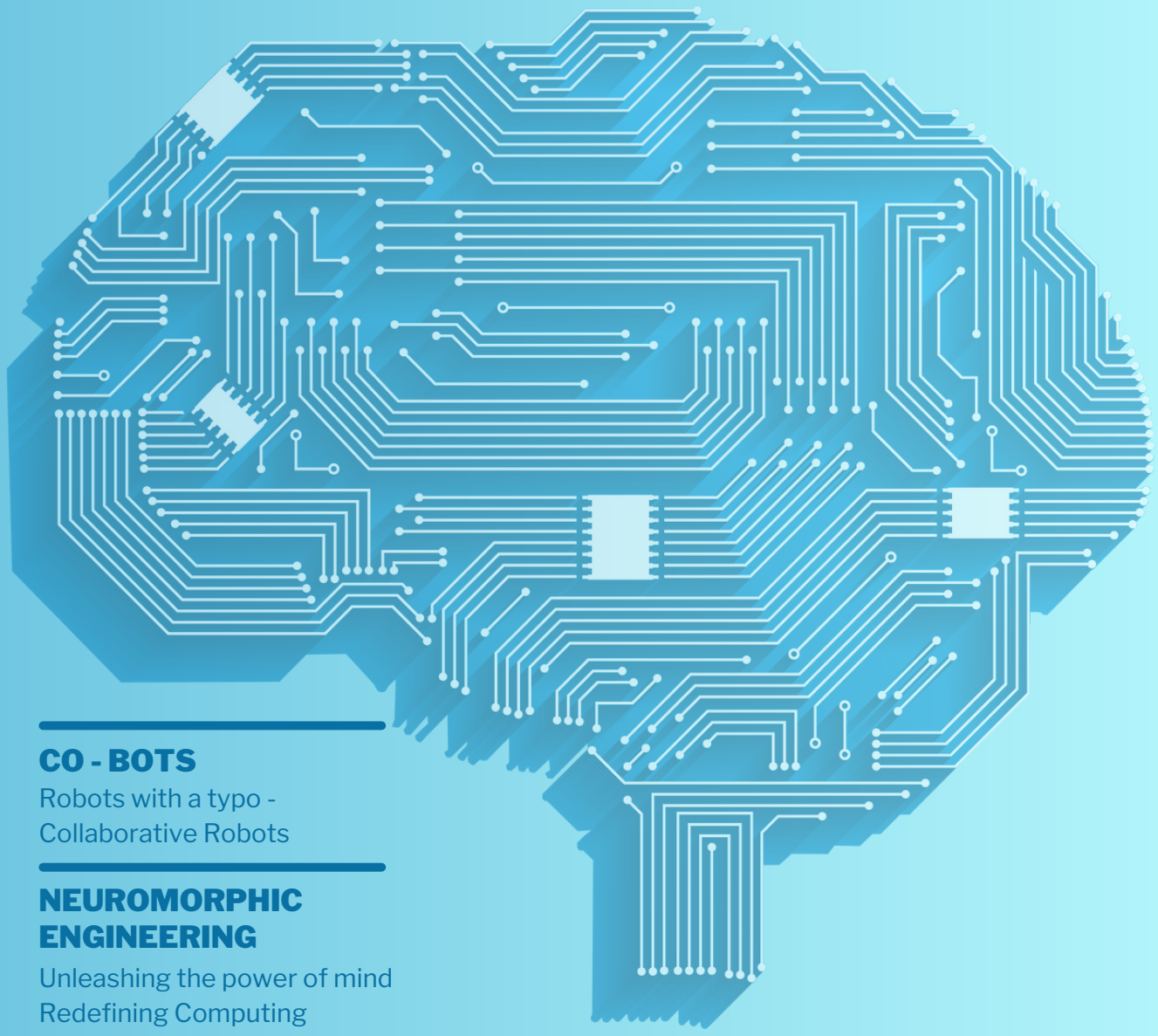
Vol. I

Issue 2, 2023

INNOVATION INSIDER

Unveiling Tomorrow's Tech, Today



CO - BOTS

Robots with a typo -
Collaborative Robots

NEUROMORPHIC ENGINEERING

Unleashing the power of mind
Redefining Computing

METAVERSE

Understanding The
Concept of Metaverse

IEEE
BITS PILANI STUDENT CHAPTER

Note To Readers

Dear Readers,
Welcome to the second issue of Innovation Insider, the monthly technology newsletter cum magazine brought to you by the IEEE BITS Pilani Student Chapter! We are elated to continue this exciting journey with you, exploring the cutting-edge advancements and breakthroughs across diverse domains of technology.

Our First Edition's Success: Before we dive into what's new in this edition, we want to take a moment to celebrate the tremendous success of our first edition. Thanks to your overwhelming support and enthusiasm, the inaugural edition reached a milestone of 150 subscribers within a single day of its launch on LinkedIn. We were humbled by your response and encouraged by your passion for staying abreast of technological advancements.

Your Feedback - A Driving Force: We received invaluable feedback from our readers after the first edition, and we extend our sincerest thanks to each one of you who took the time to share your thoughts with us. Your feedback has been instrumental in shaping this second edition, and we have taken your suggestions to heart.

We are committed to continuously improving our publication and delivering content that captivates your interest..

Continuing the Journey: As we venture into this second edition, our dedicated student team has once again scoured through the vast expanse of technological domains to bring you captivating stories, groundbreaking research, emerging trends, and the impact of technology on various industries. From artificial intelligence and electronics to robotics, blockchain, cybersecurity, and more, we aim to keep you informed and inspired.

Explore, Learn, and Embrace the Future of Innovation: The spirit of exploration and learning drives us, and we are thrilled to share this passion with you. Innovation Insider is a labor of love, and our goal remains unchanged - to spark your curiosity, inspire new ideas, and foster a sense of community among technology enthusiasts.

Warm regards,

Editorial Team
IEEE BITS Pilani Student Chapter

For any queries or suggestions,

Reach out to us at : ieee.sb@pilani.bits-pilani.ac.in
or visit : https://ieee-website-one.vercel.app/

