivals, carnivals, and Balls while the USA, Thailand, and Indonesia have a strong comparative advantage for Golf balls. Pakistan is competitive in exporting inflatable balls because it has the highest revealed comparative advantage in the global market.

Keywords - Competitiveness; Static RCA; Dynamic RCA; Trade Specialization; Sports products; Inflatable balls

DEFENDING AFRICANISATION OF KNOWLEDGE PROCESSES IN THE AFRICAN UNIVERSITY: TOWARDS A LIBERATED EPISTEMOLOGY

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Abstract - In this concept paper, we focus on the disputed discourse of a fitting curriculum knowledge base for university education in Africa. Education in universities is assumed to revolve, to a large extent, around knowledge enterprise and the curriculum is assigned an active role in enhancing social and economic development. African universities on have not been spared from the remnants of irrelevance left behind by colonialism. Regrettably, governments in Africa have set up universities that have abandoned the project of dispensing new directions for the genuine emancipation and liberation of the African continent. We give special attention to the epistemological emancipation of university education from the hegemony of western knowledge systems as the central instrument for an authentically African knowledge processes. It is our case that such an appropriate knowledge system will churn out citizens capable of propelling socio-economic development in this continually- revolving global environment, in which Africa and other developing continents are locked. Our puzzle of an epistemological nature is: how should the knowledge acquisition process enlighten worthwhile dispositions and qualities that products of African universities should exhibit? Conversely, is Africanisation of knowledge in higher education the answer to the socio-economic development challenges afflicting Africa in this era of the much celebrated neo-liberal and globalisation discourse? We theorise that the university in Africa should be the primary site for the production and distribution of new knowledge in the context of the African experience, alongside the global experience. We make a clarion call for an epistemological break with respect to university teaching, learning, researching and sharing of knowledge within African settings to rectify, the largely constrained conditions and dislodged location.

Keywords - Hegemony, Emancipation Globalization, Transformation, Postcolonial, Indigenous, Knowledge, Euro-Centrism, African.

STUDY OF SOME NONLINEAR PROBLEMS FORPARTIAL DIFFERENTIAL EQUATIONS ANDFRACTIONAL WITH NON-LOCAL CONDITIONS

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Abstract –

This thesis is devoted to the study of some classical and fractional nonlinear parabolic problemswith different boundary conditions.
We started the first chapter of this thesis with reminders of some fundamental preliminary concepts andthe tools needed for this work.
The second chapter is devoted to studying the existence and uniqueness of a weak solution of anonlinear parabolic problem with an integral condition and a Neumann condition. Where, we show theexistence and uniqueness of the strong solution for the linear problem by the method of energy inequality.
Then, applying an iterative process based on the results obtained for the linear problem, we prove theexistence and the uniqueness of the weak solution of the nonlinear problem.
The third chapter is devoted to the solvability of the weak solution and the blow up solution in finitetime of a problem for a class of semi linear parabolic equations with an integral condition of second type.
In the fourth chapter, we study a mixed problem related to a nonlinear fractional parabolic equationwith a classical Neumann condition and an integral condition by the energy inequality method for the linearproblem and by the linearization method for the non-linear problem.
Finally, in the fifth chapter, the existence and uniqueness of a weak solution of the Dirichlet
problem for a class of semi-linear parabolic equations by the Faedo-Galerkin method was examined.

Keywords - Nonlinear parabolic equations, Fractional equations, Functional spaces, Energy inequality, Faedo-Galerkin method, Fixed point theorem, Sturm Liouville problem, Blow up solution, Integralconditions.

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ESTIMATING THE PERMEABILITY OF APOROUS CERAMIC TILE

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Abstract - Porous ceramics are widely used for water filtering, improving heat transfer, supporting catalysts, vaporizing liquids, etc. Residential tiles used for water sealing are made from ceramic as well. Moisture infusion analysis based on Richard's equation is necessary to improve tile quality, and this analysis depends heavily on estimating the tile permeability. The current research demonstrates three techniques for calculating ceramic-tile permeability. The first technique is a theoretical model that requires information about the material's effective diameter and porosity that was obtained via scanning electron microscopy (SEM). The second suggested technique is known as mercury intrusion porosimetry (MIP). The pore size, density, pore volume, and porosity of the ceramic tiles, among other characteristics, are evaluated using mercury in this procedure. The experiment's pressure was varied from 0.1 to 60000 psi. These criteria were used to determine the tile's permeability. The last strategy addressed in this research is the falling-head permeameter (FHP) approach. This procedure involves inserting the specimen into a sealed transparent rectangular conduit. Water is then allowed to pass through it. The rate at which the water level in the duct recedes over time is associated with permeability.All the approaches yield permeability values that are in the same order-of-magnitude of 10^{-16} m^2.

Keywords - Permeability, Porous Media, Richard's equation, Ceramic tile, Saturation, Falling-head Permeameter, Mercury Intrusion Porosimetry

I. INTRODUCTION

Porous ceramics are widely used in different areas including their use as liquid and gas filters, residential tiles, liquid transport medium in Loop Heat Pipes (LHP), supports for catalysts,wicks in air freshening devices, etc. [1, 2]. Permeability is an essential property of porous media for predicting fluid velocity in them. The ability to predict permeability in rock samples is useful in petroleum engineering, environmental science, hydrogeology, and other fields. Numerous studies have tried to establish a link between permeability and other easily computed parameters such as porosity and specific surface area, but these correlations have often proved inaccurate in consolidated porous media such as ceramic tiles since their permeability is dependent on detailed microstructure of porous materials [3]. In addition, there is no explicit function for permeability of ceramic that may correlate permeability with particle diameter and porosity, therefore allow one to get a decent estimate easily. Different techniques for determining the permeability of various materials may be found in the scientific literature. All approaches may be categorized into the following three groups: a) Theoretical methods, b) Experimental methods, and c) Numerical methods. There are a variety of permeability expressions in theoretical models. Further classifications include empirical models, deterministic models based on Stokes flow, network models, statistical models, and flow-around-submerged-object models, among others [4]. Most of the theoretical models include an expression composed of the square of the effective diameter and a function of the porosity [5-8]

Literature has a number of experimental techniques for measuring permeability. Constant pressure 1-D flow technique, constant flow rate 1-D flow method, radial flow method (point injection in 2D, line injection in 3D), etc. [4]. A comparison study between falling head and constant head can be found in the literature of Sandoval et.al.[9]. They studied falling head and constant head method for the determination of the permeability and came up with some correlations. Permeability estimations using numerical approaches are also available in the published literature. In their research, Zarandiet al.[5]presented one such approach. They first developed unit cells by randomly distributing parallel fibers in a confined space using the software GeoDict, and then employed two techniques based on the Stokes-flow based physics to estimate numerical permeability. First, they turned to the commercial software Fluent to estimate pressure drop across the unit cell for a specified creeping flow. In their second technique, they relied on Whitaker's closure formulation, which is based on the proof of Darcy's law (the law used for modeling flows in porous media) using the volume averaging method for flows in porous medium. COMSOL was used to solve the closure equations. Both the techniques achieved fairly good comparison with experimentally determined permeability[5]. Mostaghimiet al. provide one of the few alternative numerical methods available for calculating Stokes flow directly on binarized 3D images (obtained through micro-CT imaging) [10]. Permeability measurements of auncoated residential tile using MIP (Mercury Intrusion Porosimetry) and FHP(falling-head permeameter) techniques have not been explored earlier, as shown by the results of the aforementioned literature review and the authors'

previous study. In addition, there is no known explicit function that correlates permeability of ceramic with porosity and particle diameter. Therefore, in the current work, these experimental methodologies are employed to assess the permeability of ceramic tile and compare the measured values to some theoretical models.

II. BACKGROUND

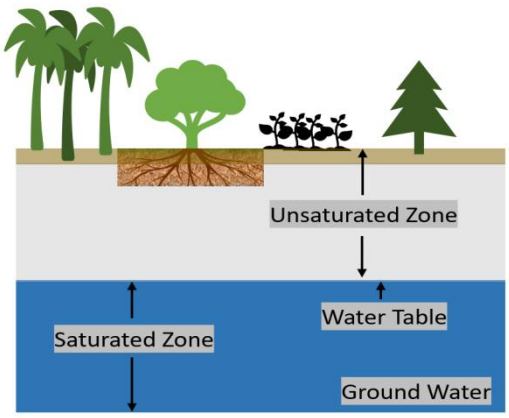
Understanding how liquid flows through a porous substance is essential for hydrology, petrology, and other geological fields. Similarly, the distribution of water in soil is crucial. To facilitate comprehension, Figure 1.a depicts distinct zones depending on soil moisture content. Dry ceramic surfaces are regarded as being in the unsaturated zone for this study. Water droplets are discharged from a source and land on the ceramic surface. When water comes into contact with ceramic, the area immediately underneath it is known as the saturated zone (Figure 1.b). By solving the following Richards equation, one may determine the distribution of water saturation as it seeps inside under capillary action.

$$\epsilon\frac{\partial S}{\partial t} = \nabla\cdot k_r\frac{K}{\mu}\left(-\frac{d\langle p_C\rangle}{dS}\right)\nabla S + \frac{K\rho g}{\mu}\left(\frac{dk_r}{dS}\right)\frac{\partial S}{\partial z} \quad (1)$$

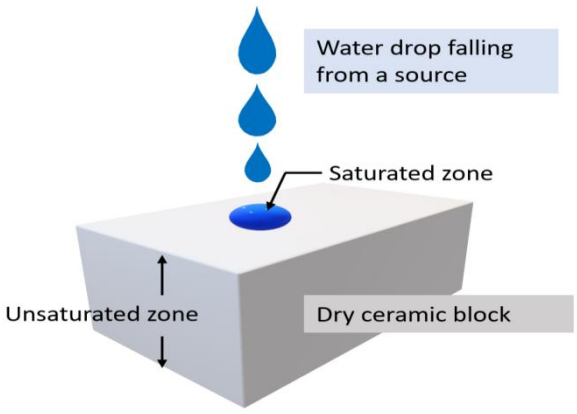
This equation, after including suitable saturation-dependent models for relative permeability and capillary pressure,can be modified further for the ceramic tile as

$$\epsilon\frac{\partial S}{\partial t} = \nabla\cdot\frac{0.04\,K}{\mu}\frac{S^{1.75}}{1-S}\nabla S + \frac{K\rho g}{\mu}3S^2\frac{\partial S}{\partial z} \quad (2)$$

Now, the time-dependent water saturationin the ceramic tile may be predicted by numerically solving this equation. However, the permeability (K) value is needed for this determination. Therefore, the purpose of the current research is to determine permeability using two distinct approaches and compare the findings with predictions of theoretical models.



(a)



(b)

Figure 1: Different zones on the basis of water saturation - a) Soil, b) Reference Ceramic Tile

III. THEORETICAL MODEL

Among theoretical models, several expressions for permeability exist. Most theoretical models are of the form

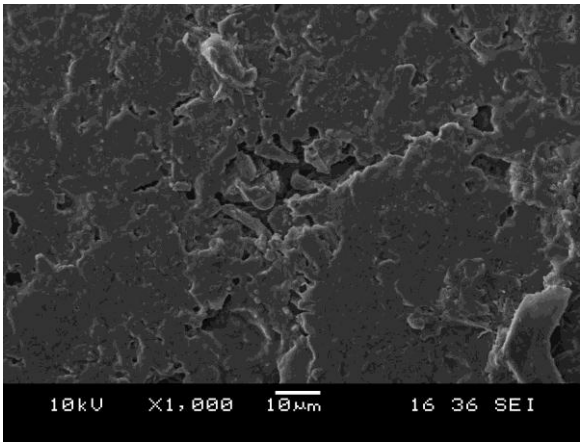
$$K = {D_e}^2 F(\varepsilon) \quad (3)$$

where D_e is the effective diameter and ε is the porosity. This function of porosityF(ε) can be estimated forseveral models: Kezeny-Carman [3], Davies [8], Chen[7], Tomadakis and Robertson [6]. The functions for different model are listed in Table 1.

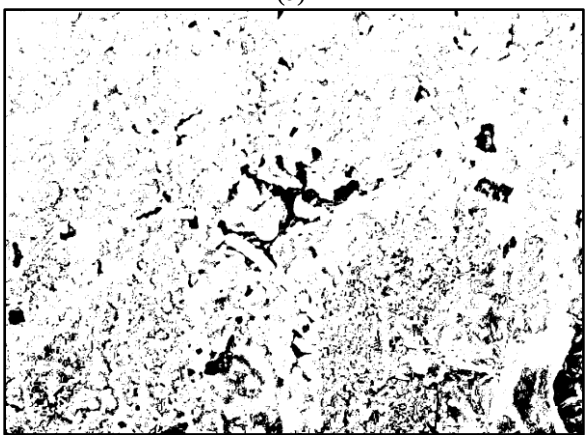
Model	F(ε)	
Kozeny - Carman	$\frac{\varepsilon^3}{180\,(1-\varepsilon)^2}$	(4)
Chen	$0.129\,\frac{\varepsilon}{(1-\varepsilon)}\ln\frac{0.64}{(1-\varepsilon)^2}$	(5)
Tomadakis - Robertson	$\frac{\varepsilon}{8\ln^2\varepsilon}\frac{(\varepsilon-0.11)^{2.785}}{0.912[(1.785)\,\varepsilon-0.11]^2}$	(6)
Davies	$\frac{1}{64\,(1-\varepsilon)^{1.5}[1+56(1-\varepsilon)^3]}$	(7)

Table 1: Porosity function for different model

The porosity of the material was determined in this case using a scanning electron microscope (SEM)(Figure 2.a).The sample was coated with gold for about one minute using a Vacuum Desk coater. Then, the micrograph was obtained. After that, the micrograph was imported to an open-source software Image J. Using the software, first the threshold of the image was adjusted by the mean method with red color. Then it was converted into a binarized image and the color was inverted, final binarized picture is depicted in Figure 2.b.The image was then analyzed using Image J. After the analysis,a porosity of 0.27 and effective diameter of 696.088 nm, which is the average pore diameterfor this case, was calculated.



