Human Intelligence Upgradation Using Artificial Intelligence Inspired by Neuroscience Models

Authors:-

1.Omkar Satish Dhekane
B.Tech Student, Department of Computer Science and Engineering
SVERI's College of Engineering, Pandharpur,
Solapur, Maharashtra, India
| ✉ dhekaneomkar912@gmail.com

2. Rohan Nivrutti Yadav
B.Tech Student, Department of Computer Science and Engineering
SVERI's College of Engineering, Pandharpur,
Solapur, Maharashtra, India
| ✉ rohanyadav8622@gmail.com

3. Jaydeep Prakash Survase
B.Tech Student, Department of Computer Science and Engineering
SVERI's College of Engineering, Pandharpur,
Solapur, Maharashtra, India
| ✉ jayadipsurwase@gmail.com

4. Ashutosh Vikas Malape
B.Tech Student, Department of Computer Science and Engineering
SVERI's College of Engineering, Pandharpur,
Solapur, Maharashtra, India
| ✉ ashutoshmalape092860@gmail.com

5. Rohan Popat Savle
B.Tech Student, Department of Computer Science and Engineering
SVERI's College of Engineering, Pandharpur,
Solapur, Maharashtra, India
| ✉ sawalerohan694@gmail.com

Abstract:-

Artificial Intelligence (AI) has developed rapidly, and it was able to show its capabilities for automation of the task and support for a decision making that is complicated. However, AI systems don't self-improve and depend on humans to upgrade such software. The human brain is extremely plastic and able to learn and grow throughout a person's lifetime, however. Theoretical neuroscience explains the brain mechanisms associated with how people process information, learn, and adapt. The combination of neurally-inspired models and AI systems also paves the way for replacing, not just augmenting human intelligence. In this chapter, we explore an alternative: how neuroscience may inform inspired AI about augmenting human cognitive skills that bring greatest value-increase in the form of learning faster, remembering more, deciding better and solving problems better. Furthermore, it presents the architecture,

applications, issues and possible research directions for the system from a Computer Science and Engineering perspective.

Keywords:-

Brain -Computer Interface, Artificial Intelligence, Neuroscience, Neural Decoding, EEG, Neural Networks, Neuroprosthetics, Signal Processing.

1.Introduction:-

AI technologies are a fundamental part of today's computer systems, applied to areas as diverse as health, education, cyber security and automation. AI, though more sophisticated, is not self-aware or self-replicating. AI translators or other AI programs need constant human input to be updated, optimized and made ethical. Another thing humans have in their favor is the fact that the brain is highly adaptable — neuroplasticity allows for learning, developing, and adapting to new challenges.

Neuroscience is the study of how the human brain is structured and how it works, with implications for learning, memory, and cognition. "Nobody's trying to resurrect Skynet," says Mitchell, but rather we want is to augment human intelligence using AI and, by working with brain-inspired models of computation that are more explainable than artificial neural networks," raise them to the next level.

2. Problem Statement:-

Most of what we have in terms of AI we see it's use in automation which in turn increases speed and efficiency. But what we don't see is them tackle issues like slow learning, mental fatigue, memory loss, lack of focus, and difficulty in decision making.

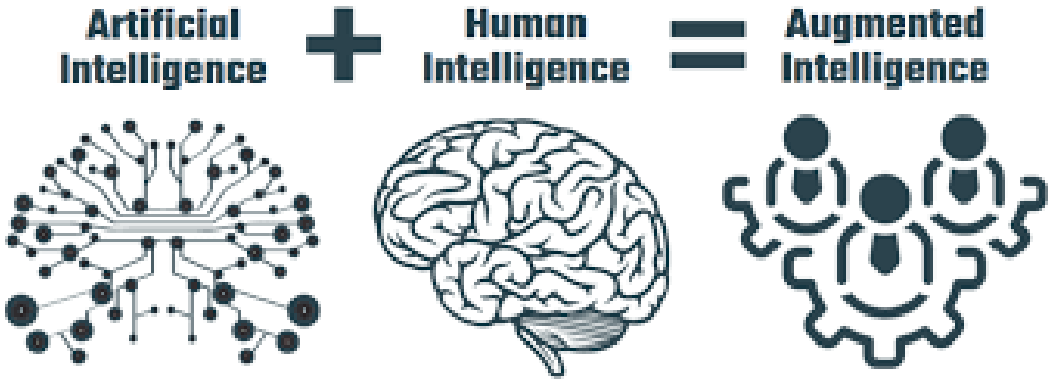
In the present time what we see is that students have a hard time retaining large amounts of what they study and also report to be worn out after long study sessions. As for the work force, professionals are dealing with decision over load which is a result of many tasks, email and deadlines this in turn lowers productivity and increases stress. In health care and high pressure jobs we see that people's focus and judgment is impaired. Also we note that elderly people are reporting memory decline which in turn requires them to have continuous cognitive support.