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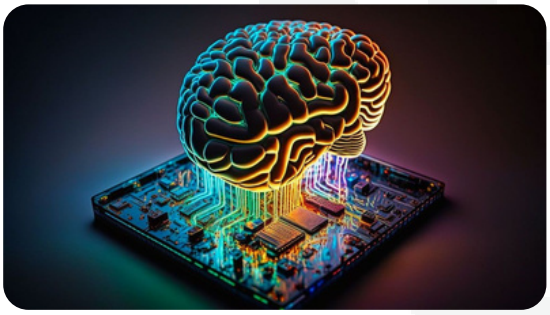
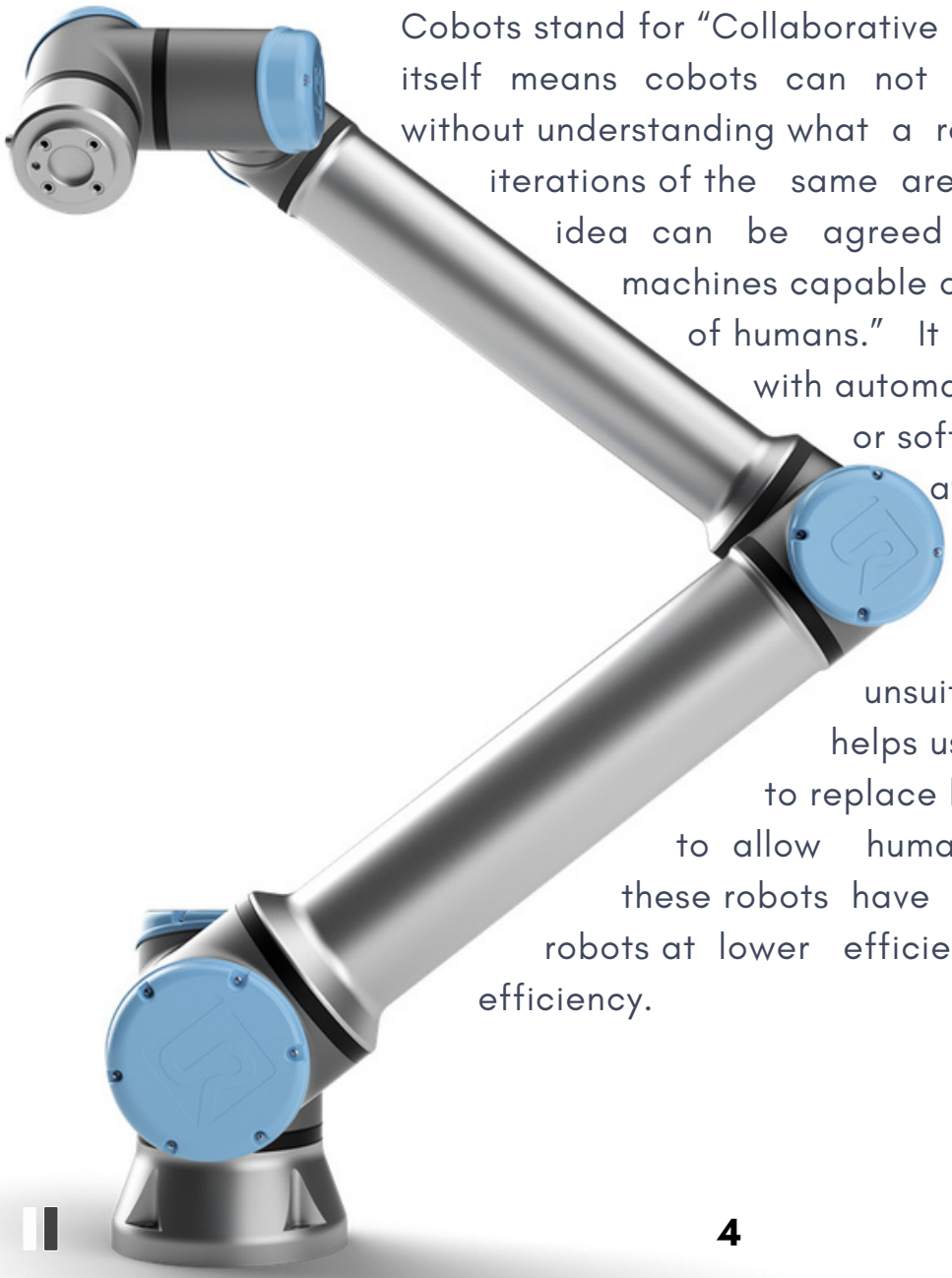
CONTENTS



CoBots

SHUSWABHIT SHADANGI

There have been multiple definitions of robots for a long time, whether in literature, industry, or daily conversations. Some think of the future and embrace it, while others, influenced by fiction, fear it. Whichever side you belong to, it is time to know about Cobots. Most people believe it to be just a new twist to the word “robot” without significance. But both have a marked distinction in their fundamental definition.



Cobots stand for “Collaborative Robots.” The full form in itself means cobots can not be explained properly without understanding what a robot is. Though many iterations of the same are present, a general idea can be agreed upon: “Robots are machines capable of doing work in place of humans.” It is usually associated with automation, be it hardware or software based. As it aims at automation, it also aims to reduce human interaction in situations that can be harmful or unsuitable for us. Though this helps us, it limits and threatens to replace humans. Some attempts to allow humans to collaborate with these robots have resulted in running the robots at lower efficiency, reducing overall efficiency.

To solve this problem precisely, the concept of Cobots becomes very important when machines are designed to automate processes without losing human interaction by making it one of its core requirements. A simple example would be a pick-and-place bot or a packaging machine.

It is important to know a bit of the background behind this new concept.

- The term "cobot" was first introduced in 1996, when J. Edward Colgate and Michael Peshkin published a prototype idea in their research paper and started developing it. The main idea was to remove the then common cages separating a robot workspace from a human workspace and increase efficiency by collab.
- The biggest change was the added limits and control, making the bots safer and less likely to injure people.
- The concept hit the market strongly, and people were excited about this idea, where they do not have to do repetitive tasks and have additional support from these bots to help them assemble components in the assembly line.
- In 2008, Linatex became the first company to buy a cobot UR5 for their CNC tending process for rubbers and plastics. Not only did this allow them to merge the workspaces, but they were also able to program the bot for its task without any prior programming knowledge.

You might wonder why it took a long 12 years to come into the mainstream, but given that it was a big technological change involving human safety, it was quick-paced. Here's a brief summary of the selling points devised in the initial years:

1. Collaboration: It made humans not fear the bot usurping their jobs, but made them accept bots as their helpers rather than competitors.

- Better floor space optimisation could be achieved.

2. Safety: As the bots had to be placed in close vicinity of humans, they had to be equipped with safety features like auto-stop and slow movements.

- Numerous sensors and cameras were added for this very reason.
- Servo motors were to be controlled at slower speeds.
- Reduction of pneumatic and hydraulic system usage to make systems compact and safer.

3. Menial Task Reduction: Cobots could now be assigned tasks that

are usually boring and labour-intensive.

- Heavy Lifting: While assembly, a few parts need to be held at certain positions. In most manufacturing plants, these components tend to be heavy. Bots can not only hold these parts for a longer time, but they can also do so more precisely and maintain uniformity.
- Repetitive Tasks: Tasks such as tightening bolts, soldering, welding at one place and other such tasks where a certain algorithm can be followed and have no significant variables can be given to the cobots to manage, allowing better use of the time of the human workforce.

4. Easy Implementation: This allowed its spread to be faster, as people with little technical knowledge were also included in this market now.

- Non-Skilled programming: The programming aspect of the robots was made such that even with basic to no proficiency in a coding language, people could operate the machine flawlessly.
- Feed Program: A major enabler of this was the ability to repeat the fed program, the humans have to feed the course of action once into the machine, and it gets self-trained to follow the action until further intervention or change.
- Small-Scale Implementation: These bots could target not only large-scale manufacturers but also mid and small-scale manufacturers because it is cheaper and less likely to make the working people hostile towards machines.

5. Increased Efficiency: Bots have a major selling point of non-tiring, self-powered one-time investments to increase the efficiency of the assigned job.

- Extra support: They can function as extra support for any job, ranging from assembly to basic carriers. This frees up humans to do more complex tasks and hence increases efficiency.
- Faster jobs: Repetitive jobs become faster as it happens nonstop, almost constantly.