(a)



(b)

Figure 2: a) Micrograph of the sample obtained by SEM, b) Corresponding transformed binary picture

Model	Permeability, K (m^2)
Kozeny - Carman	$1.09x10^{-16}$
Chen	$1.36x10^{-14}$
Tomadakis - Robertson	$1.14x10^{-16}$
Davies	$8.15x10^{-16}$

Table 2: Value of Permeability obtained from different theoretical models

IV. MERCURY INTRUSION POROSIMETRY METHOD

MIP is the second method used for determining the sample material's permeability. Due to its non-wetting property, mercury is the working fluid for this test (described in Table 1). Since mercury does not wet most substances and cannot enter pores by capillary action, it must be forced into pores by external pressure. Mercury can be pushed into large macropores with little pressure, while considerably more pressure is necessary to drive it into minute holes. According to the Washburn equation, the equilibrium pressure is inversely proportional to the pore size.[11]:

$$D_p = -\frac{4\,\gamma\cos\theta}{P} \qquad (8)$$

Here, D_P is the pore diameter, γ denotes the surface tension, $\theta$is the contact angle of mercury, and P is the applied pressure.

Property	Value
Adv. Contact Angle, θ	130 degrees
Rec. Contact Angle, θ	130 degrees
Surface Tension,γ	$4.65x10^{-1}$ N/m
Density, ρ	13533.5 Kg/m^3

Table 3: Properties of mercury for the experiment

Mercury porosimetry requires the progressive introduction of mercury into a porous material under controlled circumstances. Using the Washburn equation, the experimental setup calculates volume and size distributions using pressure versus intrusion data. This information is essential for determining the permeability. Katz and Thompson's model serves as the MIP's foundation for determining permeability. [12]. The relation can be expressed as:

$$K = c\,l_c^{\,2}\frac{\sigma}{\sigma_0} \qquad (9)$$

Here, c is permeability constant in the order of 1/226. l_c is the characteristics length which will be discussed later. σ/σ_0 is the conductivity formation factor.

After repeating the experiment at various pressures ranging from 0.1 psia to 60000 psia, Figures 3 and 4 exhibit the intrusion volume in relation to the injection pressure.The experimentally determined threshold pressure (P_t) is 151.41 psi. At the threshold pressure, the intrusion volume versus pressure curve is at its steepest. This pressure is necessary to identify the length's properties, l_c. Now, based on the Washburn equation:

$$l_c = -\frac{4\,\gamma\cos\theta}{P_t} \qquad (10)$$

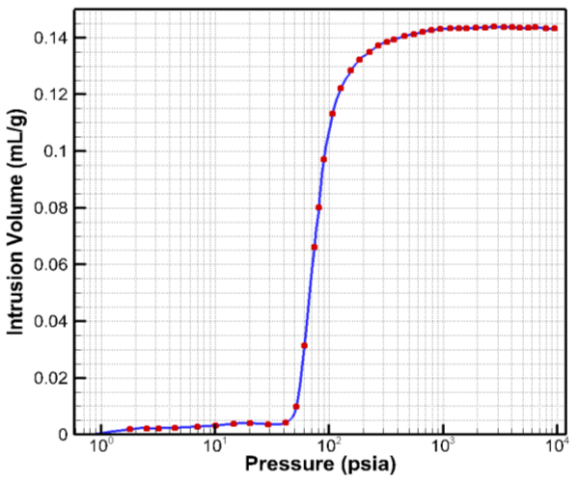


Figure 3: Intrusion volume as a function ofpressure

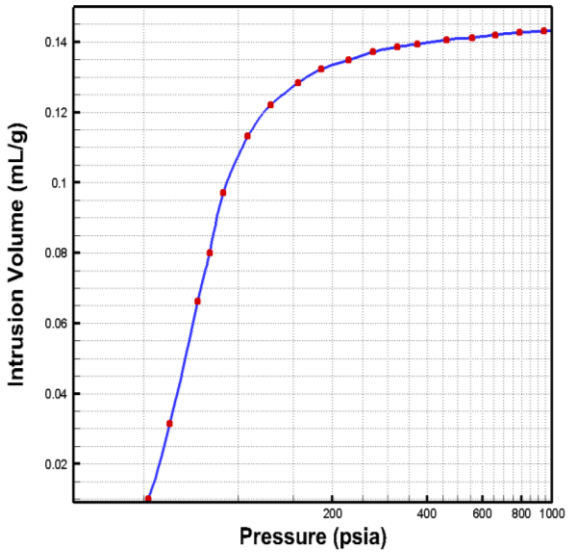


Figure 4: Intrusion volume as a function of pressure subtracting off the surface mercury volume

Now, conductivity formation can be calculated by [13]:

$$\frac{\sigma}{\sigma_0} = \frac{l_{max}^{\ e}}{l_c}\,\varepsilon\, S(l_{max}^{\ e}) \qquad (11)$$

The highest length at which conductivity occurs is denoted here by $l_{max}^{\ e}$. The $I_v \times D_p^{\ 3}$ vs $D_p$curve provides the necessary information for this calculation. I_v stands for the volume of the intrusion. Saturation as a function of $l_{max}^{\ e}$, $S(l_{max}^{\ e})$ is calculated by interpolating the Specific I_v vs. D_P curve at $l_{max}^{\ e}$ and dividing by the total specific intrusion volumeI_{tv}. ε in the equation is the porosity of the material.

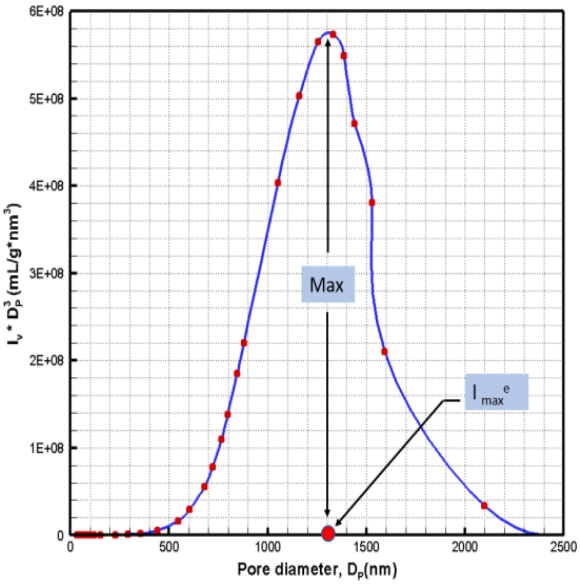


Figure 5: Optimum path for conductivity. Electrical conductance function ($I_v \times D_P^3$) vs. pore diameter which occurs at $l_c = l_{max}^{\ e}$

Calculation parameters	Value
Threshold pressure, P_t	151.41 psia
Characteristic length, l_c	1194.5 nm
Length for maximum conductance, $l_{max}^{\ e}$	1331.87 nm
Porosity, ε	0.36
Permeability constant, c	0.00442
Saturation, $S(l_{max}^{\ e})$	0.1531
Permeability, K	3.86×10^{-16} m^2

Table 4: List of the parameters used in the MIPcomputations

V. FALLING HEAD PERMEABILITY METHOD

The third method used in present study for the determination of permeability is the Falling-Head Permeameter (FHP) method. A schematic of the in-house developed permeameter used in this experiment is depicted in Figure 7. First, the sample is covered with aluminum foil to protect the surfaces from being covered by other materials. Then, a portion of the duct is sliced from the main duct with thickness close to the tile. After that, the ends of the duct are rubbed on a sand paper for surface finish.The sample is positioned inside the sliced portion of the duct, and the gap between the sample and duct wall is sealed from all sides. Finally, the prepared part is joinedto the end of the main duct. Figure. 7 illustrates the experimental setup for permeability measurement by the falling-head method. After the set-upis ready, the water is poured into the duct. Water's starting height (h_1) was noted at time t=0. The water starts penetrating the sample. As water penetrates through a sample, the water level at a falling-head permeameter's input falls over time. Due to the continual lowering of the intake head, which signifies a drop in the input pressure driving the flow, the Darcy velocity inside the porous sample falls. The ultimate height (h_2) is noted after time t. Now, the permeability may be calculated using the relationship shown below:

$$K = \frac{\mu\, a\, L}{\rho\, g\, A\, t} \ln \frac{h_1}{h_2} \qquad (12)$$

Here, a, A are the cross-section of the duct and sample respectively, L is the length of the sample, and t denotes the elapsed time.

Calculation parameter	Value
Density of water (at 22°C), ρ	997.77 kg/m^3
Viscosity of water (at 22°C), μ	10^{-3} Pa.s
Acceleration due to gravity, g	9.81 m/s^2
Duct Cross- sectional area, a	1.69×10^{-4} m^2
Tile Cross- sectional area, A	7.29×10^{-5} m^2

Table 5: List of parameter values used for FHP computations

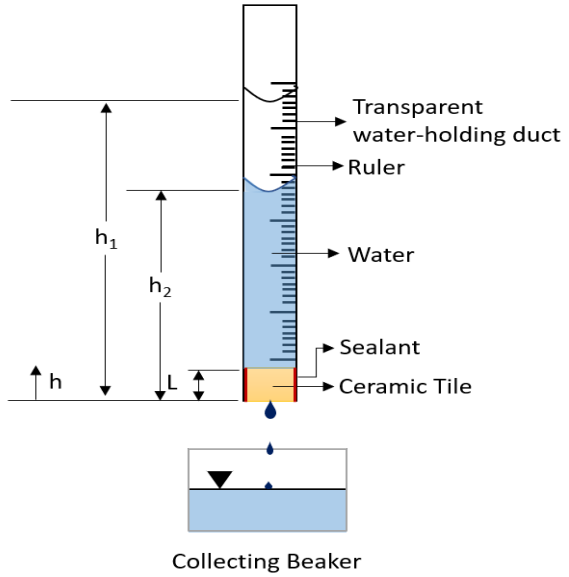


Figure 6: Schematic of the falling head permeameter (FHP)

Each of six experiments took two days because of the slow seepage of water through the tile. Table 3 lists the calculation parameters used in the present experiment. The scatter in the permeability was determined using the 95% confidence interval from six separate experiments.The final K value was computed to be $(6.09\pm 1.25) \times 10^{-16}$ m^2.

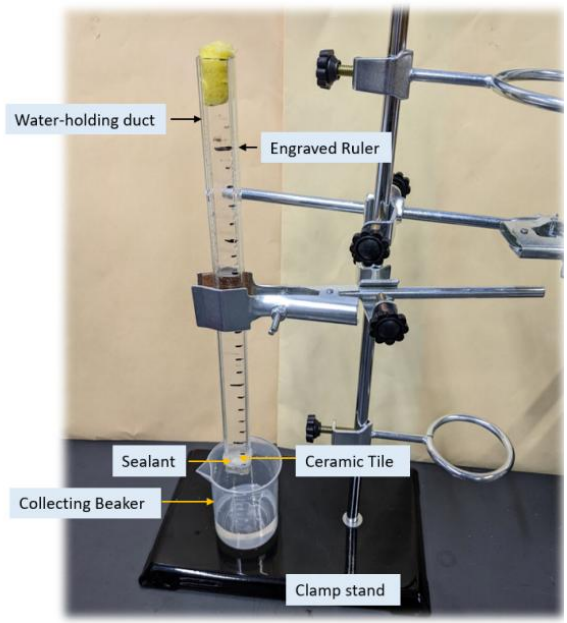


Figure 7: The experimental setup built in-house for permeability measurement by the falling head permeameter principle

VI. CONCLUSION

The permeability determined by each of the three outlined approaches is of the same order of magnitude (x 10^{-16} m^2). Of the four theoretical models considered, only the Chen modelis deviant and predicts permeability on the order of 10^{-14} m^2. The difference between Kozeny- Carman and Tomadakis - Robertson is only around 4%. Again, the permeability determined by the Davies model is comparable to that determined by the falling-head permeameter. Consequently, the permeability of this order of magnitude can be used to solve Richard's equation to get the saturation distribution within the ceramic tile.

