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Computer Engineering Department Presents

# TECHNICAL MAGAZINE

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# Prof.Dr.Manzoor Ali

(HOD) Computer Department

# Sneha Abhijeet Bhalerao

(Editor)

# Shri. Gajanan U. Jadhav

(Lecturer) Computer Department

# Gargi Ashok Wawre

(Editor)

# And ASCE Team Members

# **BRAINCHIP TECHNOLOGY**

## ABOUT BRAINCHIP

BrainChip's technology revolves around the Akida Neuromorphic System-on-Chip (NSoC), a distinctive approach to computing inspired by the brain.The human Akida chip employs а architecture, mimicking neuromorphic the structure and function of biological neural networks. This design allows for parallel and energy-efficient processing of information. resembling the brain's distributed processing. At its core, BrainChip utilizes Spiking Neural Networks (SNNs), a type of artificial neural network that replicates the spiking behavior of biological neurons. This asynchronous processing capability distinguishes it from traditional neural network architectures, contributing to its efficiency key feature is the event-driven processing of the Akida chip. Instead of continuously processing data, it consumes power only during relevant events. This event-driven model enhances energy efficiency, making it well-suited for edae computing applications.Tailored for edge AI applications, the Akida chip enables real-time processing of data at the source. This is advantageous for tasks like image and sound recognition, where rapid decision-making without

The technology is characterized by low power consumption, a result of its neuromorphic architecture and event-driven processing. This feature makes it suitable for battery-operated devices and scenarios where power efficiency is paramount.BrainChip's Akida technology finds applications in diverse fields. including surveillance (for real-time video analysis), autonomous vehicles (object detection and recognition), and Internet of Things (IoT) devices. The technology's emphasis on processing power, efficiency, and low latency makes it well-suited for demanding edge AI tasks.

relying on extensive cloud computing is crucial.



#### **BRAINCHIP ADVANTAGES**

It's energy-efficient design, driven by neuromorphic architecture and event-driven processing, ensures low power consumption.

The ability to perform real-time processing at the edge is a key strength, particularly valuable in applications like surveillance, autonomous vehicles. and IoT devices.The parallel processing capability, inspired by the human enhances overall computational brain, efficiency by handling multiple tasks simultaneously.Tailored for AI edge excels applications, Akida where local processing is preferred, reducing the reliance on cloud computing and addressing concerns related to latency and privacy. The utilization of Spiking Neural Networks (SNNs) provides a more biologically inspired approach, allowing for efficient learning and processing of complex patterns.

Akida's versatility is evident across various fields, including surveillance, autonomous vehicles, and IoT, showcasing its adaptability to different industries and use cases.

#### BRAINCHIP DISADVANTAGES

The technology may face challenges in gaining widespread market recognition compared to more established players in the AI and semiconductor industries.

Integration of neuromorphic technologies like Akida may be complex, requiring specialized knowledge and expertise. This could pose difficulties for users seeking seamless implementation into existing systems.

Akida's focus on edge AI applications may limit its suitability for use cases that demand centralized or cloud-based processing, potentially excluding certain applications.

In the competitive landscape of AI hardware, BrainChip competes with other established and emerging players, which could impact its market position.

Neuromorphic architectures, including Akida, may encounter scalability challenges when handling large and complex datasets compared to traditional architectures. These considerations highlight that while Akida has distinctive advantages, users should be mindful of potential challenges and weigh them against the specific requirements of their applications.





#### BRAINCHIP EXAMPLES

Cochlear Implants: A form of neural implant that stores hearing by directly stimulating the auditory nerve.

Brain-Computer Interfaces (BCIs): These interfaces allow direct communication between the brain and computers, enabling users to control devices or type using their thoughts.

Memory Enhancement: Research is ongoing to develop implants that can enhance memory function, potentially benefiting those with memory disorders.

Epilepsy Management: Neural implants can detect abnormal brain activity and deliver targeted electrical stimulation to prevent seizures.