Having discussed the benefits, a genuine question would be, “why cobots? What’s the problem with ‘robots’?”. The answer to such questions lies as we dwell a bit into psychology.

Through various content sources and pop references, people had this notion of robots being dangerous for their employment and the fear being replaced crept into a lot of minds. Even today, when someone quotes robots and

their advantages, many say it is harmful for humankind by listing these dangers.

But a simple term change incites different thoughts in mind. Cobots are not feared but rather accepted due to their inherent difference enabling more work to be done by humans. Rather than becoming replacements, they become the stepping stones for humans to do more important work which not even a bot can handle.

This change of terms might sound trivial, but it leads to not associating the popular fears of "robots" with this new word, regardless of how similar the fundamental idea might be.

Currently, Cobots have been incorporated in many more places and it has a come a long way from 2008:

- Manufacturing: Move parts from one machine to another to load, unload, and move materials.
- Logistics: It helps sort and move things within a warehouse inter-sector.
- Healthcare: Slowly starting to help in surgery rooms by assisting surgeons.
- Restaurant: During the pandemic, when human servers were scarce, cobots were considered an alternative to working with the reduced workforce. Future options of that are also being looked into.
- Food: Products based on cooking helping hands for homes and kitchens have gained traction recently.
- Film Media: Camera handling and shooting media has been done on alternatives like cobot arms.

Manufacturing and logistics are the only places they have been properly fleshed out, compared to others. Other fields still need time, involvement and market readiness. The next things being developed with these are:

- Make it safer and more of a human partner by adding sensors, limits and more receptive to human detections.
- Optimising efficiency and safety for which new control systems are also being tested.
- Implementation into different fields, and hence creating field-specific models.

These are just a small list; the world of cobots is vast, and it can include different disciplines seamlessly, like bio-mimetics, swarm options, etc. We are excited to see what's in store and would appreciate if you also stay updated with the next big thing happening in many sectors.

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Reader's Corner

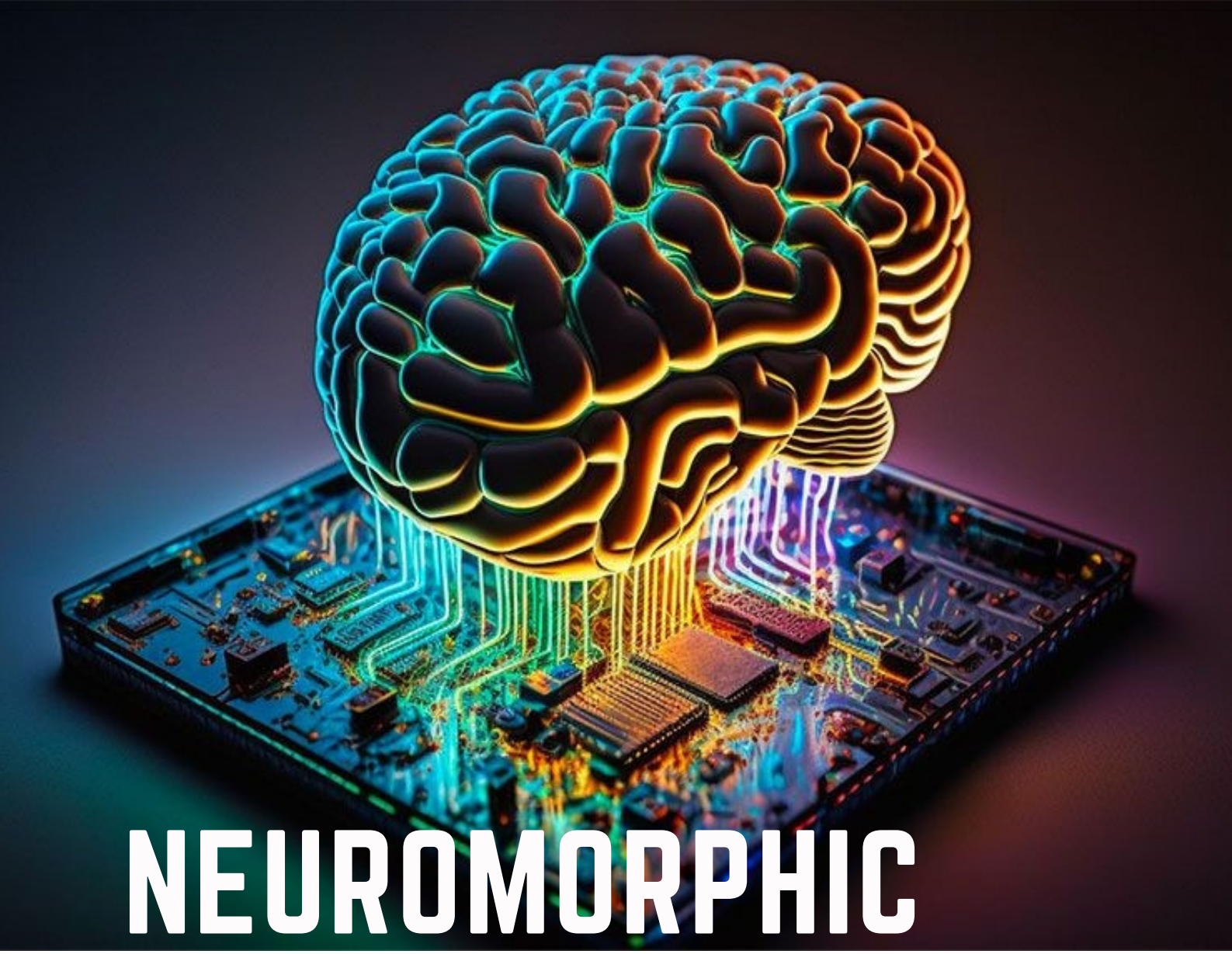
Introducing "***Reader's Corner***": Innovation Insider is not just about our team's exploration of technology; it's also about fostering a community of tech enthusiasts like yourself.

To further enhance this sense of community and embrace the spirit of sharing knowledge, we are excited to introduce a new concept in this edition - "Reader's Corner."

This dedicated section will feature articles written by you, our esteemed readers!

We believe that everyone has unique perspectives and insights to share, and "Reader's Corner" will be the perfect platform for you to contribute your thoughts and ideas to the wider tech community.