ACKNOWLEDGEMENT

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NOMENCLATURE

Symbol	Definition	Unit
a	Cross-sectional Area of duct	m^2
c	Permeability constant	
g	Acceleration due to gravity	m/s^2
h_1	Initial height	m
h_2	Final height	m
g	Acceleration due to gravity	m/s^2
h_1	Initial height	m
h_2	Final height	m
k_r	Relative permeability	
l_c	Characteristics length	m
l_{max}^e	Length for maximum conductance	m
p_c	Capillaty pressure	Pa
A	Cross-sectional Area of sample	m^2
D_b	Solid particle Diameter	m
D_p	Pore Diameter	m
I_{tv}	Total intrusion volume	m^3
I_v	Intrusion volume	m^3
K	Permeability	m^2
L	Length of the sample	m
P_t	Threshold pressure	Pa
S	Saturation	
Greek		
γ	Surface Tension	N/m
ε	Porosity	
θ	Contact angle	Degree
μ	Viscosity	Pa.s
ρ	Density	Kg/m^3

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SCALE-UP THE PRODUCTION CAPACITY OF SLOW RELEASE UREA WITH POLYSTYRENE – STARCH MIXED COATING AND ITS CHARACTERIZATION

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Abstract - Slow-release fertilizers are useful in increasing the efficiency of nutrient utilization by plants and reducing side effects due to the use of conventional fertilizers. This study aims to increase the production capacity of slow-release urea from the mixed of starch polystyrene coating formula (2:1) which was the best formula in previous study to 10, 20, 40, and 80 times. In this study, measurements of coating efficiency, granule size distribution, granule morphology, and coating thickness measurements were carried out using Scanning Electron Microscopy (SEM), Fourier Transform Infrared (FTIR) spectroscopy, Differential Scanning Calorimetry (DSC), and release tests on distilled water, soil, and mud media. The results of the measurement of coating efficiency on formulas 1, 2, 3, and 4 were 82, 80.9, 88.7, and 89.6%. The coated urea has a granule size in the diameter range of 1.5 to 3.6 mm. On the observation of the surface morphology of the coating looks smooth, compact, and uniform. Results of coating thickness measurements on formulations 1, 2, 3, and 4 were 49.22, 20.34, 30.33, and 39.05 µm. The FTIR result of slow-release urea showed the same spectrum as uncoated urea. The DSC test of coated urea showed a melting point of 136.53°C and the melting point of starch polystyrene polymer did not show a melting point. The release test on distilled water, soil and mud media in this study still showed a slow release of urea when compared to conventional urea. It can be concluded that the increase in the capacity of slow-release urea with starch-polystyrene mixed coating did not affect the characteristics and release of urea compared to previous studies.

Keywords - Scale-Up, Fertilizer, Slow Release, Polystyrene, Starch, Urea

FINANCIAL TECHNOLOGY AND THE TRANSFORMATION OF BANKING SERVICES

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Abstract –

This article's primary goal is to examine and debate the part played by fintech in modernizing Indian banking services. Secondary source analysis is carried out, and the research design is qualitative. Secondary information is gathered from pertinent journal articles, academic papers, editorials, websites, and government records. The investigation concludes that major factors contributed significantly to India's fintech development. Programs to promote financial literacy and India Stack are two important initiatives that aid India's success in the fintech industry. In India, various Fintech companies are revolutionizing multiple financial services such as payment solutions, personal loan lending, credit cards, personal finance management solutions, and one-stop online banking. Underserved demographics, a flexible regulatory environment, and a higher level of engagement from state authorities influence how Malaysia's fintech industry will develop. The study paper describes the function of fintech companies in Malaysia's banking sector. Many people have considered fintech a disruptive technology. However, this study showed that the industry has altered Malaysian banking services and that there are still prospects for the sector to grow in Malaysia.

Keywords - Finance, Technology, Financial Technology, Banking, Services, Banking Services, India

AN EMPIRICAL ANALYSIS OF DIFFERENT PROTEIN FOLDING ALGORITHMS ON CYTOKINE PROTEIN STRUCTURE

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Abstract – Numerous applications, including identifying protein misfolding, protein docking, and comprehending the function of proteins, depend on accurate prediction of the three-dimensional structure of proteins. Cytokines, a type of protein involved in intercellular communication in the immune system and inflammation, are of special interest due to their medicinal significance. Accurate prediction of these protein types can be very resourceful in medical studies. Several deep learning-based algorithms for predicting protein structures from amino acid sequences, such as Alpha Fold 2, Omega Fold, and ESM Fold, have been developed in recent years. There has been significant research in this field, such as benchmark studies of nanobodies[6], comparative study of deep learning based model ESM2 and Homology modeling based Swiss Model[9], evaluating protein docking using Alpha Fold 2[7] and so on. But there has not been a study that analyzes the performance of these models on Cytokines. In this work, we assessed how well these models performed at predicting the Cytokine structures. Overall, these results highlight the importance of considering both accuracy and speed when selecting a protein structure prediction model.

Keywords - Protein Folding, Cytokines, Structure Prediction, Alpha Fold, Omega Fold, ESM Fold.

I. INTRODUCTION

Proteins are made up of amino acids. The protein folding problem aims to clarify how a protein's three-dimensional structure is determined by the order of its amino acids. This is significant because a protein's 3D structure determines how it functions, and improperly folded or misfolded proteins are a major contributor to a number of degenerative and neurological diseases, including Gaucher's disease, Cystic fibrosis, Parkinson's disease, Huntington's disease, Creutzfeldt-Jakob disease and etc. Scientists may be able to create cures for these disorders and a better understanding of their causes if the protein folding problem is solved.

A unique class of proteins called Cytokines is utilized by the human immune system. Cytokines aid in the coordination of the immune response to infections and other stimuli like inflammation. They also promote the growth of additional immune cells, including T cells and B cells, and support the activation and differentiation of these cells. Some Cytokines can interfere with nervous system function and have been linked to the development of certain neurological illnesses. Dysregulation of Cytokines has been connected to a variety of illnesses, such as autoimmune disorders, cancer, and infectious diseases. Thus, Cytokines play a key role in controlling a number of bodily functions as well as the immune system of human health. Traditional protein structure determination methods include X-ray crystallography, cryo-electron microscopy, and nuclear magnetic resonance, all of which are resource intensive and time consuming. These techniques were used to compile a collection of proteins known as the protein data bank (PDB), which served as the basis for the development of a deep learning model to forecast protein structure.

Recent research demonstrates how well AlphaFold2 and EMSFold deep learning models perform on various protein types, including heterodimeric protein complexes [8], nanobodies [6,], and others. In the instance of nanobodies, it has been noted that while AlphaFold 2 performs best overall, DeepAB performs better in particular portions of the nanobodies. Protein complexes were assessed using various AlphaFold 2 implementations and settings. Although the model was generally successful in predicting the structure of the majority of protein complexes, it also fell short on a few different types.

Although protein folding models were tested on the various protein types indicated above, Cytokines have not been subjected to any specific testing. Therefore, we think that the protein structure of Cytokines has to be assessed by the trained deep learning models because it is a much more complex but crucial protein for the human body. We must also specify where the given model excels and where it fails.

In order to conduct this research, we collected 64 samples of various Cytokines, applied AlphaFold 2[3], OmegaFold[4], and ESMFold[5] on each sample, and then documented the results. The results indicate that AlphaFold performs best overall, however it takes a long time to output its prediction. Although ESMFold's prediction is significantly quicker than AlphaFold2's, it is not quite as accurate.

Additionally, we notice that all of the models have a lot of trouble with specific Cytokine protein combinations. Additional research is needed to understand why they perform badly in particular architectures.

II. RECENT WORKS

A study conducted a benchmark on predicting the three-dimensional structures of nanobodies using various protein folding models[6], including AlphaFold 2, roseTTaFold, DeepAB, NanoNet, and tFold. The performance of these models was evaluated using the RMSD and TM-Score metrics, which were calculated for different regions of the nanobodies such as CDR1, CDR2, and CDR3.

The results showed that AlphaFold 2 had the best overall performance, with only slightly worse performance than DeepAB in the VHH region. NanoNet, on the other hand, was only able to predict the positions of Cα atoms in the structure. To ensure a fair comparison with NanoNet, the positions of all atoms except Cα were removed from the resulting files of the other models and the original files, and the models were scored again. Under these conditions, NanoNet performed better than the other models in the VHH, CDR1, and CDR3 regions. However, when considering all factors, AlphaFold 2 was found to be the best performer in all regions of nanobodies.

Another study evaluated the performance of AlphaFold 2 on predicting the structures of protein complexes[8]. The benchmark included 152 diverse heterodimeric protein complexes, and multiple implementations and parameters of AlphaFold 2 were tested for accuracy. The results showed that AlphaFold 2 was able to generate correct predictions for most of the protein complexes, but some structures such as those involved in antibody-antigen and other adaptive immune interactions were not successfully predicted. Overall, these findings suggest that AlphaFold 2 is a powerful tool for predicting the structures of protein complexes, although there may be some limitations to its performance in certain cases.

A different study performed a comparative benchmark between deep learning based ESM2 model and the homology modeling based Swiss model[9]. In that, the Expasy web server was used to determine the homology model of the protein and ESM2 api was used for getting the prediction of protein structure ESM2 server. RamachanDraw, GDT-TS was used to compare the predictions. It was observed that ESM2 performs better than the Swiss model.

Since deep learning-based protein folding models have just recently been created, there are still many implementation and evaluation-related issues that need to be thoroughly investigated. There hasn't been any investigation into how well these models predict the architectures of Cytokines, in particular. As a result, we made the decision to carry out a benchmark study on Cytokines to assess how well different protein folding models perform using different scoring metrics. Our investigation intends to advance knowledge of these models and their use for forecasting Cytokine structures.

III. PROTEIN FOLDING ALGORITHMS

AlphaFold 2 is a deep learning system developed by DeepMind, a research division of Alphabet Inc., that uses machine learning techniques to predict the three-dimensional structure of proteins. AlphaFold 2 was announced in November 2020 as a major advance in the field of protein structure prediction, achieving state-of-the-art results on a benchmark dataset known as the CASP (Critical Assessment of Techniques for Protein Structure Prediction) challenge.

AlphaFold 2 uses a technique known as multiple sequence alignment (MSA) to find structures that match with the amino acid sequence. This aids in identifying regions of the amino acid sequence that are more prone to alter and gathering information about these mutations. Based on existing templates, AlphaFold 2 identifies proteins that might have comparable structures and creates a preliminary representation of the structures for pairwise comparison. A deep learning model with 48 blocks of neural networks called "Evoformer" is used to process the MSA and paired structures.The "structure module," the next deep learning module, uses eight blocks of neural networks to create the final 3D protein structure from the input sequence[3].

OmegaFold is a machine learning system developed by researchers at the Broad Institute of MIT and Harvard that uses machine learning techniques to predict the three-dimensional structure of proteins. OmegaFold uses a combination of machine learning techniques, including deep neural networks, to predict the structure of proteins from their amino acid sequence. It was developed as an improvement on the AlphaFold system developed by DeepMind. It uses 3 neural networks. First one is the protein language model(PLM), the second one is Geoformer, and the third one is called the structure module[4].

The ESMFold is similar to AlphaFold. It uses the ESM2 as the first model or the language model. The Evoformer was modified and Folding Trunk was used which is the second neural network of the model. The structure module was kept the same as AlphaFold 2. This model works way faster than the previous two models with slight to no compromise in accuracy[5].

IV. RESULT

The scoring methods we have selected are RMSD, TM-Score, GDT-TS and GDT-HA. All the scores were normalized by their protein length.

RMSD is calculated as the square root of the mean squared difference between the predicted and experimentally determined coordinates of the protein atoms. The smaller the RMSD, the closer the prediction is to the experimental structure, and the more accurate the prediction is considered to be. The template modeling score or TM-score is a measure of similarity between two protein structures. The TM-score is intended as a more accurate measure of the global similarity of full-length protein structures than the often used RMSD measure. TM-score provides a value from 0 to 1 where a score between 0 to 0.17 implies random similarity between two structures and a value from 0.5 to 1 implies that the structures are in the same fold[1].

The GDT is calculated as the average of the percentage of residues (amino acids) whose coordinates in the predicted structure are within a certain distance threshold of the corresponding residues in the experimentally determined structure[2]. The higher the GDT score, the more accurate the prediction is considered to be. GDT_TS gives an overall average measure of how close each amino acid in the predicted model is to those in the empirical model, taking into account many different superpositions of the two models. Normally GDT-TS is used to score protein structures, however there is a more accurate variation of it called GDT-HA.

	RMSD	TM-Score	GDT-TS	GDT-HA
Alpha Fold 2	2.70 (±2.17)	0.71 (±0.31)	0.72 (±0.33)	0.61 (±0.31)
OmegaFold	4.97 (±5.96)	0.68 (±0.35)	0.69 (±0.33)	0.58 (±0.32)
ESM Fold	5.62 (±6.39)	0.67 (±0.32)	0.69 (±0.33)	0.58 (±0.31)

Table 1 Mean score and standard deviation of protein folding models on Cytokines

Comparing only RMSD values, it can be seen Alpha Fold 2 averages 2.70Å and both Omega Fold, ESM Fold scores almost twice of that (4.97Å, 5.62Å). Our analysis found that Alpha Fold had the lowest standard deviation in its RMSD scores, indicating that it was the most precise model among the ones we evaluated.

On the other hand, ESM Fold had the highest standard deviation, indicating that it was the least precise of the models we studied. These results suggest that Alpha Fold may be a particularly reliable choice for predicting the structures of Cytokines. However, RMSD uses the actual distance between two alpha carbons. Because of this reason, it might not be the best way to measure the performance of these models.