Although we have brains which are able to learn and adapt, they also have inborn limits. At present AI tools mostly what we use as aids do not in fact improve human thought, learning, or memory. Also they are not designed according to how the human brain itself grows and changes.

There is a push for AI which augment human intelligence as opposed to that which only does tasks. By way of neuro science based AI models we may see smart systems that support better learning, memory, focus and decision making in real time. This research is to put together AI neuroscience hybrid systems which improve human intelligence in day to day life.

therefore we see the value in the development of AI which augments human intelligence as opposed to it just performing tasks. By way of neuro science informed AI models we see the ability for these intelligent systems to support better learning, memory, focus and decision making in real time. This research is aimed at developing AI neuroscience hybrid systems which improve human intelligence in day to day life.

3.Objectives of the Study:-



1. To investigate the connection between Artificial Intelligence and Neuroscience.

This objective aims to examine how the principles of the human brain such as learning, memory, perception, attention, and decision making can be instrumental in the evolution of artificial intelligence. Neuroscience studies, essentially, how neurons talk to each other, how through experiences the brain gets rewired (neuroplasticity), and how cognitive processes work. With that, we intend to create models that will bridge biological and computational intelligence leading to more efficient and human like AI systems.

2.To review AI models that are inspired by neuroscience

The purpose of this study is to assess AI models that feature mechanisms inspired by the human brain. These are artificial neural networks, deep learning models, spiking neural networks, reinforcement learning, and cognitive models. The main emphasis is on the evaluation of the models brain emulation capability, learning efficiency, adaptability, and other limiting factors. Such an assessment would be helpful in deciding which models are ideal for enhancing human intelligence.

3. Designing a system for human intelligence upgradation

This goal is about coming up with a conceptual or functional proposal for a system that leverages AI to upgrade human intelligence and not to displace human brain capacity. Such a system may be a great aid to human beings by making them learn faster, remember more, be more focused, sharpen their problem, solving skills, and improve decision, making. Drawing from AI models inspired by the brain, the system intends to help humans break through cognitive barriers such as mental tiredness, information overload, and slow learning which are often caused by our brain limitations.

4. To explore uses of integrated AI and Neuroscience

This objective aims at finding out uses of integrated AI and neuroscience which are capable of raising human intelligence. Among the potential uses can be personalized learning systems, brain, computer interface systems, mental health care tools, cognitive training, decision support systems, and technologies that help in cognitive and neurological disorders. The objective is to assess the effect of the potential uses on human efficiency in education, work, and life.

5. To determine challenges and future research scopes

This final objective examines the challenges of integrating AI with neuroscience, including ethical dilemmas and data privacy issues, the complexity of computing, the interpretability of AI models, and gaps in the understanding of brain functions. Furthermore, this objective outlines future research prospects, such as brain-computer interface systems, ethical systems of AI, better models of brain-inspired learning, and a more sustainable collaborative paradigm of human-AI systems for enhanced long-term intelligence, which could mitigate the risks of unsupervised systems.

4.Related Work (Literature Survey):,

Artificial intelligence and neuroscience are two fields where many researchers have indicated the relationship keeps getting stronger and more profound over time. One of the earliest concepts of this field was Hebbian learning theory which stated that in human brain learning is a consequence of strengthening connections between some neurons that get activated together again and again. This idea traditional artificial neural networks; in these networks learning happens is by changing the weights of the interconnections between artificial neurons.

Such advanced AI architectures as Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) take inspiration from the structure of the human brain. CNNs can be considered as quite direct imitators of the human visual cortex which is utilized for image and video recognition.
These methods help to enhance the behavioral flexibility and energy efficiency of AI systems.