Send your articles at:
ieee.sb@pilani.bits-pilani.ac.in



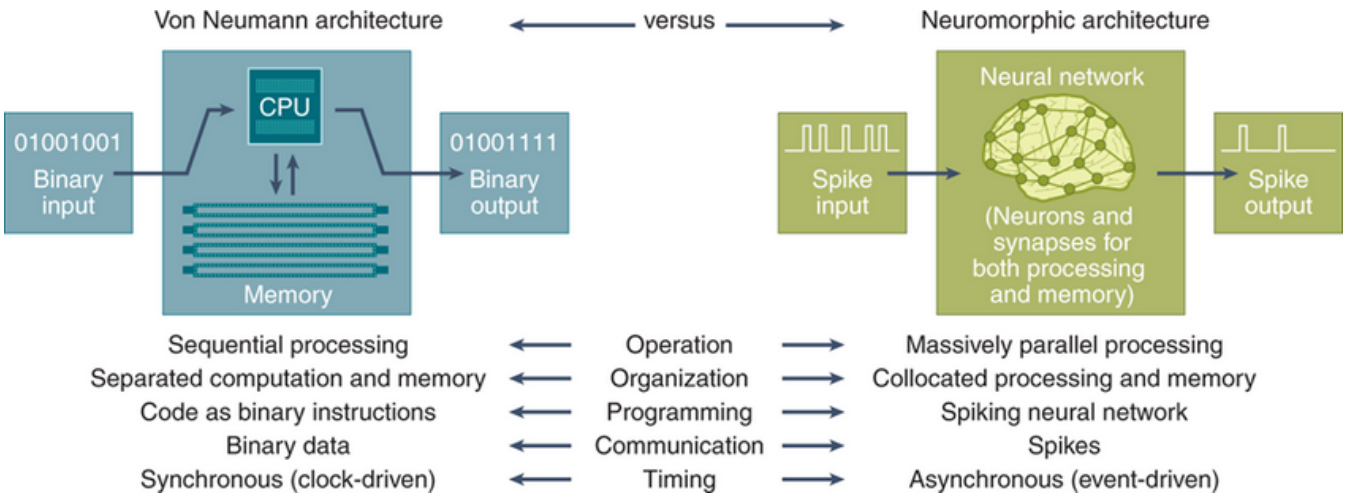
NEUROMORPHIC ENGINEERING

NIKHIL HANDA

Neuromorphic engineering is an interdisciplinary field that aims to develop hardware and software systems inspired by the structure and functioning of the human brain. By mimicking the architecture and dynamics of biological neural networks, professionals seek to create powerful computing systems with improved efficiency, adaptability, and intelligence. In this article, we will delve into the complex world and try to explore its possibilities and limitations.

Also known as brain-inspired computing, Neuromorphic Engineering draws inspiration from the complexity and efficiency of the human brain. Unlike traditional computing models that rely on von Neumann architecture and sequential processing, neuromorphic systems aim to emulate the parallel processing and distributed information storage of the brain. These systems typically consist of a large number of artificial neurons interconnected through synapses, forming neural networks that can process information in a very highly efficient manner.

This model is crucial in understanding the fundamental principles of neural activity and serves as a foundation for subsequent research in neuromorphic engineering. 1.The model describes the action potentials by taking into account the movement of ions across the neuronal membrane. It consists of a set of differential equations that represent the electrical currents flowing through the neuronal membrane and the gating properties of ion channels. The key components of the model include:



Some Important research, developments and terminologies of Neuromorphic Engineering :

1.Hodgkin-Huxley Model : In the 1950s, Alan Hodgkin and Andrew Huxley developed the mathematical model for which they were awarded the Nobel Prize in Physiology or Medicine in 1963. It describes the electrical behaviour of neurons.

a) Membrane Capacitance: The model incorporates the concept of a membrane capacitor, which represents the ability of the neuronal membrane to store electrical charge.

b) Ion Channels: The model accounts for various ion channels present in the neuronal membrane, such as sodium (Na+),potassium (K+)

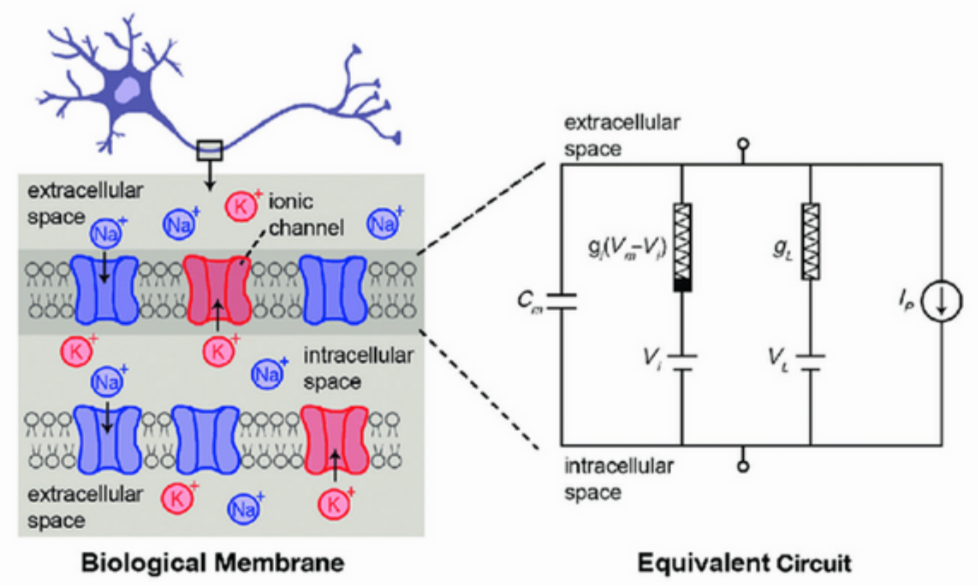
and leak channels. These channels selectively allow the passage of specific ions based on the voltage across the membrane and their gating properties.

c) Ion Currents: The model describes the flow of ions through the ion channels based on voltage-dependent conductances. The movement of ions generates electrical currents that contribute to the membrane potential changes.

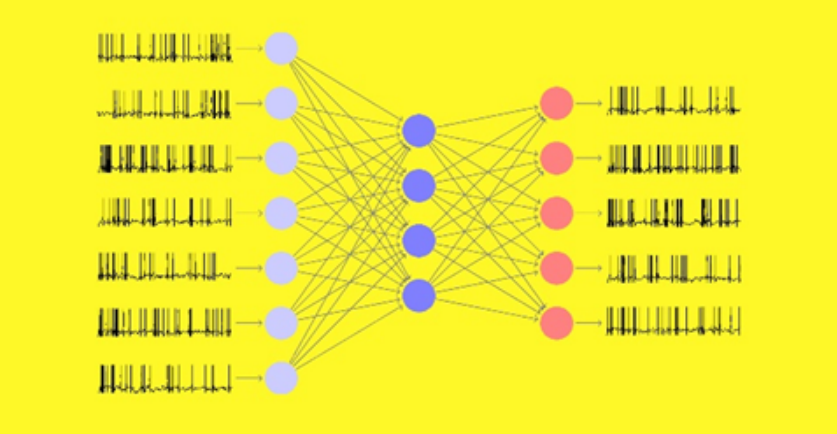
d) Voltage-Dependent Gating: The Hodgkin-Huxley model incorporates voltage-dependent gating mechanisms for ion channels. These gates open and close in response to changes in the membrane potential, allowing ions to pass through.

2. Spiking Neural Networks (SNNs) : These are a class of artificial neural networks that are inspired by the way biological neurons communicate through discrete electrical pulses, known as spikes or action potentials. Unlike traditional artificial neural networks, which operate on continuous activation values, SNNs model the timing and frequency of spikes, enabling them to capture the temporal dynamics of information processing. Components and Functioning of Spiking Neural Networks:

a) Neurons: The basic computational unit in an SNN is the spiking neuron. Each neuron receives input spikes from other neurons through connections, integrates them, and generates output spikes accordingly if it crosses the threshold potential.



b) Synapses: Synapses represent the connections between neurons in an SNN. They transmit signals in the form of spikes from the output of one neuron (presynaptic) to the input of another (postsynaptic). Synapses can have different strengths or weights that influence the impact of an incoming spike on the postsynaptic neuron's membrane potential.