Mood Regulation: Experimental devices aim to modulate mood by stimulating specific brain regions, offering potential treatments for conditions like depression.

Neuralink: A project by Elon Musk, Neuralink aims to develop brain-machine interfaces for various applications, including enhancing cognitive abilities and addressing neurological disorders.

These examples showcase the diverse range of applications for brain chip technology, with ongoing research pushing the boundaries of what is possible.it is also used in real world for research and it is also helpful in future.

# HISTORY OF BRAINCHIP

In the future, advancements in brain-chip technology are poised to revolutionize various aspects of our lives. One significant avenue of progress lies in the refinement of Brain-Computer Interfaces (BCIs). These interfaces could facilitate direct communication between the brain and external devices, offering tremendous potential for individuals with disabilities and the broader population. Furthermore, the prospect of cognitive enhancement looms on the horizon. Brainchip technology holds the promise of devices capable of improving memory, learning, and decision-making processes. This has implications for education. professional development, and the overall augmentation of human cognitive abilities.

In the realm of healthcare, the understanding and treatment of neurological disorders stand benefit substantially from these to technological strides. Enhanced insights into the functioning of the brain could lead to more effective interventions for conditions such as Alzheimer's, Parkinson's, and epilepsy. The integration of brain-chip interfaces with artificial intelligence (AI) systems is another exciting frontier. This synergy could result in improved collaboration between humans and Al, fostering enhanced problem-solving skills, creativity, and overall cognitive performance. As technology advances, the miniaturization of brain-chip devices is anticipated.





#### CONCLUSION

In conclusion, brain chip technology represents a groundbreaking advancement with numerous potential benefits across various domains including healthcare, communication, research. entertainment. prosthetics, and However, its adoption also raises significant ethical, privacy, and societal concerns that must be carefully addressed. As the technology continues to evolve, it is essential to prioritize responsible development and deployment, ensuring that the benefits are maximized while minimizing potential risks and ensuring respect for individual autonomy and privacy. Continued research, dialogue, and regulation will be crucial in realizing the full potential of brain chip technology in a manner that is ethical, equitable, and beneficial for society as a whole.

## Author:

1.Gauri Waghchaure2.Pranjal Nirkhe3.Dhanshree Tupshendre

# **DNA DATA STORAGE**

## ABOUT DNA DATA STORAGE

DNA digital data storage is the process of encoding and decoding binary data to and from synthesized strands of DNA. While DNA as a storage medium has enormous potential because of its high storage density, its practical use is currently severely limited because of its high cost and very slow read and write times.

In June 2019, scientists reported that all 16 GB of text from the English Wikipedia had been encoded into synthetic DNA. In 2021, scientists reported that a custom DNA data writer had been developed that was capable of writing data into DNA at 18 Mbps.The demand for data storage devices is increasing day by day as more and more data is generated every day.

Presently devices such as optical discs, portable hard drives, and flash drives are used to store data. All these non-biodegradable materials used in data storage pollute the environment. As the data increases, the current data storage technology would not be enough to store data in future as data is growing every day. To backup our data, we are using various hard drives and big data centers to harvest the important data. This type of storage system is more compact than current magnetic tape or hard drive storage systems due to the data density of the DNA.





#### EVOLUTION OF DATA STORAGE

1.Mechanical Storage (1930s-1950s): Early punch cards, magnetic drums.

2.Magnetic Tape (1950s-1970s): Widely used for sequential access, especially for backup and archival.

3.Hard Disk Drives (HDDs) (1956-present): Revolutionized data storage with random access, faster retrieval times, and increasing capacities.

4.Floppy Disks, CDs (1970s-2000s):Popular for personal computer storage; CDs common for software distribution and multimedia.

5.Flash Memory (1980s-present):Introduced non-volatile, solid-state storage with faster access and increased durability.

6.NAS, SAN (1990s-present):Enabled centralized storage management, crucial for multiple users in enterprises.