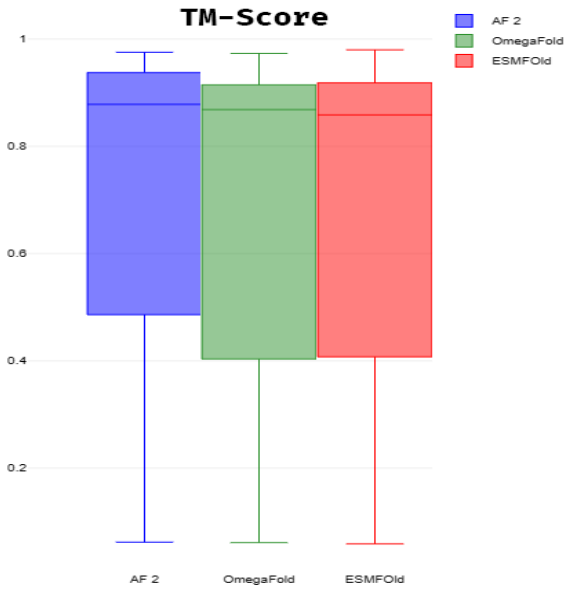

Fig 1.1: Boxplot of TM-Scores

When evaluating the performance of these models using the TM-Score metric, we found that the differences between Alpha Fold 2, Omega Fold, and ESM Fold were relatively small. Alpha Fold 2 scored 0.71, OmegaFold scored 0.68, and ESM Fold scored 0.67, with standard deviations ranging from 0.31 to 0.35. Despite having a slightly lower score, ESM Fold had a lower standard deviation compared to Omega Fold, making it a more reliable choice. Overall, these results suggest that all three models performed similarly well according to the TM-Score, although small differences in accuracy and reliability may still be worth considering.

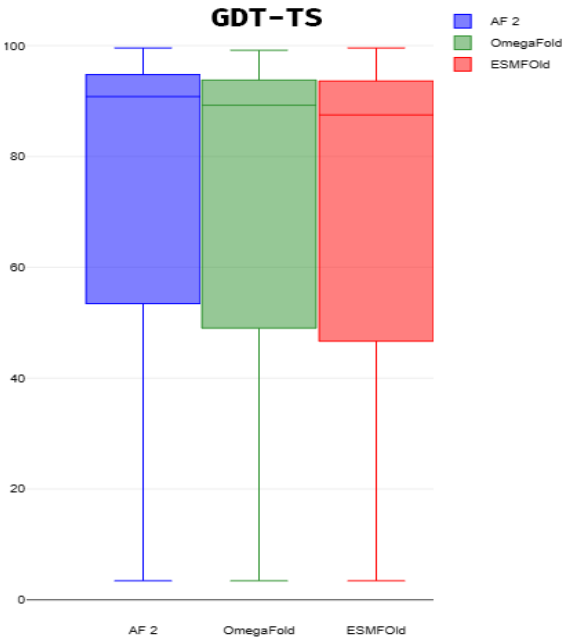

Fig 1.2: Boxplot of GDT-TS

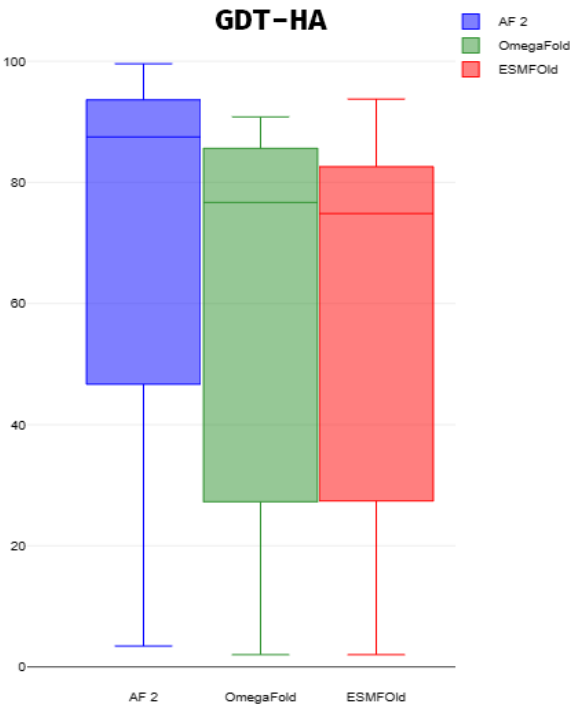

Fig 1.3: Boxplot of GDT-HA

The GDT-TS score is often used to compare the performance of different models in the CASP (Critical Assessment of Techniques for Protein Structure Prediction) evaluation. This score is based on the percentage of alpha carbons that are found within certain distance cutoffs of each other[2]. In our analysis, Alpha Fold 2 performed the best among the three models, while Omega Fold and ESM Fold had similar scores with a mean of 0.69 and a standard deviation of ±0.33. This pattern was also observed for the GDT-HA score, with both OmegaFold and ESMFold obtaining a score of 0.58 and a slightly lower standard deviation of ±0.31 for ESMFold. Overall, these results indicate that Alpha Fold 2 performs particularly well according to the GDT scores, but OmegaFold and ESMFold also show strong performance with similar scores and relatively low standard deviations.From the box plots in fig 1.1, 1.2 and 1.3 it can be seen, the accuracy of AlphaFold 2 is much more consistent than both Omega Fold and ESM Fold.

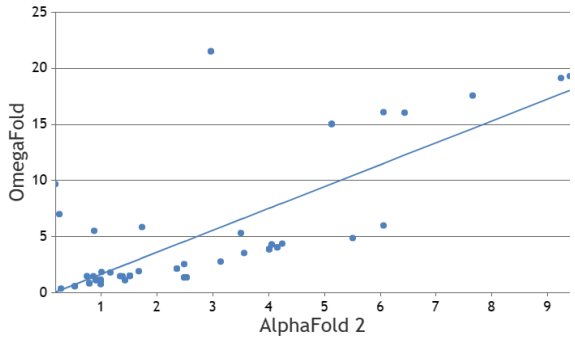

Fig 2.1: Scatter Plot of AlphFold2 and OmegaFold using RMSD score

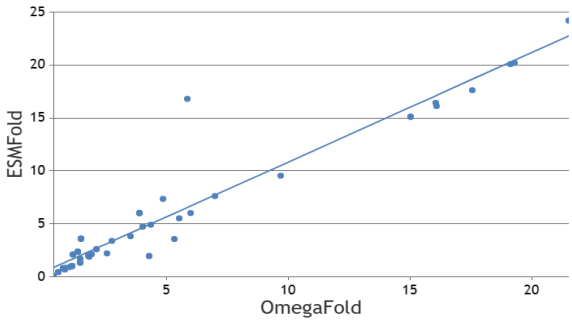

Fig 2.2: Scatter Plot of OmegaFold and ESMFold using RMSD score

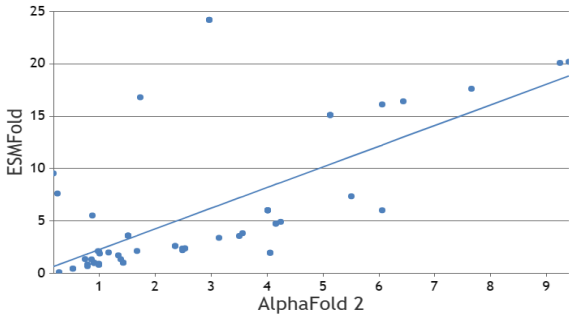

Fig 2.3: Scatter Plot of AlphaFold 2 and ESMFold using RMSD score

The code of modern machine learning methods, especially protein folding-related deep learning methods, is more or less black-boxed[6]. So, to figure out if there is any similarity between the algorithms, scatterplot was visualized (fig 2.1, 2.2 and 2.3) and correlation of RMSD value of each pair of the models were calculated. It was found that the correlation between RMSD values of OmegaFold and ESMFold is 0.96. This indicates that the algorithm used in these two might be similar in nature. Also, it provides a reasoning as to why their GDT-TS and GDT-HA score is so similar. The correlation of Alpha Fold and Omega Fold is 0.71 and correlation of Alpha Fold and ESM Fold is 0.67.

V. COMPUTATIONAL TIME

The tests were performed using Colab notebook using the implementation found in https://github.com/sokrypton/ColabFold. Predicted pdb was scored using the program provided by https://zhanggroup.org/TM-score. At the time of testing, the allocated GPU by Google Colaboratory was the Nvidia Tesla T4 which ran on driver version 460.32.03.

Out of all the algorithms, ESMFold performs fastest. Taking about 12-15 seconds on average per protein sequence. OmegaFold takes about 40-50 seconds on average. On the other hand AlphaFold2 takes about 4-5 minutes on average. It is to be noted that, in cases of protein that is quite large in length (400 or above), AlphaFold takes around 30 minutes to complete. The implementation of AlphaFold 2 that was used to

benchmark uses mmseq2 for MSA instead of Jackhammer.

VI. CONCLUSION

We have successfully implemented Alpha Fold 2, Omeg a Fold, and ESM Fold protein folding models on different samples of Cytokines protein structures and assess their performances using different scoring metrics. There were some protein sequences where the results of all the models were inaccurate. To understand these abnormalities, a more thorough test needs to be conducted by clustering the Cytokines based on their structure. However, judging from the sequences that were tested, Alpha Fold 2 performs with higher accuracy. But ESM Fold scores very competitively if we take in how fast it predicts.

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★★★

HANDWRITTEN WORD RECOGNITION USING DIFFERENT ARCHITECTURES OF CONVOLUTIONAL NEURAL NETWORK

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Abstract - A language is mainly a combination of words. To recognize a particular means to recognize the words. Word recognition is very important for every language. The characters that are included in a character's image are identified by handwriting recognition software [1]. Handwritten word recognition (HWR) is not done accurately still. In previous times, the used technique was less accurate. To solve the problem, we proposed a technique in the proposed method. Five architectures of the Convolutional neural network (CNN) have been used in the proposed method. Those are ResNet-50, Alex Net, VGG-16, Efficient B2, and Efficient B3. Moreover, to train all models we use 2 datasets. First is Zilla (64), and Test (10). In the Zilla (64) dataset, there are 64 classes and almost 5000 input images. The 64 classes define 64 districts of Bangladesh. For Zilla (64) dataset, we get 92.12% validation accuracy from ResNet-50, 85.77% validation accuracy from Alex Net, 97. 69% validation accuracy from Efficient B2, 92.22% validation accuracy from Efficient B3, 77.31% validation accuracy from VGG-16. Almost every model gives a good accuracy rate compared to the existing work. A little bit of error was found because of the resemblance and lofty curvature nature of the data.

I. INTRODUCTION

Bangla is the national language of Bangladesh. Bangla is also spoken in some parts of India. Its native speakers are about 300 million. Bangla has huge importance in the official work of that portion. Every official work has been recorded manually. To preserve those analog documents, it is important to convert the document into digital format [2]. To do so, first, we have to recognize the handwritten document. Secondly, the recognized document as the image will have to convert into a pdf file.

The main portion of the work is to recognize the handwritten document. Handwritten character is very challenging than printed forms [3]. Due to the architecture of the convolutional neural network (CNN) and extensive research on using deep CNN to distinguish handwritten numbers, characters, etc., CNN has recently gained popularity for sophisticated image identification [4]. In almost every language in the world, it is already accomplished to recognize the handwritten document and make it digital from the analog version.

In contrast, limited work has been done in Bangla [5]. The primary work of language recognition is the character recognition of that particular language. Bangla language has consisted of 50 characters. The word is combined of those characters. In the recognition part almost every paper that is existing proposed the same type of method. The method is to apply the conventional Convolutional neural network. Almost every method proposed a limited number of hidden layers. For this reason, the accuracy rate of that method is low. A novel method of recognizing the handwritten document has been stated. The architectures of CNN are used to recognize the handwritten word. We use five architectures of CNN to implement the method. Those models are 1. Vgg-16, 2. Alex-net, 3. Resnet-50, 4. EfficieentB2 5. EfficientB3. CNN is now widely used for image classification.

It is very effective for classifying images. We have used two datasets to extract the classifying result from images. One is Zilla (64)[6] dataset (From Kaggle) and the other is the Test (10) dataset. Zilla (64) has 64 classes.

And Test dataset contains 10 classes. The test dataset is specially made for this experiment. For recognizing Bangla character, some effective model has been proposed in the existing paper. Normally deep learning-based algorithms are used to do so. Some models proposed augmentation technique as their working procedure. In the word recognition field, there has been done limited work and that work is not efficient.

To increase accuracy and also decrease time complexity we have proposed this method. In this paper, the 5 each architecture got high accuracy. Efficient B2 got almost 97% validation accuracy and ResNet-50 got 92% validation accuracy.We use Convolutional neural network (CNN) based architecture in this paper. The reason behind it is good in terms of image classification. That neural network gives maximum accurate results.