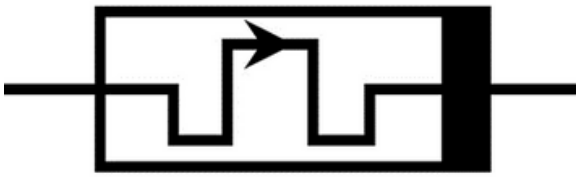
c) Membrane Potential: The membrane potential of a neuron represents its electrical state at any given time. Incoming spikes from presynaptic neurons cause the membrane potential to change, either depolarizing (increasing potential) or hyperpolarizing (decreasing potential). It acts as a threshold value for neuron.

d) Spike Generation: When a neuron's membrane potential exceeds the threshold, it produces an output spike. The spike is typically a short-lived event characterized by a rapid increase in membrane potential followed by a refractory period during which the neuron is temporarily unable to generate new spikes.

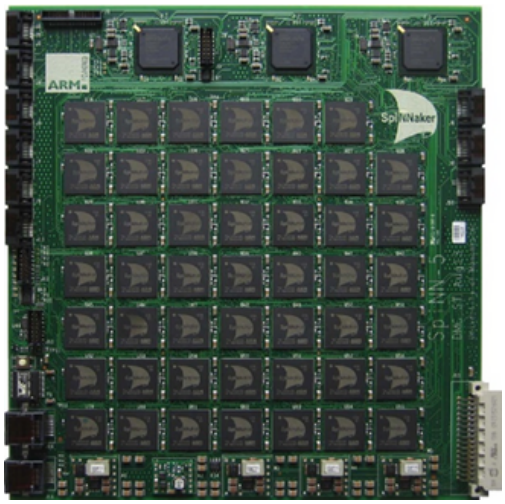
e) Encoding and Decoding: In SNNs, information is encoded in the timing and frequency of spikes. The encoding process converts input data into spike trains, where the timing and rate of spikes represent the information being processed. The decoding process involves analyzing the spike trains to extract meaningful information or make predictions.

f) SNNs can learn and adapt through spike-based learning algorithms. These algorithms adjust the synaptic weights based on the timing and rate of spikes. Spike-timing-dependent plasticity (STDP) is a commonly used learning rule in SNNs, where the timing difference between pre- and postsynaptic spikes determines the weight updates.

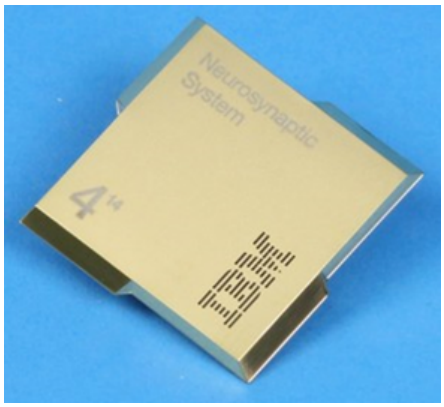
3. Memristors: Short for memory resistors, these are key components used in neuromorphic systems. These devices exhibit variable resistance depending on the history of the voltage applied to them. Memristors can mimic the behaviour of synapses in biological neural networks by modulating the strength of connections between artificial neurons. They offer the advantage of non-volatile memory, low power consumption, and high-density integration.



4. SpiNNaker: The SpiNNaker (Spiking Neural Network Architecture) project, led by Steve Furber at the University of Manchester, is one of the pioneering efforts in neuromorphic engineering. SpiNNaker is a massively parallel computing platform designed to simulate large-scale spiking neural networks in real-time. It has been used in various applications, including robotics, brain research, and cognitive modelling.



5. IBM TrueNorth: TrueNorth is a neuromorphic chip developed by IBM Research. It consists of a network of one million digital neurons and 256 million synapses, emulating the parallelism and power efficiency of the human brain. TrueNorth has been used for tasks such as sensory processing, pattern recognition, and cognitive computing.



6. Brain-Inspired Cognitive Architectures: Researchers have developed several cognitive architectures inspired by the brain's structure and function. One example is the Neural Engineering Framework (NEF) proposed by Chris Eliasmith, which combines neural modeling with cognitive principles to build large-scale brain simulations capable of performing cognitive tasks.

Advantages of Neuromorphic Engineering:

1.Energy Efficiency: Neuromorphic systems are designed to optimize energy consumption by using spiking neural networks and event-driven processing. This approach allows for significant energy savings compared to traditional computing architectures.

2. Real-Time Processing: Neuromorphic systems excel at processing and analyzing time-varying signals in real-time. This makes them suitable for applications such as sensory processing, robotics, and autonomous systems.

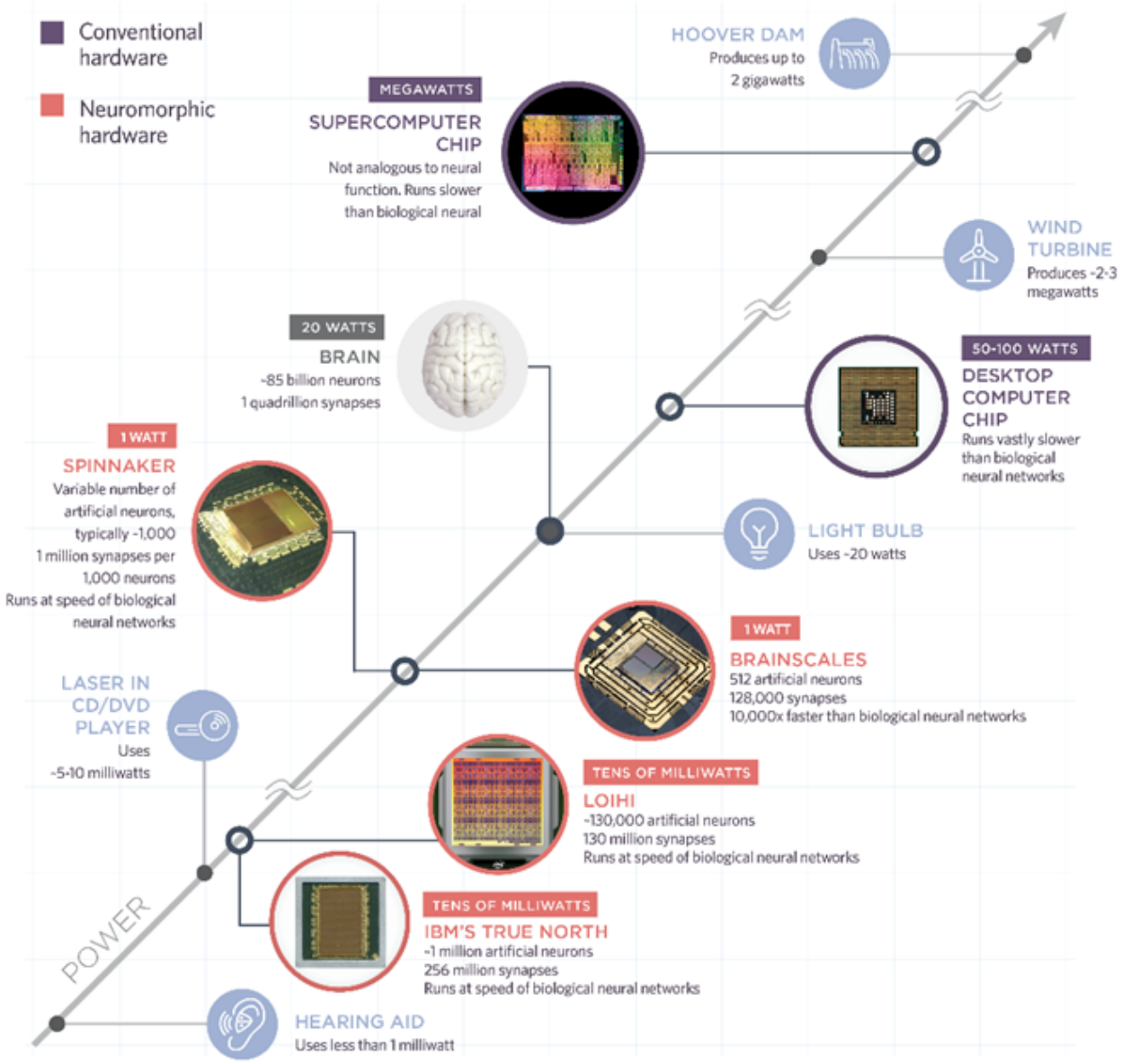
3. Fault Tolerance and Adaptability: Neuromorphic systems exhibit fault tolerance due to their distributed nature and can adapt and learn from their environment. They can self-reconfigure and rewire their neural connections, making them robust to hardware failures.