7.Cloud Storage (2000s-present):Scalable, ondemand storage accessible from anywhere, transforming data management.

8.SMR,Helium-Filled Drives(2010spresent):Improved storage density and energy efficiency in traditional hard drives.

9.Optical Storage Innovations (2010s-present): Ongoing innovations in optical storage, like Bluray, for higher capacities and faster transfers.

10.DNA Data Storage (2010s-present): Research into using DNA for unprecedented storage density and durability, potentially revolutionizing archival solutions.

## HISTORY OF DNA DATA STORAGE

The idea and the general considerations about the possibility of recording, storage and retrieval of information on DNA molecules were originally made by Mikhail Neiman and published in 1964-65 in the journal-USSR, and the technology may therefore be referred to as MNeimONics, while the storage device may be known as MNeimON (Mikhail Neiman OligoNucleotides).

In 2007 a device was created at the University of Arizona, using addressing molecules to encode mismatch sites within a DNA strand.

On August 16, 2012, the journal Science published research by George Church and colleagues at Harvard University, in which DNA was encoded with digital information that included an HTML draft of a 53,400 word book written by the lead researcher, eleven JPG images and one JavaScript program.An improved system was reported in the journal Nature in January 2013, in an article led by researchers from the European Bioinformatics Institute (EBI) and submitted at around the same time as the paper of Church and colleagues.

The long-term stability of data encoded in DNA was reported in February 2015, in an article by researches from ETH Zurich.

In March 2017, Dr. Yaniv Erlich and Dina Zielinski of Columbia University and the New York Genome Center published a method known as DNA Fountain which allows perfect retrieval of information from a density of 215 petabytes per gram of DNA.





#### ENCRYPTION METHOD

Many methods for encoding data in DNA are possible. The optimal methods are those that make economical use of DNA and protect against errors. If the message DNA is intended to be stored for a long period of time, for example, 1,000 years, it is also helpful if the sequence is obviously artificial and the reading frame is easy to identify. Encoding text:-

Several simple methods for encoding text have been proposed. Most of these involve translating each letter into a corresponding "codon", consisting of a unique small sequence of nucleotides in a lookup table. Some examples of these encoding schemes include Huffman codes, comma codes, and alternating codes.

Encoding arbitrary data:-

To encode arbitrary data in DNA, the data is typically first converted into ternary (base 3) data rather than binary (base 2) data. Each digit (or "trit") is then converted to a nucleotide using a lookup table. To prevent homopolymers (repeating nucleotides), which can cause problems with accurate sequencing, the result of the lookup also depends on the preceding nucleotide. Using the example lookup table below, if the previous nucleotide in the sequence is T (thymine), and the trit is 2, the next nucleotide will be G (guanine).

## DNA OF THINGS

The concept of the DNA of Things (DoT) was introduced in 2019 by a team of researchers from Israel and Switzerland, including Yaniv Erlich and Robert Grass. DoT encodes digital data into DNA molecules, which are then embedded into objects. This gives the ability to create objects that carry their own blueprint, similar to biological organisms. In contrast to Internet of things, which is a system of interrelated computing devices, DoT creates objects which are independent storage objects, completely off-grid.

As a proof of concept for DoT, the researcher 3D-printed a Stanford bunny which contains its blueprint in the plastic filament used for printing. By clipping off a tiny bit of the ear of the bunny, they were able to read out the blueprint, multiply it and produce a next generation of bunnies. In addition, the ability of DoT to serve for steganographic purposes was shown by producing non-distinguishable lenses which contain a YouTube video integrated into the material.

## FUTURE OF DNA DATA STORAGE

DNA data storage involves encoding digital information into the nucleotide sequences of DNA molecules. The key advantages include extremely high data density, long-term stability (potentially thousands of years), and energy efficiency. Researchers are working on optimizing synthesis and sequencing techniques, reducing costs, and improving error correction methods.