Another notable progress has been the development of BrainComputer Interface (BCI) technology. BCIs enable the human brain to communicate directly with machines without any physical interaction by decoding brain signals. Several applications have been demonstrated for the technology such as providing better living conditions for patients with disabilities; helping in the rehabilitation process; and facilitating various brain functions like memory and motor control.
Research into cognitive training platforms like Lumosity reveals varied results regarding their impact on general intelligence or IQ.

On the other hand, when humans use AI, based tools like advanced language models (for instance, GPT, based systems), studies indicate that human performance in creative and problem, solving tasks can be raised significantly, by roughly 1525%. It appears from this evidence that AI cannot be seen as a direct source of intelligence increase; however, it is a highly efficient human thinking abilities booster if used as a helper.

5.Neuroscience-Inspired AI Models:-

Human brain functions and its anatomy have been a major source of inspiration for the design of AI architectures and their working. It includes studying the brain's information processing, learning from experiences and adapting to situations. Such AI models allow synthetic entities to be human, like in terms of behavior, natural and efficient

1.Artificial Neural Networks (ANNs)

Artificial Neural Networks (ANNs) are a replica of biological neural networks. In the biological neuron, a synapse integrates two neurons; in the same way, ANNs are arranged as multilayered networks of nodes or artificial neurons. Learning is possible by the change in the strength of the connections between nodes, which is a response to the incoming data. Pattern recognition is one of the major applications of ANNs which include image classification, voice recognition, and extrapolation of data.

2.Deep learning models

Deep learning is a highly complex extension of neural network architecture that contains many hidden layers, thus imitating the hierarchical signal processing of the human brain. Convolutional Neural Networks (CNNs) are an example, which are biologically inspired by the human visual cortex and being very effective in image and video recognition. As the data gets transformed through the network hierarchy, the network automatically learns the data features at different levels of abstraction in a way similar to how the human visual cortex processes the visual stimuli switching the focus from simple edges to full objects.

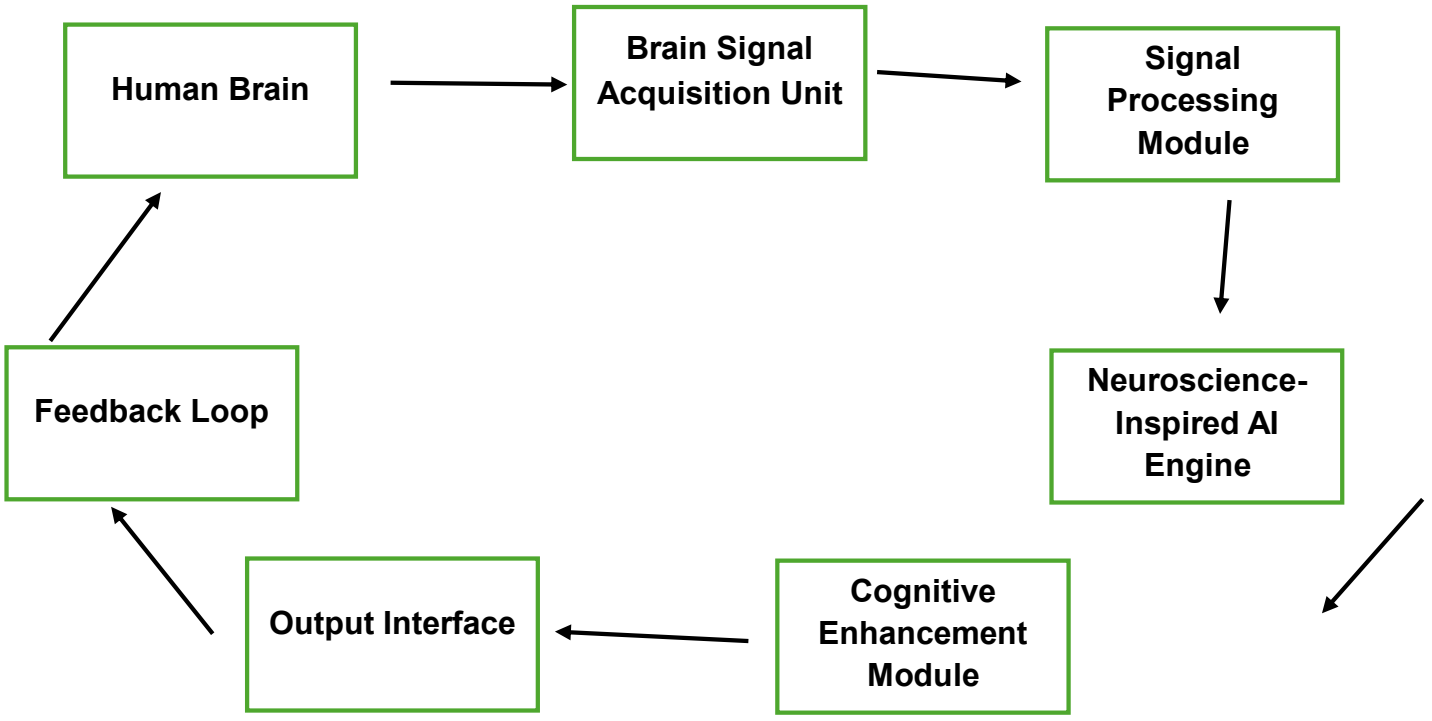
3.Spiking Neural Networks (SNNs)