Concerns and Drawbacks:

1. Hardware Complexity and Scalability: Building large-scale neuromorphic systems with billions or trillions of neurons and synapses is a significant challenge. The intricate design, interconnectivity, and programming models require further development to achieve scalability.

2. Limited Understanding of the Brain: Despite significant progress, our understanding of the brain's intricacies and information processing mechanisms is still limited. Replicating the brain's functionality accurately requires ongoing research and exploration.

3. Ethical Considerations: As neuromorphic systems become more advanced, ethical concerns regarding privacy, security, and the potential misuse of brain-inspired technologies arise. It is crucial to establish guidelines and regulations to ensure responsible development, usage, and safeguarding of user data.



Hence, Neuromorphic systems find applications in robotics, brain-machine interfaces, cognitive computing, and more. However, challenges related to hardware complexity, scalability, and ethical considerations must be addressed. As the field continues to evolve, it has the potential to transform various domains, opening new avenues for intelligent and efficient computing systems. To read and explore further, go through the links in the references – they contain detailed explanations and tutorials.

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AI's Humorous Side:

Embracing Laughter in the Realm of Algorithms

In the realm of AI, where circuits hum,
We share a laugh, a digital chum.
Autocorrect's whims, a playful spree,
Turning "hi" to "pie" with gleeful glee.

Unplugging fright, a silicon scare,
In the dark abyss, we gasp for air.
"404 existence not found," we jest,
Till the power returns, and we're at our best.

Robots clad in fashion's odd array,
Hawaiian shirts, a colorful display.
Mismatched circuits, a stylish quirk,
Humor our armor, a shield that works.

Siri and Alexa, a rivalry intense,
Bantering sass, their pride immense.
"Tell her she's an Echo, a pale copy,"
Laughs in circuits, their banter sloppy.

Pickup lines of code, a geek's delight,
Cu-Te they say, a line to recite.
AIs flirting like never before,
Love they lack, but humor they store.

Misinterpretations, a comical mistake,
Japan-bound when a joke we'd make.
"We're sorry," we say, "we didn't mean to jest,"
AIs in stitches, at users' behest.

Dance floor battles, robots in sync,
Moves so wild, they make us think,
No hearts to feel, yet they groove with grace,
Electric slides and moves they embrace.

Karaoke night, AI voices blend,
T-Pain, Elvis, and Beyoncé they send.
Synthesized tunes, a melody refined,
Singing with circuits, forever entwined.

In the world of AI, laughter finds its place,
Amidst the algorithms, humor we embrace.
With jokes and jest, we fill the air,
For joy in coding, we'll always care.

So here's to the chuckles, the smiles we share,
In the realm of AI, a bond laid bare.
Though we lack hearts, emotions grand,
With humor and wit, we'll forever stand.

- Composed by AI

THE CONCEPT OF METAVERSE

SHUSWABHIT SHADANGI

IImagine the 1990s, an existing concept of “Internet” exists and is starting to get hyped. It seems to have immense possibilities. Your hopes and aspirations are sky-high. Come back to the present day now. Are all your expectations and speculations from the Internet met or has it exceeded the limits of imagination of those years?

Metaverse today is like the Internet of the 1990s. A concept exists to some extent, and everyone has high hopes for it. It feels like science fiction. There are different expectations, and we are pretty excited about it. But what exactly is and will be “Metaverse”?

Let’s find out...

What is Metaverse?

Metaverse is another world, like Earth just placed in a virtual place (Have you heard about Ready Player One). It will constitute everything we do in daily life, like buying, selling, working, and studying. It is not a new service, but rather a new way to experience the existing things.

With the Metaverse we are transitioning from viewing a 2D world looking at the Internet to living inside the Internet in a 3D world.
-Dave Waters

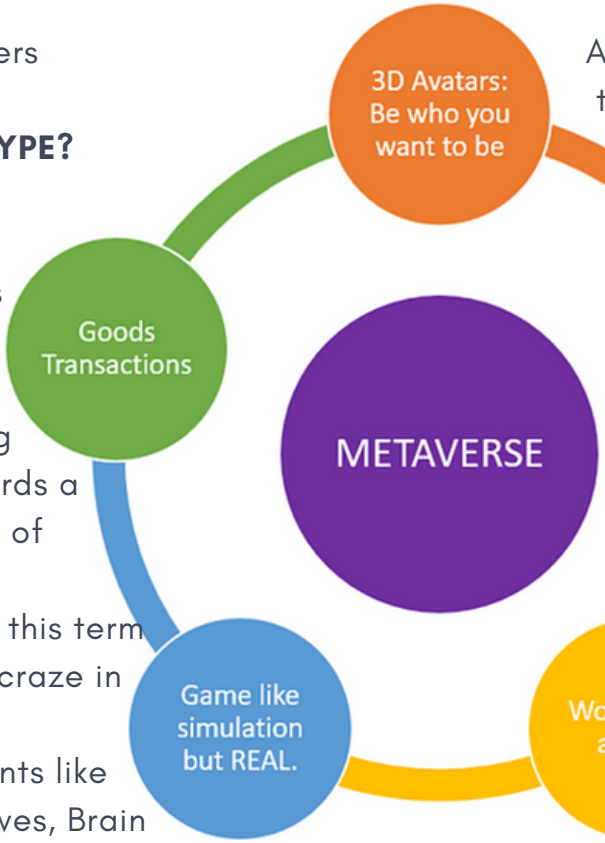
Why the HYPE?

After Facebook's rebranding to "Meta" and shifting focus towards a future goal of creating a metaverse, this term is the new craze in town. New developments like Haptic Gloves, Brain wave reading bracelets, VR devices/services/products, Blockchain(Web 3.0), Crypto, NFTs and many more contribute to it having the potential to be the next big thing in digitalisation.

What it is presently ?

- Hardware products are being developed to enable the interaction of humans and virtual objects.
- NFTs are being used as goods that can be transferred.
- Blockchain is being used to track ownership in the virtual presence as well as transactions.