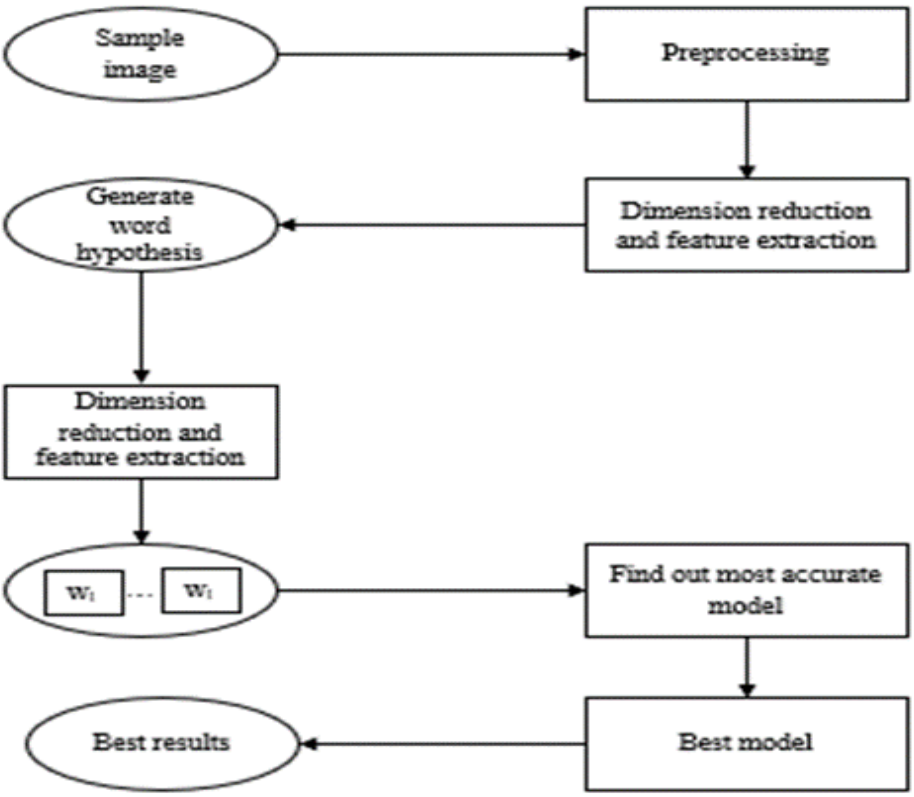

Fig. 1.Word recognition procedure [7]

"Fig. 1" illustrates the whole scenario of the work. Sample image is being taken as input is the first step. Then pre-processing is been done including feature extraction. The pooling layers of the model have done the dimensional reduction part. The accuracy of recognizing the work is being evaluated by using five different architectures of convolutional neural networks. Finally, the best model has been taken to do the work in terms of their accuracy.

II. RELATED WORK

Related work: Bangla characters are very complicated characters through the world. Specially combined word is very complex. Those are hard to understand. Handwritten word detection is being done comprehensively for the reservation of document in many languages of the world.

Md. Tanvir Hossain et. al. [8]proposed multi-Zoned character segmentation also a merging method. This method gives handwritten term. A procedure of segmenting the handwritten characters from the input image has been suggested here to identify that word from input image. In terms of character recognition, 84% of accuracy is measured. The accuracy rate is 82% for word recognition.Sara Binte Zinnat, et. al.[9] has stateda method of automatic Bangla word recognition. The proposed method of here is speaker and also gender independent. The method can detect continuous speech. A system that increases the redaction of the ASR system has been stated here by extracting some new features named LF or local feature. MFCCs as well as LFs are used as input to the Hidden Markov Model (HMM) based classifiers for getting word recognition performance.

Ayan Kumar Bhunia et. al.[10]has proposed a study for bringing out features for Bangla text recognition. Different types of features have been extracted here. Local Gradient of Histogram (LGH), Pyramid Histogram of Oriented Gradient (PHOG) and also profile features have been extracted here. All of the features are used in Hidden Markov Model (HMM) based framework. There are some types of zones there. Features are mainly extracted from middle zone. Md Ali Azad et. al. [11]has proposed a zone segmentation method.A deep convolutional neural network-based model DConvAENNet to recognize handwritten word (Bangla) has been proposed by. Three types of datasets are used here. Those are BanglaLekha-Isolated, CMATERdb 3.1, Ekush. The accuracy is not sufficient that they get from here. 22 number of experiments have been used here.

Nilanjana Bhattacharya et.al. [12]proposed a unique word recognition system. A feature set is proposed here that is modified. The method is mainly based on making feature set. Firstly, the required feature set is made from existing feature set by including new features. It helps the model to increase the overall accuracy. For getting testing accuracy, An HMM-based classifier has been used.

Kanchan Chowdhury, Lamia Alam, Shyla Sarmin et. al. [13]has proposed a handwritten word recognition model. The proposed model has a great impact to recognize different types of writing style. Fuzzy linguistic based rules have been used to construct the model. The proposed model is impactful for mixing dataset but less effective for a sole written dataset.To overcome the existing problem, a model has been proposed. The proposed method gives much better accuracy than the existing paper. The proposed method has implemented a noble technique to recognize the handwritten word. The existing paper uses an augmentation technique to recognize a word. The augmentation technique is not appropriate for this work. Data loss can happen in the augmentation technique. That is the reason of getting the accuracy is low. We construct a convolutional neural network-based model to train and test our data. The proposed model is free from degradation problems and so is giving higher accuracy. The most architecture of our model acquired 96-98% training accuracy and also good testing accuracy.

III. BACKGROUND

The total number of native speakers of Bengali is about 250 million. Now, the official document of the country is increasing at a large rate. Every governmental and non-governmental office is preserving its record typically. It is getting more complex because of its huge space complexity, cost, and so on. So, if we can preserve it digitally then the problem can be reduced. Handwritten character/word detection in other languages is already done comprehensively. But in the Bengali language this kind of work especially word detection is not done ably. In this study, the method of handwritten Bangla word recognition using a convolutional neural network is proposed to do it ably.

3.1. VGG-16 architecture

"Fig. 2" shows the architecture of VGG-16. The input size of vgg-16 is (224, 224, 3). There are 64 channels and a 3*3 filter size in the first two layers also has the same padding. After those 2 layers, there is a max pooling layer that has (2, 2) stride. Convolutional layers have 2 layers and their filter size is (3,3). The total filter is 128. Then it increases step by step. Finally, it has a fully connected layer as a dense layer. After that, the max pooling layer (2,2) is called an identical layer. Then 256 filters expanse across both 2 convolutional layer which has filter sizes of (3,3). There are then three convolutional layers which are two sets. A max pool layer has after that.

Pseudocode of VGG-16 [14]:

Input: Handwritten word image

Output: Recognition of handwritten word images.

Procedure:

1. If a set of training and validation data set, then follow step 2 to 5
2. Resize to dimension (256×256)
3. Pre-processing to resize the image (224×224)
4. If a set is (224×224)
5. Preprocessing image with different preprocessing techniques.
6. Training Model= VGG-16 (include_top=False, weights= 'imagenet')
7. for a model in Model
8. Fined tuned with transfer learning
9. For epochs =50
10. Set the learning rate to 0.001
11. for images in handwritten word recognition
12. Update model parameter
13. End step for loop of 11th step
14. End for loop of 9th step
15. Whether training accuracy does not flourish for given epochs follow 16 and 17
16. After that js= js×.1
17. Block feature layers
18. For the epochs 50 or 100
19. For testing every image in data loader batch: Model parameter will be updated
20. End the for loop of step 18
21. Whether testing accuracy does not flourish till final layer
22. After that js= js×.1
23. End of For loop of step 18

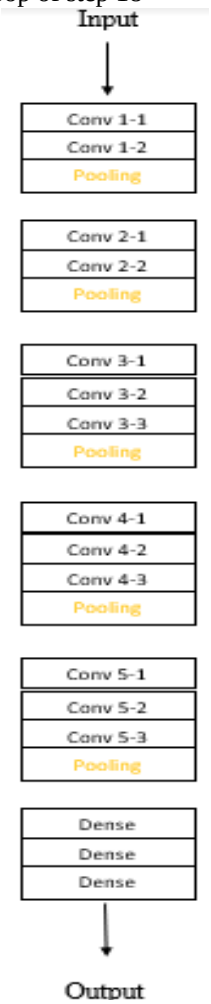

Fig. 2. Architecture map of VGG-16[15]

3.2. ResNet-50 architecture

"Fig. 3" shows the architecture of ResNet-50. Residual Networks (ResNet): Following the initial CNN-based design (AlexNet), which took first place in the ImageNet 2012 competition, each succeeding winning architecture employs additional deep neural network layers to lower the error rate. This is effective for smaller numbers of layers, but when we add more layers, a typical deep learning issue known as the Vanishing/Exploding gradient arises. This results in the gradient becoming zero or overly large. Therefore, the training and test error rate similarly increases as the number of layers is increased. A novel architecture called Residual Network was launched by Microsoft Research experts in 2015 with the proposal of ResNet. This network employs a VGG-19-inspired 34-layer plain network architecture before adding the shortcut connection. The architecture is subsequently changed into a residual network by these short-cut links.

Pseudocode of ResNet-50:

Input: Handwritten word image

Output: Recognition of handwritten word images.

Procedure:

1. If a set of training and validation data set, then follow step 2 to 5
2. 2.Resize to dimension (256×256)
3. Pre-processing to resize the image (224×224)
4. If a set is (224×224)
5. Preprocessing image with different preprocessing techniques.
6. Training Model= ResNet-50(include_top=False, weights= 'imagenet')
7. for a model in Model
8. Fined tuned with transfer learning
9. For epochs =50
10. Set the learning rate to 0.001
11. for images in handwritten word recognition
12. Update model parameter
13. End step 11's for loop
14. End 9's for loop

3.3. Alex-Net architecture

Compared to all other conventional machine learning and computer vision techniques, AlexNet obtained cutting-edge recognition accuracy."Fig. 4" depicts the AlexNet architecture. The first convolutional layer has 96 distinct 1111-sized receptive filters for convolution and max-pooling using Local Response Normalization (LRN). The 33 filters used in the max pooling operations have a stride size of 2. The second layer uses 55 filters to carry out the same procedures.The third, fourth, and fifth convolutional layers, which use 384, 384, and 296 feature maps, all employ 33 filters.With dropout and a SoftMax layer at the very end, two fully connected (FC) layers are utilized. For this model, two networks with comparable structural similarities and an equal number of feature maps are trained concurrently.AlexNet features two fully connected layers and three convolutional layers. Whenever the ImageNet dataset is processed. For the entire network, there are 61 million weights and 724 million MACs.That architecture gives good accuracy for mixing dataset (data from male and female).

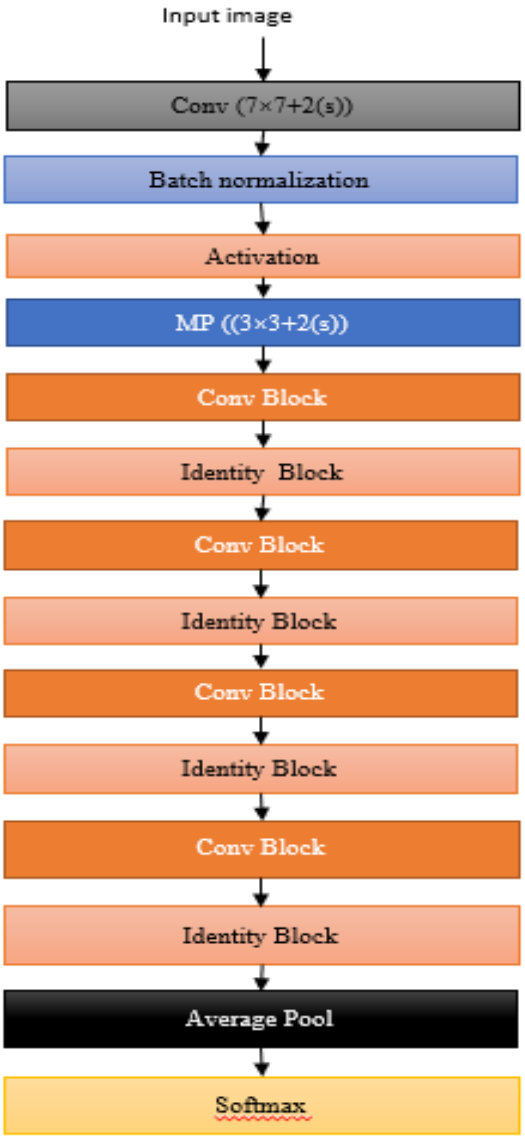

Fig. 3. Architecture map of ResNet-50[16]

Pseudocode of AlexNet:

Input: Handwritten word image

Output: Recognition of handwritten word images.

Procedure:

1. If a set of training and validation data set, then follow step 2 to 5
2. Resize to dimension (256×256)
3. Pre-processing to resize the image (224×224)
4. If a set is (224×224)
5. Preprocessing image with different preprocessing techniques.
6. Training Model= AlexNet (include_top=False, weights= 'imagenet')
7. for a model in Model
8. Fined tuned with transfer learning

9. For epochs =50
10. Set the learning rate to 0.001
11. for images in handwritten word recognition
12. Update model parameter
13. End step for loop of 11th step
14. End for loop of 9th step
15. Whether training accuracy does not flourish for given epochs follow 16 and 17
16. After that js= js×.1
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21. Whether testing accuracy does not flourish till final layer
22. After that js= js×.1
23. End of For loop of step 18

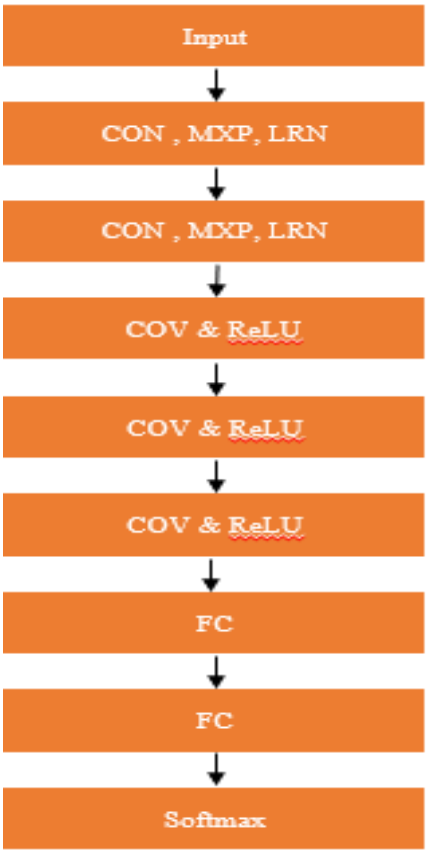

Fig. 4. Architecture map of AlexNet[17]

3.4. Efficient Net B2 and B3 Architectural details

"Fig. 5" shows the basic structure of Efficient Net B2 and B3. Any network's stem comes first after which all experimentation with this architecture, which is universal to all eight models, and the final layers begin. Following that, each of them has seven blocks. The number of sub-blocks within these blocks also varies, increasing from EfficientNetB0 to EfficientNetB7. We used B2 here. The module details of it are given below:

Module 1: This serves as the foundation for the sub-blocks.