Compared to classical neural networks, Spiking Neural Networks are a more accurate biological model, simulating the mode of communication of the biological neurons through spikes rather than continuous signals. Thanks to this event-driven and low power computation, SNNs are applicable for neuromorphic hardware, real-time sensing and brain-computer interfaces.

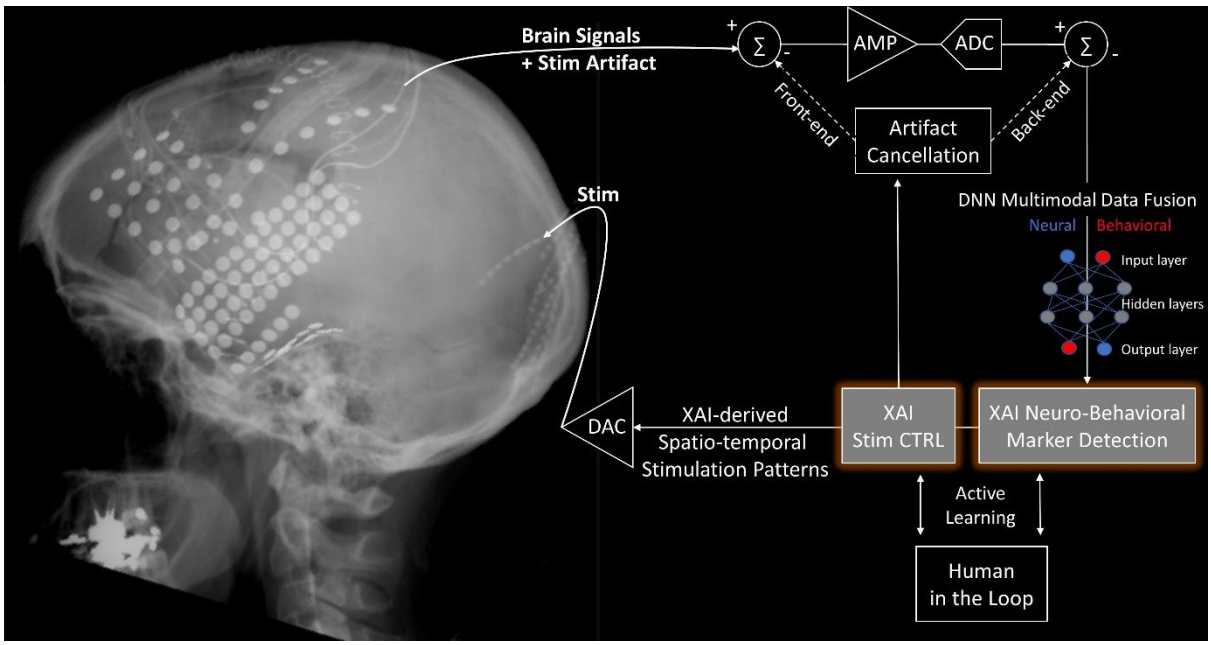
4.Role in Human Intelligence Upgradation

Inspired by the functioning of the brain, the AI models facilitate more human-like communication of the AI with human thinking. They follow the learning and the adaptability processes of the brain and thereby, augment human capabilities such as rapid learning, sound decision making, enhanced perception and cognitive aid. Consequently, AI turns into an extension and augmentation of human intelligence rather than a substitute.