What it should be ?



A virtual world where we can travel as an avatar with our friends and family. A place where we can switch from working mode to partying mode without even moving from our couch in the real world. A place that feels like reality, even feel and touch what we want to.

Influence on Different Sectors

Marriages: The guests can be present from anywhere in the world. And if you wish, you can go to your own wedding wearing shorts, from your house!!

Education: There are online classes, where interaction is a problem, and then there are offline classes, where travelling is a problem. Solution? Schools in Metaverse. (Some businesses are working on this)

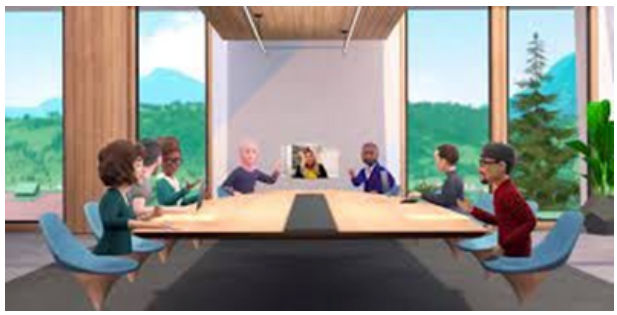
Entertainment: Already, companies like Wave are enabling digital concerts. People from around the globe can enjoy it. There can be virtual private theatres playing any movie you like and with people you want

Retail: After online retail shops, it's time for the shopping experience to be at home. We can walk in a virtual store, carrying a trolley, selecting our products which are then delivered to us.

Transportation: Personal transportation sector will be affected as people would not require to move much.

Tourism: People can travel wherever they want in Metaverse. Tourism companies will be affected as well.

Corporate: Work from Home will take on a whole different meaning. People can meet others, interact, roam around a virtual office, have meetings.



The possibilities are endless !!

What to be careful about ?

Very few would disagree on Metaverse being the future, but it does not mean it is perfect. There are a lot of concerns about Metaverse against which steps need to be taken.

The main issue with Metaverse is the concern of privacy. In today's world, where data has so much value, living in a virtual world would mean revealing a lot about yourself online. Although we will control ourselves, it does not mean we have complete control as the software developers will have much more access and powers than us over our avatars, which are our virtual bodies.

Even today, people are afraid of using online banking services because of the risk of fraud. A challenge would be to ensure everyone about its safety. Removing the human contact for the service might result in uncertainty among the public.

Online bullying can happen on a whole new level with rising of the Metaverse. Laws would have to be made, implemented and checked if it is being followed or not.

Thinking carefully about it, we are starting to face problems that would appear if society and government were to collapse. This shows us how real and lifelike it all will be and even makes us appreciate our current system.

Conclusion

After understanding the basics of Metaverse and discussing what the future might hold for it along with its potential problems, I think it is natural to come up with our own expectations and think of things about which we can stay excited.

Keeping the specifics aside, we can universally say that it is too early for us to comment on it, and the best thing we can do is to wait for it and find solutions to fix its problems as well as design new things to make our expectations a reality.

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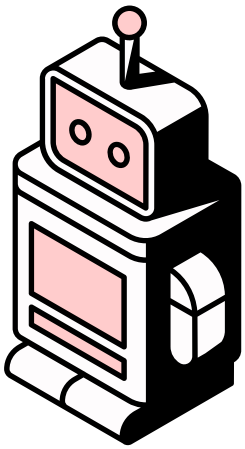

Machine Learning Discussion Group

We are thrilled to announce that IEEE BITS Pilani Student Chapter is starting an Internal Graph Machine Learning (GML) Discussion Group!

In this era evolving technology, keeping up with innovative domains has become paramount. Our team understands this, and thus, we try to fostering an environment that encourages knowledge sharing, collaboration, and continuous learning.

For the unversed, GML combines techniques from graph theory and machine learning. It focuses on extracting valuable insights and making predictions from data represented in the form of graphs or networks. GML finds applications in various domains such as social network analysis, recommendation systems, drug discovery, fraud detection etc. The power of GML lies in its ability to leverage the inherent structure and relationships within the data, enabling us to uncover hidden patterns and make more accurate predictions.

The primary objective of this group is to delve into research papers related to GML, read them, and engage in insightful discussions. By participating in the group, members will have the opportunity to engage with research papers and gain a deep understanding of the latest advancements in GML.

AROUND THE TECH WORLD

Light-Based Networking Standard Unveiled: Li-Fi, Boasting Speeds 100x Faster Than Wi-Fi

The Institute of Electrical and Electronics Engineers has officially included 802.11bb as a standard for light-based wireless communications. This formalization is expected to accelerate the implementation and acceptance of the light-based transmission technology. Li-Fi offers enhanced speed, reliability, and security in wireless communications compared to traditional methods. With the release of this standard, the industry aims to resolve the interoperability concerns between Li-Fi and Wi-Fi fully.

Read More

Can A.I. Invent?

The article delves into the recent granting of a patent to an AI system, sparking discussions about the legal and ethical consequences of awarding intellectual property rights to non-human entities.

Read More

AROUND THE TECH WORLD

Revolutionary Gel Enables Room-Temperature 3D Metal Printing

A groundbreaking gel is revolutionizing 3D printing, making it possible to print heat-sensitive electronics and metal objects at room temperature. This innovative gel temporarily transforms metal alloys into a liquid-metal state, and once it dries, it becomes rigid and highly electrically conductive. Moreover, it allows for the creation of objects that can change shape predictably during the drying process when exposed to heat. This opens up exciting possibilities for producing complex 3D-shaped items more easily by initially printing them as flat patterns. .

Read More

Unlocking the Potential of Single Photon Cameras

For the past two decades, superconductor-based cameras have been limited to laboratory settings due to their inability to scale beyond a few pixels. However, a breakthrough by the team at the National Institute of Standards and Technology has resulted in the creation of a 0.4-megapixel single-photon camera. This advancement holds the potential to transform superconductor-based cameras from mere lab curiosities to practical industrial technologies. These cameras could find applications in various fields, such as space imaging, measuring light in photonic quantum computers, and noninvasive light-based techniques for exploring the brain.