Challenges include the current high cost, slower read/write speeds compared to traditional storage, and the need for precision in DNA synthesis. As technology progresses, addressing these challenges may pave the way for practical and scalable DNA data storage solutions, impacting fields like archival storage and large-scale data management.



#### CONCLUSION

In the rapidly evolving realm of data storage, the integration of DNA as a storage medium signifies a paradigm shift. The remarkable density and stability of DNA present a compelling case for addressing the escalating demands of our data-centric world. While challenges persist, ongoing research and technological refinements inspire confidence in overcoming obstacles.

As we gaze into the future, envisioning a world where the elegance of biology intertwines seamlessly with information technology, DNA data storage emerges as a promising contender. It beckons us towards a future where colossal volumes of data can be preserved for centuries, offering a sustainable and groundbreaking solution to the ever-growing digital archives. The narrative of DNA data storage unfolds as a captivating chapter in the ongoing saga of technological innovation, inviting us to explore the profound implications it may hold for the way we safeguard and manage information.

#### Author:

- 1. Kiran Kelode
- 2. Omkar Patil
- 3. Jayesh Rathod
- 4. Jay Thuse

# ETHICAL HACKING

#### ABOUT ETHICAL HACKING

Ethical hacking validates the security of networks and systems. The central mission of ethical hackers is to protect your data from unethical hackers. The ethical hacker uses the same methods as blackhat hackers, except with network administrator privileges. We must protect our data in today's evolving digital world, where biometric signatures are also digitized. Imagine hackers having stolen data and biometrics and causing financial and moral harm. Different companies pay millions to ethical hackers. Various companies lose billions of dollars annually after these payments due to these hacking activities.

Hacking can be defined as unauthorized or privileged access to a system, using software and computer technology to discover system threats and penetrate the system.

Introduces students to 4,444 modern defence mechanisms built on the organization's assets. Determine the tools and mechanisms needed to maintain the support and infrastructure of various organizations. These include processes, protocols, laws, partnerships, employees, and house assets and more required to your organization's infrastructure. Determine the hardware, machine, operating system, and software requirements for every test.

Also Ethical hacking, also known as penetration testing or white-hat hacking, involves authorized experts testing computer systems, networks, or applications to identify vulnerabilities.





Similarly, defining and implementing in real-world scenarios that model an organization's assets and the protections for those assets for testing, and also determining the limits of those protections. Furthermore, identifying the data and results obtained from the test. It is also verified that the security check result complies with the interaction rules and does not give false results related to the impact of ethical hacking. •The goal of ethical hacking. •The legal implications of usina ethical hacks outside the deployed environment. •Use ethical hacking as a defence process. •The handiness of the exercises and their ease of implementation. •The use of practical exercises outside the laboratory. •Build their practice exercises . • The main reason for ethical hacking is to assess the target system's security, system infrastructure, or network and identify weaknesses. This process finds and exploits the vulnerability and determines whether it can be unauthorized persons or other accessed by malicious activity. This paper highlights the comprehensively by elaborating on its hacking history or background. Furthermore, types of hackers, which include black, gray, and white hat hackers, are elaborated to show how these terms different in terms of working and are understanding. Similarly, ethical hacking methods and five main phases are also discussed.

# HISTORY OF ETHICAL HACKING

The First Internet Security Hacker: The first hacker to get media attention was Robert Tappan Morris in 1989 [6]. He launched the first denial of service (DoS) worm attack developed by Morris at Cornell University a year ago. He was working on a digital version of a nuclear weapon. Robert said he didn't intend to do any harm, but he wanted to highlight a security flaw. Unfortunately, a bug in the code caused the worm to replicate so many times that it caused serious damage that lasted several days. The history of hacking leads us to how ethical hacking got started. This means that the history of ethical hacking precedes the history of general hacking. To get a clear picture of this, we must delve into it [7]. The past shows that being a hacker is not necessarily a bad thing. In fact, according to history, the term "MIT" first appeared in the modern context of the famous institute, the Massachusetts Institute of Technology (MIT). The term "ethical hacking" was first used by Vice President John Patrick of IBM in 1995. However, this concept spread for a long time. This is shortest history about ethical hacking