6.Block Diagram:-



7.Flow of the System:-



The new system is designed to give human intelligence a boost stepwise by incorporating neuroscience, inspired AI models. It runs as a closed, loop device to help human learning, memory, and decision, making.

First, the process involves brain signal acquisition, i.e., cognitive brain signals are collected from the human brain through non, invasive sensors such as EEG. Thus, these raw signals represent the user's current mental state.

Then, the signal, which was collected, is up to standard and unnecessary noise and artifacts are eliminated by signal processing techniques.

After cleaning the data, feature extraction is performed to identify important cognitive features such as alpha and beta brain waves related to attention and learning.

The features extracted are forwarded to different neuro, inspired AI models like Artificial Neural Networks, Deep Learning models, Spiking Neural Networks, and Reinforcement Learning algorithms. These models interpret the user's mental state and estimate how much cognitive support is needed.

According to this evaluation, the system offers intelligent help, e.g., custom learning tips, memory support, or decision, making advice. This help is communicated to the user via an appropriate device or method.

8. Applications:-

Combining neuroscience, inspired artificial intelligence with human cognition yields a vast array of applications in the real world. Following are a few of such applications which aim to augment human potential, enhance decision, making, as well as facilitate learning and healing.

1. Smart and Adaptive Education Systems

A neuroscience, inspired AI system can help teachers develop highly, specialized educational materials for their students. By continuously' examining the brain signals of the learner that are connected with attention and comprehension, the system supplies learning content, pace, and difficulty in line with the cognitive state of the learner. This will not only help students become more efficient learners but also result in less mental tiredness.

2. Cognitive Rehabilitation and Healthcare

This sort of technology can be of great assistance if employed in the context of cognitive rehabilitation of patients who are' recovering from neurological disorders such as stroke or traumatic brain injury. BCI (braincomputer interfaces) integrated with AI can keep an eye on the patient's plight and offer tailored treatment thus bringing about quicker restoration of cognitive and motor functions.

3. Skill Enhancement and Professional Training

Some professions are entirely based on professional skills like an aircraft pilot, a surgeon, or an engineer, and such people have to keep upgrading their skills constantly. Neuro' inspired AI technologies are capable of monitoring the cognitive workload and the performance of a trainee when they are doing a simulation or a learning session. Based on the data available to the system at that time, it is supposed to give the learner an adaptive feedback in order to facilitate skill acquisition and also to reduce mistakes.

4. HumanAI Collaborative Decision Systems

Medical AI systems, among others, have the ability to analyze complex data as well as integrating human cognitive feedback. The collaboration between AI and human in this case not only leverages the natural intuition of humans and thus the accuracy of the decision is enhanced but also the reliability as well and hence better patient outcomes are achieved.

5. Cybersecurity and Defense Analytics

Neuroscience, based AI can significantly enhance human analytical capabilities in the cybersecurity and defense fields. By monitoring human cognitive states such as alertness and stress, AI systems can collaborate with human analysts to identify potential threats, reduce false alarms, and develop improved crisis management strategies under high, stress conditions.

9.Advantages:-

1. Personalized Cognitive Enhancement

The technology tailors its response to the working brain of a person by analyzing brain & behavioral patterns. Based on these analyses, totally customized learning methods and mental support are provided, thus interventions that perfectly correspond to the individual's needs and abilities.

2. Faster Learning and Skill Acquisition

Tracking of the user's attention and learning efficiency on a real, time basis, the system is capable of fine, tuning the training methods and feedback. Results of experiments and pilot projects demonstrate that adaptive systems of this kind may increase learning speed by about 2030%, thus leading to users' faster and more efficient acquisition of new skills.

3. Reduced

One of the things that the system does is limit mental exhaustion by minimizing the constant flow of information coming in. As a result of delegating repetitive cognitive activities to AI, users can enjoy less mental strain, more concentration, and great cognitive functioning in general.