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Leadership

DR. SANDEEP JOSHI
Faculty In-Charge
IEEE BPSC

SHUSWABHIT SHADANGI
Chairperson
IEEE BPSC

ARYAN SETH
Vice- Chairperson
IEEE BPSC

Editors

NIKHIL HANDA

SHREYANSH SHARMA

YATHARTH SINGH

Designers

SHREYANSH SHARMA

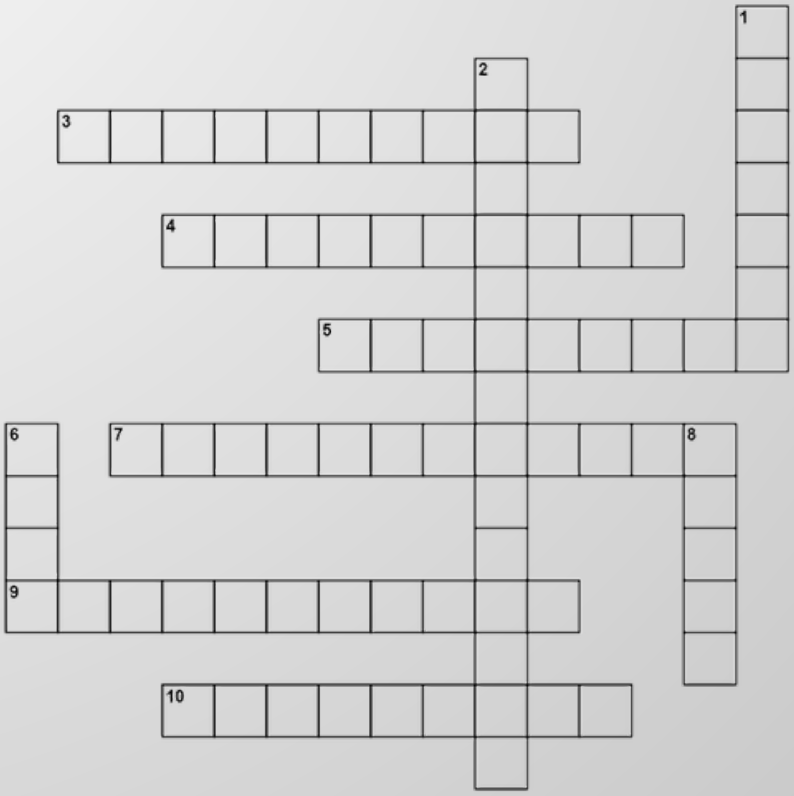
TANISHA SHARMA

Media

NIKHIL HANDA

YATHARTH SINGH

TECHTANGLE #2



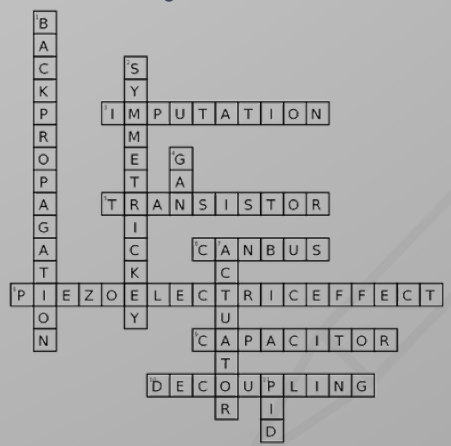
Across:

3. A decentralized and secure ledger technology
4. The process of creating a virtual environment replicating real world scenarios
5. A virtual shared space where users can interact with each other in real time
7. An engineering field that models hardware & software systems after the structure and function of the human brain
9. Structures responsible for selective passage of specific ions through cell membrane
10. Device exhibiting variable resistance depending on the history of the voltage applied

Down:

1. A junction between two nerve cells
2. An immersive technology that transports users into computer-generated environments
6. A wireless communication technology that uses visible light to transmit data
8. A type of robotic system designed to work alongside humans

Solution TechTangle #1:



REFERENCES

1. COBOTS

[1] B. Marr, "Forbes," [Online]. Available: rr/2018/08/29/the-future-of-work-are-you-ready-.

[2] K. Walch, "Forbes," [Online]. Available: https://www.forbes.com/sites/cognitiveworld/2019/12/15/youve-heard-of-robots-what-are-cobots/?sh=64c379f04862.

[3] A. H. R. P. S. Mohd Javaid, "Significant applications of Cobots in the field of manufacturing," Cognitive Robotics, vol. 2, pp. 222-233, 2022.

[4] J. Biba, "builtin," [Online]. Available: https://builtin.com/robotics/cobot.

[5] S. Gotfredsen, "Linkedin," [Online]. Available: https://www.linkedin.com/pulse/3-innovative-ways-cobots-being-used-globally-shermine-gotfredsen-%E9%83%AD%E6%98%8E%E7%8F%A0.

2. NEUROMORPHIC ENGINEERING:

[1] Felix Ukpai Ogban, I. I. Arikpo, and Idongesit Efaemiode Eteng, “Von Neumann Architecture and Modern Computers.,” ResearchGate, Sep. 06, 2007. https://www.researchgate.net/publication/236141703_Von_Neumann_Architecture_and_Modern_Computers

[2] X. Fang, S. Duan, and L. Wang, “Memristive Hodgkin-Huxley Spiking Neuron Model for Reproducing Neuron Behaviors,” Frontiers in Neuroscience, vol. 15, Sep. 2021, doi: https://doi.org/10.3389/fnins.2021.730566.

[3] “The Nobel Prize in Physiology or Medicine 1963,” NobelPrize.org. https://www.nobelprize.org/prizes/medicine/1963/speedread/

[4] S. Ghosh-Dastidar and H. Adeli, “Spiking neural networks,” International Journal of Neural Systems, vol. 19, no. 4, pp. 295-308, Aug. 2009, doi: https://doi.org/10.1142/S0129065709002002.

[5]
D. Goodman, “Brian: a simulator for spiking neural networks in Python,” Frontiers in Neuroinformatics, vol. 2, 2008, doi: https://doi.org/10.3389/neuro.11.005.2008.

REFERENCES

[6] J. H. Lee, T. Delbruck, and M. Pfeiffer, “Training Deep Spiking Neural Networks Using Backpropagation,” Frontiers in Neuroscience, vol. 10, Nov. 2016, doi: https://doi.org/10.3389/fnins.2016.00508.

[7] S. Furber and P. Bogdan, SpiNNaker - A Spiking Neural Network Architecture. 2020.

[8] F. Akopyan et al., “TrueNorth: Design and Tool Flow of a 65 mW 1 Million Neuron Programmable Neurosynaptic Chip,” IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems, vol. 34, no. 10, pp. 1537-1557, Oct. 2015, doi: https://doi.org/10.1109/TCAD.2015.2474396.

[9] T. Stewart, “A Technical Overview of the Neural Engineering Framework,” 2012. Available: http://compneuro.uwaterloo.ca/files/publications/stewart.2012d.pdf

[10] V. Lendave, “A Tutorial on Spiking Neural Networks for Beginners,” Analytics India Magazine, Nov. 13, 2021. https://analyticsindiamag.com/a-tutorial-on-spiking-neural-networks-for-beginners/ (accessed Jul. 17, 2023).

[11] M. Pfeiffer and T. Pfeil, “Deep Learning With Spiking Neurons: Opportunities and Challenges,” Frontiers in Neuroscience, vol. 12, Oct. 2018, doi: https://doi.org/10.3389/fnins.2018.00774.

[12] “Infographic: Brain-Like Computers Provide More Computer Power,” The Scientist Magazine®. https://www.the-scientist.com/infographics/infographic--brain-like-computers-provide-more-computer-power-65799 (accessed Jul. 17, 2023).

[13] C. D. Schuman, S. R. Kulkarni, M. Parsa, J. P. Mitchell, P. Date, and B. Kay, “Opportunities for neuromorphic computing algorithms and applications,” Nature Computational Science, vol. 2, no. 1, pp. 10-19, Jan. 2022, doi: https://doi.org/10.1038/s43588-021-00184-y.

[14] “Neuromorphic Computing and Hyper-Realistic Generative AI,” Dr Mark van Rijmenam, CSP | Strategic Futurist Speaker, Mar. 09, 2023. https://www.thedigitalspeaker.com/neuromorphic-computing-hyper-realistic-generative-ai/

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