Module 2: All seven of the main blocks, except for the first, use this as their starting point for the first sub-block.

Module 3: All of the sub-blocks are connected to this as a skip connection.

Module 4: The skip connection in the first sub-blocks is combined using this.

Module 5: This module combines the sub-blocks, each of which is connected to the one before it by a skip connection.

Pseudocode of EfficientNetB2 and B3 [15]:

Input: Handwritten word image

Output: Recognition of handwritten word images.

Procedure:

1. If a set of training and validation data set, then follow step 2 to 5
2. 2.Resize to dimension (256×256)
3. Pre-processing to resize the image (224×224)
4. If a set is (224×224)
5. Pre-processing image with different pre-processing techniques.
6. Training Model = EfficientNetB2 (include top=False, weights= 'imagenet'
7. for a model in Model
8. Fined tuned with transfer learning
9. For epochs =50
10. Set the learning rate to 0.001
11. for images in handwritten word recognition
12. Update model parameter
13. End step 11's for loop and 9's for loo.

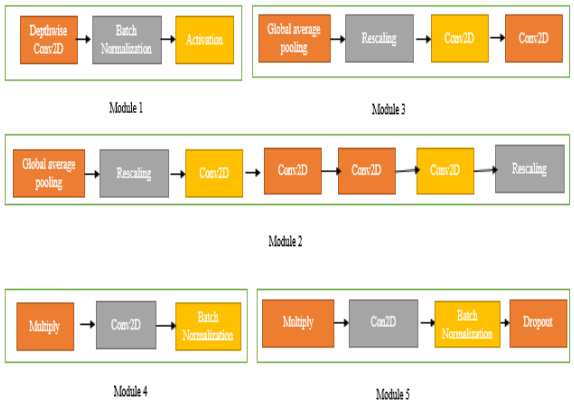

Fig. 5.Architectural details of EfficientNetB2 and B3 [24]

IV. PROPOSED METHOD

The proposed method consists of 5 CNN-based architectures. There are a total of 50 layers in the resnet-50 architecture. Alex Net is combined of 8 layers. The first 5 are called convolution layers. After that layer, it applies pooling activities with the pooling layer. Those layers apply max pooling here to deduce dimensional related features [18]. Usually, the process is used to shorten the dimensional values. Dropout does the same thing sometimes for some architecture. After pooling the model uses a fully connected or dense layer. Here toclassify the sigmoid function is used normally. The activation function is

used in feature extracting as ReLu. An efficient net has normally five portions as a module. The layer here is divided into those 5 modules. 16 layer is used in VGG-16. The group of machine learning methodsthat use sequential layers includes in-depth learning [19]. After the handwritten forms have been scanned, algorithms are run to accomplish line-level segmentation, followed by word-level segmentation [20]. The working procedure or flowchart of the proposed work is as follows:

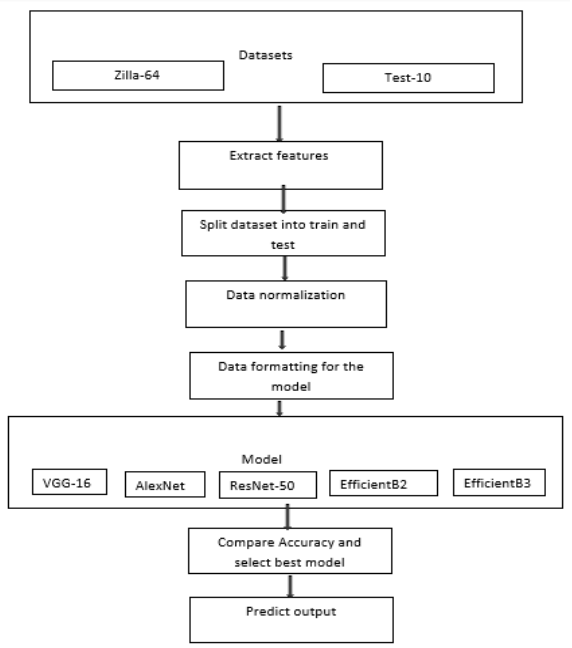

Fig. 6. Flowchart of word recognition system.

"Fig.6" has shown the total work procedure of the proposed method. The sample image is taken as input in the first step. Then pre-processing is been done including feature extraction. The pooling layers of the model have done the dimensional reduction part. Residual net (ResNet-50) uses average pooling to reduce dimension. Other architectures use max pooling to do so. It is incorporated that ResNet-50 has given maximum accuracy. The accuracy of recognizing the work is being evaluated by using five different architectures of convolutional neural networks. Finally, the best model (ResNet-50) has been taken to do the work in terms of their accuracy.

4.1. Data collection

We have used two datasets in the proposed method. Sample data have been collected from middle-aged men and women. Zilla (64) [6] has collected from Kaggle. All sample data is handwritten. These samples have been used to train the five architectures of our method.

4.2. Data collection

We have used two datasets in the proposed method. Sample data have been collected from middle-aged men and women. Zilla (64) [6] has collected from Kaggle. All sample data is handwritten. These samples have been used to train the five architectures of our method.

4.3. Dataset description

There are two types of datasets is used here. One is Zilla (64)[6]. Another is "test (10)". The description of these two datasets is given below:

4.4. Zilla (64)

This dataset consisted of 64 classes. Each class defines the district name of Bangladesh. There are about 9000 sample images in the dataset. In the dataset total sample images are divided into two sections. Male section and in contrast the female section. Each is divided with the same sample number. portions as a module. The layer here is divided into those 5 modules. 16 layer is used in VGG-16. The group of machine learning methods that use sequential layers includes in-depth learning [19]. After the handwritten forms have been scanned, algorithms are run to accomplish line-level segmentation, followed by word-level segmentation [20]. The working procedure or flowchart of the proposed work is as follows:

Fig. 7. Sample data from dataset[6]

"Fig. 7" shows the sample image of dataset "Zilla (64)". Dataset contains 9000 of sample images. 4.5 Test (10) "Test [10]" dataset is made for this proposed method. It consists of ten classes. A total of two thousand images has in the dataset. Every class has a decent number of images. We have used 90% of the images for training purposes and 10 % images for testing purposes.

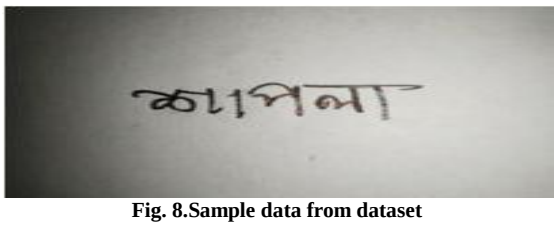

Fig. 8.Sample data from dataset

"Fig. 8" shows the sample image of dataset "Test". Dataset contains 5000 of sample images.

4.5. Pre-processing

Noise cleaning and component labelling are one of the processes of image processing [21]. The dataset is pre processed with the resample type of Kaiser fast which reduced the dataset's load time [22]. Firstly total 9000 of images are split into train and test folders. "Splitfolders" is used to do the splitting

procedure. The train folder is used to train all models of our proposed method. The testing folder is used to test the model. We can change the percentages of images in the training section and testing section with the split folders. Our method gave maximum accuracy in this way (Without overfitting). This is why we used it this way.

4.6. Feature extraction

The main element or attribute which generally helps us to detect an image or object is called features. These are very unique properties of an image. We just need to extract all the features or dimensions from an input image to unfasten the images formed on exact features or perspectives. To make things easier our proposed method used a default feature extractor in the training process. It is not used in the testing process right now. The feature extractor of CNN does it in the convolutional layer.

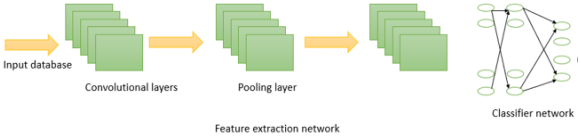

Fig. 9. Feature extraction method [25]

4.7. Environment setup

In research study and computational work anaconda is used here. Anaconda is being worked as a distribution for python and R. The goal of it is to manage packages and also deployment. Python 3.7 is used to train and test the images. Jupyter notebook is mainly a web-based IDE that used the default browser of pc. That module is used for data analysis in the proposed method. To use the module anaconda is downloaded from the site. Then it is been installed to pc. Pythons default packages are downloaded from the anaconda prompt. Now the system is ready to use.

4.8. Model evaluation

Validation accuracy, training accuracy, testing accuracy are the resulting and analysing parameter of our proposed method

Training Accuracy = TP+TNTP+FP+TN+FN

Where,

TP: True Positives

FP: False Positives

TN: True Negatives

FN: False Negatives

Testing Accuracy = (sensitivity) (prevalence) + (specificity) (1 - prevalence)

4.9. Model Building

The proposed method mainly consists of five different architectures. Those are 1. VGG-16, 2. Alex Net, 3. ResNet-50, 4. Efficient B2, 5. Efficient B3. The input size of vgg-16 is (224, 224, 3). There are 64 channels and a 3*3 filter size in the first two layers also has the same padding. After those 2 layers, there is a max pooling layer that has (2, 2) stride. Convolutional layers have 2 layers and their filter size is (3,3). The total filter is 128. Then it increases step by step. Finally, it has a fully connected layer as a dense layer. It has a total of eight layers. Five convolutional layers and 3 fully connected or dense layers. In image classification, AlexNet gives good results. It has 50 layers. The average pooling layer has existed here. It reduces the degradation problem [23]. So, data loss has decreased in this architecture. It has 342 layers. The layers area dividedinto 5 modules. The input size here is (260,260,3).

V. RESULT AND DISCUSSION

We measure three parameters from our proposed method. Validation accuracy, training accuracy, and loss error rate. The error rate is the data loss rate. We get various accuracy from our five architectures. Compared with the accuracy of the existing work, our proposed method including all architectures gives maximum accuracy. The main reason behind it is the using conventional neural network. We used Adam optimizer in our model. It increases the accuracy. We implement the model using two datasets. Accuracy also differs from architecture to architecture in adifferent dataset. We first use "Test (10)" dataset. That dataset is manually made for this work. All architecture gave the best accuracy compared with the existing model of other papers.

Model Name	Validation Accuracy	Accuracy	Validation Loss
RESNET-50	93.12	97.98	0.0549
ALEXNET	86.77	89.54	0.3059
EFFICIENTB2	95.69	98.52	0.0346
EFFICIENTB3	93.22	96.50	0.0749
VGG-16	78.31	95.26	0.1388

Table 1 Accuracy rate and loss rate of various architecture for "Test" dataset

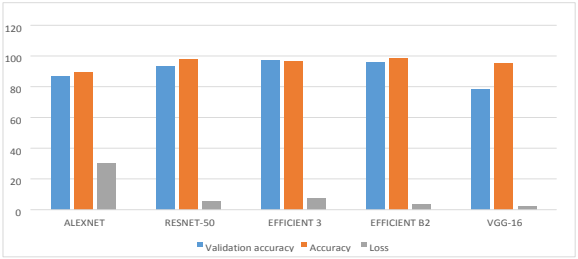

Fig. 10.Bar chart for Validation accuracy, training accuracy and loss function of five architecture (CNN) for "Test" dataset.[8]

"Fig. 10 and Table 1" has illustrated the accuracy rate of validation accuracy, training accuracy, and loss. Sample image is being taken as input is the first step. This validation accuracy, training accuracy, and loss are evaluated using two datasets. The above measurement is for the first dataset. VGG-16 has given the lowest loss rate but the accuracy rate is not enough. In contrast, resnet-50 has given maximum accuracy and also a good loss rate. The reason behind

it can be the degradation problem. Then pre-processing is been done including feature extraction. The pooling layers of the model have done the dimensional reduction part. Theaccuracy of recognizing the work is being evaluated by using five different architectures of convolutional neural networks. Finally, the best model has been taken to do the work in terms of their accuracy.The accuracy list of those five architectures has given in table 1.Sample image is being taken as input is the first step. Then pre-processing is been done including feature extraction. The pooling layers of the model have done the dimensional reduction part. The accuracy of recognizing the work is being evaluated by using five different architectures of convolutional neural networks. Finally, the best model has been taken to do the work in terms of their accuracy

So, we see that we get maximum validation accuracy from the architecture Efficient B2. And it is 95.69%. That is one of the best results in terms of accuracy ever. Our proposed model predicts to use of this architecture. Also, ResNet is giving good validation accuracy. ResNet also removes degradation issues. This architecture also can be used. Those are giving good accuracy because efficient B2 is divided into some modules. The layers are divided into five modules.We also implemented the 5 architectures with the dataset Zilla (64). Which contains about 9000 images.