In the 1960s, "hacking" was a term used by engineering students to find various ways of optimizing systems to make them more efficient. History tells us that hacking was a creative activity done by the world's smartest people. In the 1990s, when the use of the Internet spread around the world, the number of hackers surged. Personal computers gained immense popularity in the 1980s and 1990s. Many personal data and other sensitive records are stored in computer programs. This sparked the minds of hackers trying to access these systems . After that, this information was sold for a great profit. Hackers were considered people who were trapped in a room all day and continued to program for hours. In the 1960s, when this was the most popular phone, no one seemed to care about hackers. Instead, most people didn't know what a hack was. Hacking has attracted media attention, but it's not positive. Hackers have been viewed as criminals (cyber criminals) who use their expertise to access private systems, steal data, and even provide substantial sums of money to blackmail companies. A hacker of this type is now known as a black hat hacker, and depicts the hacking journey.

## ROLE OF ETHICAL HACKER

In-depth Knowledge of Security: Ethical hackers should be well versed with potential threats and vulnerabilities that can hack organisational systems. Ethical hackers are hired by organisations for their expertise skills and quick resolution to security vulnerabilities. They should be cyber security professionals having knowledge of the computer systems, network and security.

Think like Hackers: The primary role of Ethical hackers is to attack the system like hackers, without adopting authorised methods. They are supposed to think like hackers who want to steal confidential data /information. Ethical hackers look for areas that are most likely to be attacked and the different ways in which attack can take place.

In-depth Knowledge of the Organisation they intend to provide Service: Ethical hackers should be well versed with the services of the functional working of the organisation they are associated with. It should have the knowledge about the information that is extremely safe and needs to be protected. Ethical hackers should be capable of finding the attack methods for accessing the sensitive content of the organisation. This is how the ethical hackers plays there viral role





#### CONCLUSION

Ethical hacking can help in lot of ways like it strengthens computer and network security by performing penetration testing, it enables one to take preventive measures to avoid any security breach situations. Lastly I would conclude by saying that the list of benefits provided by ethical hackers is quite a big therefore Ethical hack Hackers are very much in demand.

In today's digital landscape, ethical hacking is essential for organizations to ensure the security and protection of their data and systems. It provides numerous benefits and can help to prevent devastating consequences such as data breaches and financial loss.ethical hacking stands as a crucial pillar in the realm of cybersecurity, ensuring the fortification of digital landscapes against malicious threats. By employing skilled professionals to probe systems and identify vulnerabilities, ethical hacking serves as a proactive defense mechanism, fostering a safer and more resilient digital environment.

## Author:

1.Harshita Adhane 2.Sanika Suryawanshi 3.Srushti Ahire

# EDGE COMPUTING

# ABOUT EDGE COMPUTING

Edge computing is a distributed information technology (IT) architecture in which client data is processed at the periphery of the network, as close to the originating source as possible.

Data is the lifeblood of modern business, providing valuable business insight and control critical supporting real-time over business processes and operations. Today's businesses are awash in an ocean of data, and huge amounts of data can be routinely collected from sensors and IoT devices operating in real time from remote locations and inhospitable operating environments almost anywhere in the world.

But this virtual flood of data is also changing the way businesses handle computing. The traditional computing paradigm built on a centralized data center and everyday internet isn't well suited to moving endlessly growing rivers of real-world data. Bandwidth limitations, latency issues and unpredictable network disruptions can all conspire to impair such efforts. Businesses are responding to these data challenges through the use of edge computing architecture.





In simplest terms, edge computing moves some portion of storage and compute resources out of the central data center and closer to the source of the data itself. Rather than transmitting raw data to a central data center for processing and analysis, that work is instead performed where the data is actually generated -- whether that's a retail store, a factory floor, a sprawling utility or across a smart city. Only the result of that computing work at the edge, such as real-time business insights, equipment maintenance predictions or other actionable answers, is sent back to the main data center for review and other human interactions.