4. Enhanced HumanAI Collaboration

With the help of neuro, inspired AI, the partnership between the human and the intelligent system gets even better.

By interpreting the user's cognitive state, AI can interact with the human more seamlessly and therefore human services can be more effective, leading to better decisions being made, more trust, and greater efficiency in humanAI teamwork.

AI vs Human Intelligence: Top Strengths

Artificial Intelligence (AI)	Human Intelligence
Makes Objective Decisions	Makes Efficient Decisions for Ambiguous and Uncertain Cases
Fast Calculation Abilities	Works Better in Novel Situations
Able to Mimic Human Conversations	Emotional and Social Intelligence
Low Chances of Errors in Familiar Problems	Abstract Thinking Ability
Able to Conduct Research and Hunt Facts Within Few Seconds	Ability to Look Ahead to Future

10.Challenges and Ethical Issues:-

1. The privacy and security of Brain Data.

The privacy and security of Brain Data is a highly confidential and private matter. Discriminatory actions or loss of privacy may occur if such data is inappropriately accessed and exposed. The safe storage, sharing, and handling of brain and related data is a crucial concern.

2. Ethical Issues of Brain Enhancements.

Honesty in thinking is linked to the pursuit of fairness, equality with regards to consent.". For instance:

How can we ensure that individuals who are given the privilege of enhancing their brainpower through artificial intelligence? The cost of hardware and computational power are both very high.

3.Advancements in AI modelling.

Advancements in AI modeling using neuroscience, such as. Spiking Neural Networks need dedicated hardware and computational power to continuously extract and use brain signals. As a result, the technology may become more expensive and less available.

4. Dependence on AI, Assisted Systems.

People who heavily depend on AI to make decisions, learn new information, or remember information may eventually lose their natural abilities in the mentioned fields. It is recommended to have a balanced mix of AI-aided and human conscious action to prevent cognitive dependence

11. Future Scope:-

The combination of Artificial Intelligence (AI) and Neuroscience has the potential to significantly enhance human cognition, learning, and decision, making processes in the future.

1. Smarter BrainComputer Interfaces

Eventually, brain, computer interfaces will enable people to operate devices through mere thought. Initially, they will serve those unable to speak or move, but more broadly, they will aid students and employees in concentrating, learning, and achieving higher productivity.

2. Brain, Like Computers

The architectures of novel computers will imitate the human brain. Such machines will have a higher speed, consume less power and be more capable of learning. As a result, AI technologies will become more robust and economical.

3. Better Memory and Focus

Brain, connected AI solutions will be able to assist humans in memorizing, concentrating, and choosing wisely. For instance, they can detect brain fatigue and suggest resting or offer cognitive assistance when the need is great.

4. Helping the Brain Learn and Heal

AI has the potential to monitor neural plasticity during training or convalescence. It may facilitate the medical treatment of brain disorders and even enable personalized education by adjusting to the students' brains.

5. AI That Grows with Humans

In the future, AI will understand each person’s thinking style and adapt to them. This means AI will become a personal thinking partner that grows smarter with the user.

6. Using Technology Safely

Because brain data is very personal, strong rules will be needed to keep it safe and private. This will make sure these technologies are used fairly and for human benefit.

12. Conclusion

This article explores the idea that Artificial Intelligence, if it is modeled after the human brain functioning, can really be used to boost human intelligence instead of replacing it.

For instance, AI can facilitate students' learning in a way that is compatible with their cognitive style or it can help doctors make more accurate diagnoses of brain functions.

The combination of AI and neuroscience is a powerful duo that both humans and machines can benefit and raise their level together. AI could be a smart assistant that is always ready to help people, basically .

In short, the paper draws attention to the hopeful scenario of the mutual cooperation of Human Brain and AI for the creation of a more intelligent, healthier, and capable world. This method not only unlocks a plethora of opportunities for innovation in Computer Science and Engineering but also provides a positive outlook for human intelligence in the near future.

Authors & Affiliations:-

Omkar Satish Dhekane
B.Tech Student, Department of Computer Science and Engineering SVERI's College of Engineering, Pandharpur, Solapur, Maharashtra, India
8766988123 | dhekaneomkar912@gmail.com

Address: Yashwant Nagar Dharashiv, Tal. Dharashiv, Dist. Dharashiv

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