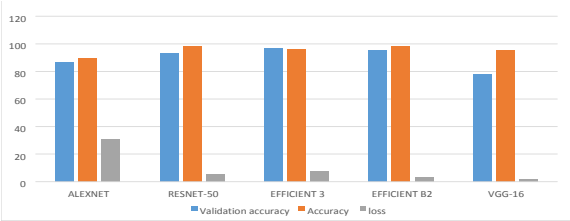

Fig. 11. Bar chart for Dataset "Zilla (64)"[8]

Model Name	Validation Accuracy	Accuracy	Validation Loss
RESNET-50	92.12	93.98	0.0549
ALEXNET	85.77	88.54	0.3059
EFFICIENTB2	97.69	97.52	0.0346
EFFICIENTB3	92.22	94.50	0.0749
VGG-16	77.31	93.26	0.1388

Table 2 Accuracy for dataset "Zilla (64)

"Fig. 11 and Table 2" has illustrated the accuracy rate of validation accuracy, training accuracy, and loss for dataset "Zilla (64). Sample image is being taken as input is the first step. Then pre-processing is been done including feature extraction. The pooling layers of the model have done the dimensional reduction part. The accuracy of recognizing the work is being evaluated by using five different architectures of convolutional neural networks. Finally, the best model has been taken to do the work in terms of their accuracy.So, using another dataset we get maximum validation accuracy from efficient B2. And we got 98% almost validation accuracy. Training accuracy also best is 98% almost. The total loss or error rate is less than all architecture. For efficient B2, it is 3.46 %. Res Net has also given good accuracy. Validation accuracy and training accuracy both are high in number. If validation accuracy and training accuracy remains so close in terms of percentage, we can define it as a good model. We can see in the above. The validation accuracy and training accuracy of ResNet-50 are almost the same. Validation Accuracy is 92% and training accuracy is 94%. It is incorporated that the model is well-tuned. It is simple to train networks with several layers (even thousands) without raising the training error percentage. By applying identity mapping, Res Nets assist in solving the vanishing gradient problem. This is the reason why the accuracy of ResNet-50 is higher and well-tuned. The model is overfitting free. We also see the error rate of Efficient Net B2 and B3 is much lower than other architecture. These architectures also convey a good rate of training accuracy.

VI. CONCLUSION

In the field of image classification convolutional neural network is inevitable. HWR(Handwritten word recognition) will play a significant role in many sections of governmental and non-governmental institutions. In the previous some HWR-related papers we have seen low accuracy in the data training stage and data testing stages. Compared with accuracy, our model is best for recognizing handwritten words. We can also increase accuracy to increase hidden layers and increase epochs. The huge number of layers can create degradation problems though. Data loss can happen there. So ResNet-50 is more suitable for these concerns. ResNet-50 also gave the best accuracy. To compare the existing paper, our model is best in terms of accuracy. Someone can just increase the dataset as his/her requirement and can get maximum accuracy using our proposed method. Compared to the existing work our proposed method gave the best accuracy. Also, the error rate is much lower than the existing work. Future work will be to increase the dataset (Maximum words of Bengali dictionary) and convert it into a pdf file for document preservation after recognition.

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★★★

ROLE OF RESILIENCE IN RELATIONSHIP BETWEEN FUNCTIONAL & DYSFUNCTIONAL NEGATIVE EMOTIONS AND WELLBEING IN INDIVIDUALS WITH OBSESSIVE –COMPULSIVE DISORDER

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Abstract -
Background: Individuals with OCD feel urge to repeat compulsion or mental acts until the experience of relief in anxiety and distress.The negative emotions can affect the severity in OCD and play role in wellbeing of Individuals with OCD.Resilience has a direct relationship with wellbeing it refers to the ability to cope with and adapt to new environment. This study aims to study role of resilience in presence of Functional and dysfunctional negative emotions.
Method: The present study investigated the relation between resilience, functional and dysfunctional negative emotion and psychological wellbeing in 150 patients with OCD.
Result: Results showed that functional and dysfunctional negative emotion was negatively correlated to resilience and wellbeing.Additionally, resilience was positively associated with psychological wellbeing. Further analyses showed that resilience moderated the relationship between functional negative emotion and psychological wellbeing. Though, no significant interaction of resilience was found between dysfunctional negative emotions and psychological wellbeing.
Conclusion: Examining these relationships thus aids in improving understanding of emotions and the development of therapeutic strategies for improved therapeutic results.

Keywords - Resilience, Functional and dysfunctional negative emotions, psychological wellbeing, obsessive compulsive disorder

MODERATING ROLE OF AGE IN ASSOCIATION BETWEEN FUNCTIONAL AND DYSFUNCTIONAL NEGATIVE EMOTION AND OCD SEVERITY

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Abstract -
Background: Obsessive-compulsive disorder (OCD) is a persistent mental illness in which obsessions or intrusive thoughts lead to obsessive actions and routines. Uncontrollable, unpleasant thoughts and ritualized, repeated activities that make one feel forced.Those with OCD know their obsessive thoughts and compulsive actions are unreasonable, yet they can't avoid them.The current study examines the moderating effect of age and explores the relationship of Functional as well as dysfunctional type of negative emotions with severity in Obsessive Compulsive disorder.
Method: The present study investigated the effect of age in relation between functional and dysfunctional negative emotion and OCD severity in 150 patients.
Result: Results showed that functional and dysfunctional negative emotion was positively correlated to OCD Severity and significant relationship exists between them.Additionally, no significant interaction of Age was found between Functional &dysfunctional negative emotions and OCD severity.
Conclusion: Investigating these connections thus contributes to a better understanding of emotions as well as the creation of new therapeutic approaches, which in turn leads to enhanced therapeutic outcomes.

Keywords - Functional and dysfunctional negative emotions, OCD severityAge, obsessive compulsive disorder

VEHICLE MOVEMENT ANALYSIS FOR WIND POWER EXTRACTION

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Abstract - In the last few decades, the research and applications of renewable energy have increases due to the fast depletion of our non-renewable energy resources. Among them, wind energy and solar energy are the two most extensive researched energy sources and hence, the research on wind turbines have been carried our quite frequently. One of the most recent and less studied technologies is extracting wind energy from the air pushed aside by fast moving vehicles. However in order to start researching on those turbines, it is important to research on the vehicles. How vehicles move and how they can be made to move in order to maximize the wind energy production is very important. Hence, in this paper we will be dealing with that fundamental issue of the above mentioned technology. In this paper we will be looking into three particular cases of vehicle movement, i.e. when a single car moves, when two cars move side-by-side in the same direction and when to vehicles approach each other from opposite direction in different lanes. We will study how these influence the air velocity field around, the optimum position to put a turbine and also give an estimation of time-gap required between two consecutive vehicles approaching the turbine.

Keywords - Non-Renewable, Vehicle Movement, Air Velocity Field, Optimum Position, Time-Gap

I. INTRODUCTION

As the per capita energy consumption increases through the last decade and the non-renewable energy sources deplete at an alarming rate, scientist are now focusing on developing new technologies for extracting energy from wind, the sun and ocean. Only, a few years back, the scientists started thinking about extracting wind from moving vehicles. Salvadori et al. (2012), made a study of wake structures created behind trucks moving on highways for studing the wasted wind energy. Quartey et al. (2014) connected a horizontal axis wind turbine on the roof of vehicle head, to extract wind energy when the vehicle moves. Prasanth et al. (2011) showed us three procedures of getting wind energy from moving trains. That paper also described the basic physics of how wind gets moved aside when a vehicle moves. Anand (2019) constructed a wind turbine which can extract energy from both wind and the sun. The most significant work on extracting wind energy from moving vehicles came by Kumar et al. (2016). That paper develops a physical model which gives us the velocity of wind pushed aside by the vehicle and the power developed by the turbine. The paper considered an imaginary cylinder of air created at the back of the moving vehicle and at the end of the cylinder, the turbine was placed. Kumar et al. (2016) also proposed the use of piezoelectric materials to harness electricity from the vibrations on the roads initiated by moving vehicles considering the design from the previous paper.

However, the optimum position of where to put the wind turbine and how the vehicles should be made to move in order to maximize the performance of these arrangements are not studied in the literature. We intend to do that using three specific arrangements, i.e. a single car moving and two cars moving at same and different directions. We do a complete numerical study of how these arrangements produce wind and how much time lag should be in between two vehicles to ensure a smooth working of the turbines.

II. FLOW SET-UP AND BOUNDARY CONDITIONS

All the analysis is done by the commercial software of ANSYS Fluent 2022 (Student Version). The domain was taken as a 10×100 m 2D box, with the car of dimensions 1×2 m lying on the left end of the box. The single car is placed on the center while the double cars are placed at a distance of 1 m from each other. Only triangular mesh elements were chosen of size 0.05 m. A user defined function was written in C (provided in Appendix A1 and A2) which provided a test car velocity of 1 m/s (+ x). Along with it, wind was considered to be blowing in the opposite direction of the car movement with velocity of 0.05 m/s (- x). No-Slip boundary condition along the car bodies and symmetric b.c. along the top and bottom edge was considered. The left edge was considered a pressure outlet and the right edge was considered as a velocity inlet with air of very small velocity entering.

The flow was considered transient with gravity value of 9.81 m/s^2 (-y). The Navier Stokes equations were approximated using RANS and the standard k-Є closure model was used to model the unresolved stress terms. Dynamic meshing with Smoothing and Re-layering were chosen, in order to accommodate the moving vehicle in the mesh. The calculations were run for 800 iterations (enough time to ensure the vehicle move to the end). Each of the iteration had 10 time steps of length 0.1 s. Along with this; the simulation data were stored after every 5 of the

iterations, in order to animate the car movement through the domain. Figure 1 shows us the mesh and geometry used for simulating the velocity around one and two cars moving at the same direction and different directions

Figure 1(b): One car moving

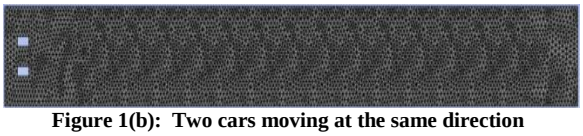

Figure 1(b): Two cars moving at the same direction

Figure 1(c): Two cars moving at the different direction

III. VELOCITY PROFILES

For a single car passing through a road, the velocity profile is indicated by Figure 2. In this figure, it is visible that the velocity reaches the maximum value right behind the vehicle and then it decreases steeply, since the no slip condition has to be satisfied at the vehicle edges and subsequently, the boundary layer flow is induced. After a certain distance on both the sides of the vehicle, the velocity increases again to approximately 0.3 m/s (approx. 70 % reduction to the maximum value), after which it finally decreases. Hence, the optimum position to place the turbines are along the lines with velocity 0.3 m/s. which are shown by black dotted lines.

For two cars passing by, the same domain size has been considered. Figure 3 shows the velocity profile induced by two cars moving at the same direction. In figure 3 the velocity is the highest right behind the vehicles. Similar to Figure 1, they tend to have second local maxima of 0.4 m/s (approx. 60 % reduction to the maximum value) on the further sides of the vehicles, after which they finally decrease down. However, in between the two vehicles, we get to see other local maxima of more than 0.4 m/s. This makes the optimum position of placing the turbines more (shown by the three black lines) and hence a more efficient transportation design consideration.

Similarly, as seen in Figure 4, for the car moving in different direction, the global maxima are attained right behind the two vehicles. However, in this case, the velocity keeps on decreasing without reaching other local maxima on the way. Unlike in figure 3, the velocity distribution induced in between the two vehicles is the lowest and there is no physical significance of that position. Hence, no particular optimum position to place the turbines are found in this type of vehicle movement arrangement. Hence we assume an optimum position of 3 and -3 m (in black).

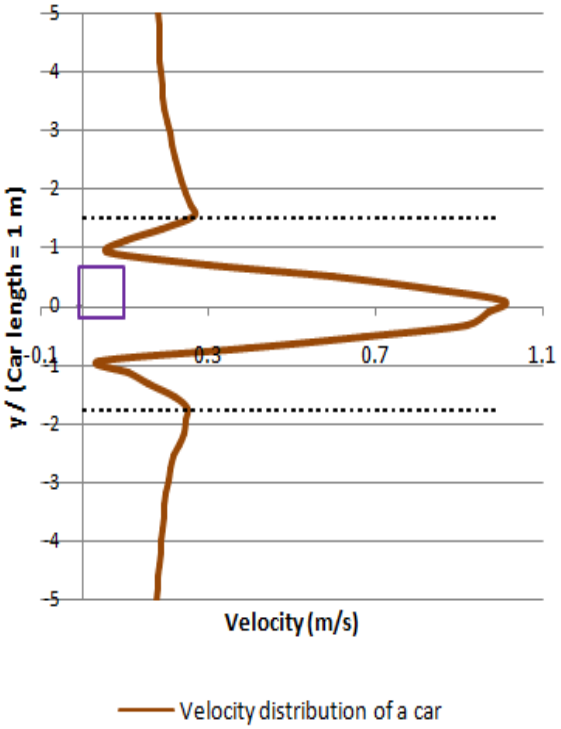

Figure 2: Vehicle distribution in case of a single car

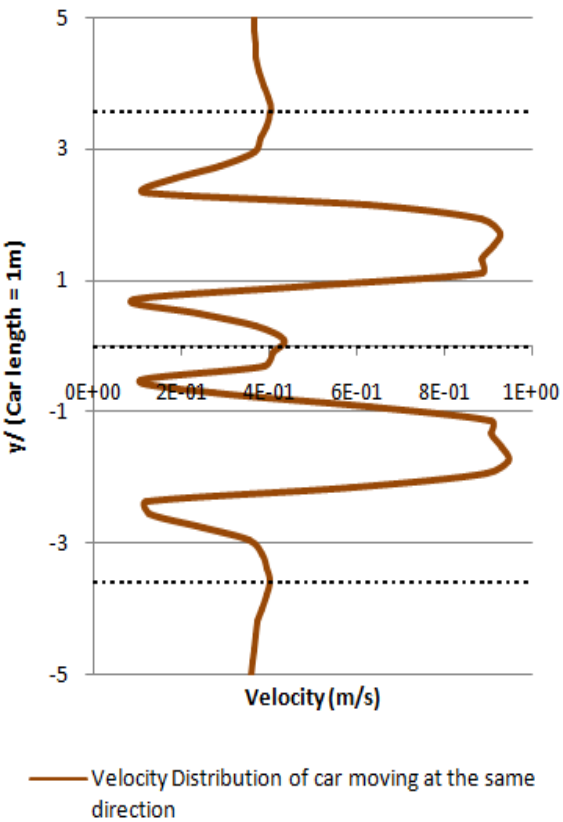

Figure 3: Velocity profile in case of vehicles moving in the same direction

IV. MINIMUM TIME DURATION BETWEEN TWO VEHCILES

One of the most important factors a designer needs to make sure is that the turbine should keep on

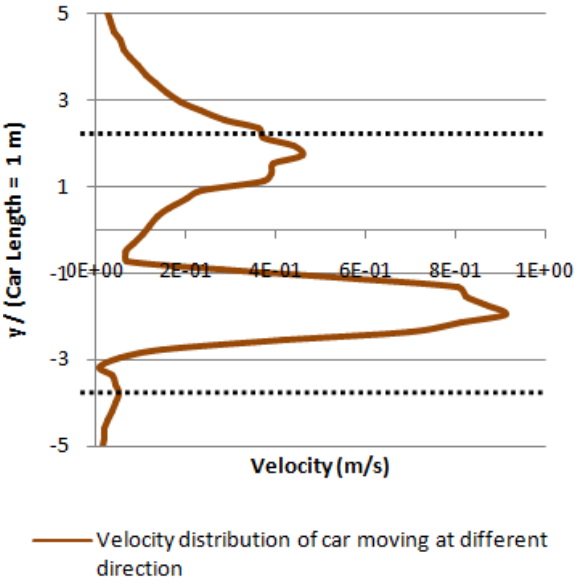

Figure 4: Velocity profile in case of vehicles moving in the different direction

rotating without stopping. For this, a consistent flow of wind is required, which in turn tells us that a continuous approach of vehicles is required. This can be analyzed by giving an estimate of the required time gap between two passing vehicles to ensure that the turbine rotates continuously. In this paper, a simple approach is taken in order to do this. The velocity profiles are recorded at a certain location (across a line in the domain) at regular time intervals. The recording is started when the vehicle just passes by that particular position and this time is considered as t = 0s. The velocity at the most favorable point to place the turbine (as discussed earlier) is considered. The moment it goes below a threshold velocity (chosen by intuition), that time is termed as the minimum time difference between the passing of two vehicles through that particular position which can be allowed in order to get a smooth functioning of the turbine.

Figure 5 and 6 shows how the velocity profile flattens out across a particular line for a single car and two cars moving in the same direction, respectively. The images are self-explanatory. The nature of the velocity profiles and their explanations are described in details in the previous section. It starts out with strong features (till approximately 20 s) and slowly flattens out. Figure 7 shows us the velocity profile characteristics when two vehicle moves in opposite to each other. Here, as one vehicle moves across the line, we get strong features (10 – 25 s) and then it starts flattening out; but at 35 s, we find the features again strengthening. This is because of the second car which is moving at the opposite direction, passing across the line.

From figure 8, we can see the how the velocity of all the eight vehicles decreases to a very low value near the end. Judging from the figure, two zones were shaded out. 10 -12 s was chosen as the optimum time difference between two vehicles in order to ensure the smooth supply of air, as well as for a smooth running of the turbine. This is because, till 10 -12 s, the wind loses 33.33 – 50 % of their energy. However, this case may not be fulfilled in every situation. Hence a highest time difference of 30 s is also estimated, till which the wind loses 50 – 75 % of its energy. Above this time difference, the turbine will not work properly and is predicted to stop in between waiting for the next vehicle to power it up.

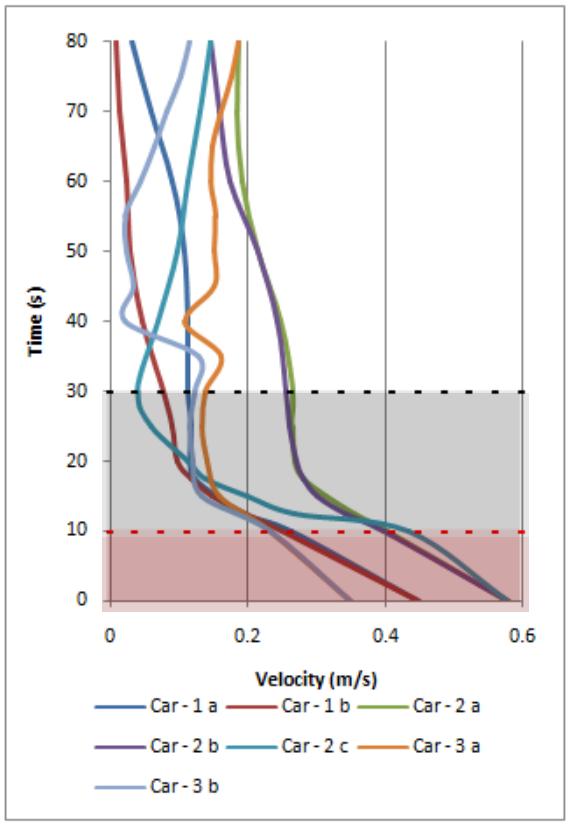

Figure 8: Velocity decrement with time; Car 1a and 1b refers to the two optimum lines of placing turbine in case of single car (Fig 2); Car 2a, 2b and 2c refers to the three optimum lines of placing the turbine in case of double cars moving in same direction; Car 3a, 3b refers to the two optimum lines of placing the turbine in case of double cars moving in double direction

V. CONCLUSION

From the above analysis, we can conclude that in a broad road, where multiple cars move in a same

direction, wind turbines can be used most efficiently in those cases. Turbines can beput in between the lanes. As when, car moves in opposite direction in narrower roads, turbines don't perform satisfactorily in between positions as well as in away positions. The case where a single car passes is more efficient than the former case. Subsequently, in order to ensure a smooth and continuous turbine motion, an estimated optimal time difference of 10 - 12 s and highest time difference of 30 s were predicted between two consecutive vehicles.

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APPENDIX

A1 – User Defined Function for Vehicles moving in same direction

```
#include "udf.h"
DEFINE_CG_MOTION(moving_wall_1,dt,vel,omega,time,dtime)
{
        real t = CURRENT_TIME;
        NV_S(vel, = , 0.0);
        /*vel[1] = 2*cos(3.1416*t);*/
        vel[0] = 1;
}
```

A2 – User Defined Function for Vehicles moving in different direction

```
#include "udf.h"
DEFINE_CG_MOTION(moving_wall_1,dt,vel,omega,time,dtime)
{
        real t = CURRENT_TIME;
        NV_S(vel, = , 0.0);
        /*vel[1] = 2*cos(3.1416*t);*/
        vel[0] = 1;
}
DEFINE_CG_MOTION(moving_wall_2,dt,vel,omega,time,dtime)
{
        real t = CURRENT_TIME;
        NV_S(vel, = , 0.0);
        /*vel[1] = 2*cos(3.1416*t);*/
        vel[0] = -1;
}
```

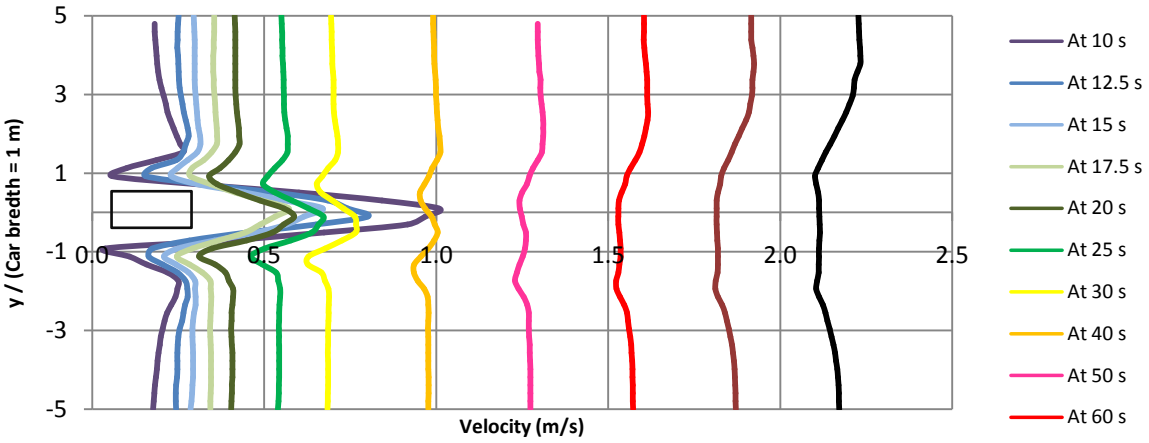

Figure 5: Time series of velocity profile across a line for a single car passing

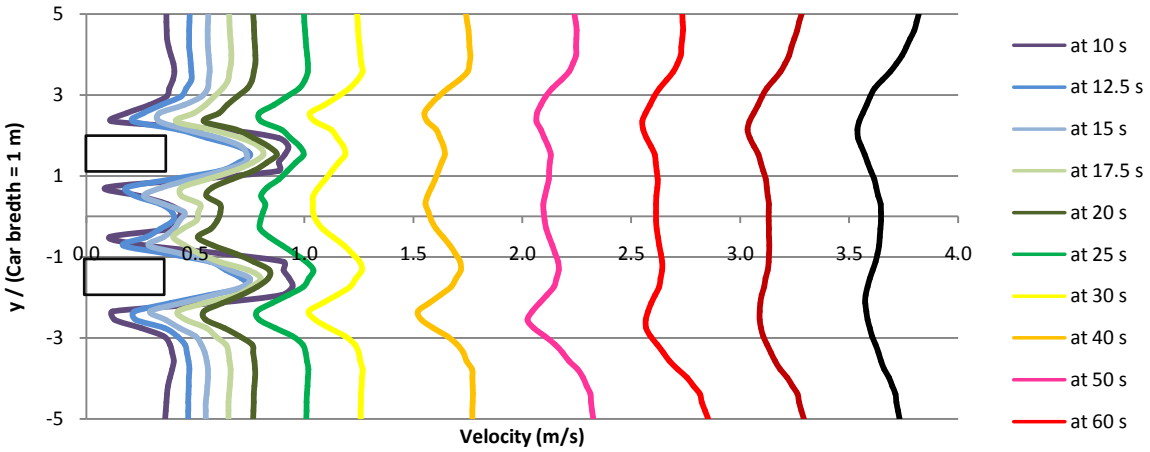

Figure 6: Time series of velocity profile across a line for two cars passing (same direction)

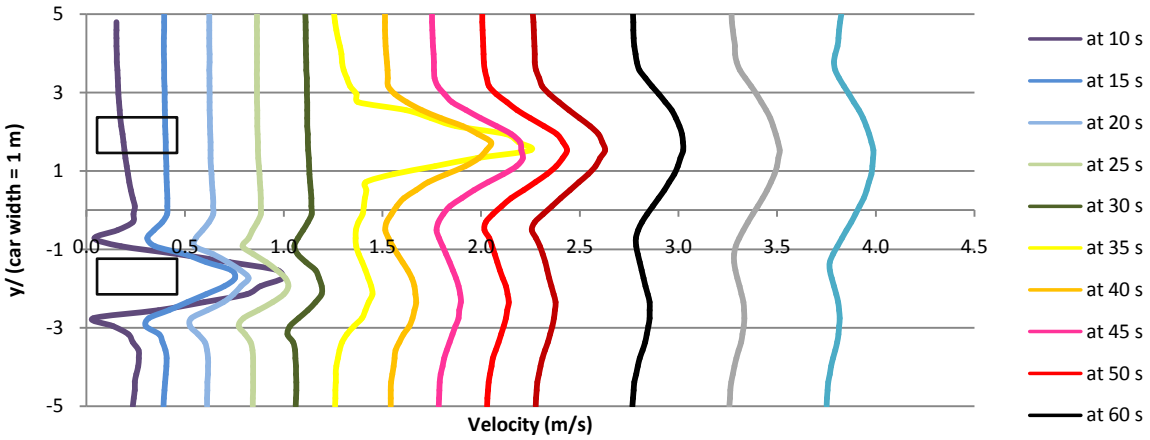

Figure 7: Time series of velocity profile across a line for two cars passing (diff. direction)

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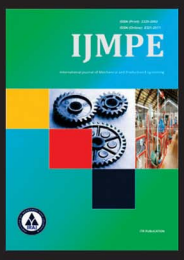

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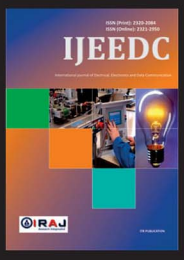

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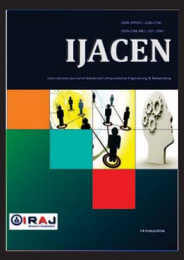

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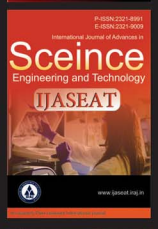

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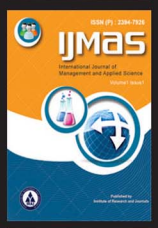

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