Edge computing means running fewer processes in the cloud and moving those processes to local places, such as on a user's computer, an IoT device, or an edge server. Bringing computation to the network's edge minimizes the amount of longdistance communication that has to happen between a client and server.

Thus, edge computing is reshaping IT and business computing.

# HOW DOES EDGE COMPUTING WORKS ?

Edge computing is all a matter of location. In traditional enterprise computing, data is produced at a client endpoint, such as a user's computer. That data is moved across a WAN such as the internet. through the corporate LAN, where the data is stored and worked upon by an enterprise application. Results of that work are then conveyed back to the client endpoint. This remains a proven and timeclient-server tested approach to computing for most typical business applications.

But the number of devices connected to the internet, and the volume of data being produced by those devices and used by businesses, is growing far too quickly for traditional data center infrastructures to accommodate. Gartner predicted that by 2025, 75% of enterprise-generated data will be created outside of centralized data centers. The prospect of moving so much data in situations that can often be timeor disruption-sensitive puts incredible strain on the global internet, which itself is often subject to congestion and disruption.

So IT architects have shifted focus from the central data center to the logical edge of the infrastructure -- taking storage and computing resources from the data center and moving those resources to the point where the data is generated. The principle is straightforward: If you can't get the data closer to the data center, get the data center closer to the data. The concept of edge computing isn't new, and it is rooted in decades-old ideas of remote computing -- such as remote offices and branch offices -- where it was more reliable and efficient to place computing resources at the desired location rather than rely on a single central location.



# THE FUTURE OF EDGE COMPUTING IN YOUR INDUSTRY

CIOs in banking, mining, retail, or just about any other industry, are building strategies designed to personalize customer experiences, generate faster insights and actions, and maintain continuous operations. This can be achieved by adopting a massively decentralized computing architecture. otherwise known as edge computing. Within each industry, however, are particular uses cases that drive the need for edge IT.

Banks may need edge to analyze ATM video feeds in real-time in order to increase consumer safety. Mining companies can use their data to optimize their operations, improve worker safety, reduce energy consumption and increase productivity. Retailers can personalize the shopping experiences for their customers and rapidly communicate specialized offers. Companies that leverage kiosk services can automate the remote distribution and management of their kiosk-based applications, helping to ensure they continue to operate even when they aren't connected or have poor network connectivity. Also, The future of edge computing in IT involves decentralized processing, reduced latency, and increased efficiency as devices handle data closer to the source, enabling faster decision-making and improved user experiences.

#### BENEFITS OF EDGE COMPUTING

1.Cloud Security – The localized analytic nature of edge computing reduces the number of data transfers sent between a device and a centralized cloud, resulting in enhanced security surrounding the minimally required data in cloud storage.

2.Device/Asset Security – Again, the close physical proximity of edge computing improves data integrity and offers a more secure solution than cloud computing.

3. Quality Assurance - Quality assurance is a key feature that developers seek when integrating edge computing in their IoT devices and systems. Edge computing offers continuous reliability in data quality regardless of poor internet other or connectivity issues.

4.Securing the Physical Environment – Users looking to integrate edge computing in IoT benefit from the enhanced physical security that edge computing offers.

5.Employee Productivity –Edge-enabled IoT devices allow for increased uptime in business operations.

6.Operations Optimization – Edge computing optimizes IoT systems and device operation.





#### CONCLUSION

The idea of edge computing is to get closer to devices to reduce the amount of data that needs to be transferred, which results in better response time. Edge computing is evolving rapidly, and some in the industry believe that the cloud will be used only for massive computations and storage in the future, while all other data will be processed in edge data centers.

Edge computing systems only transfer relevant data to the cloud, reducing network bandwidth and latency and providing near-real-time results for businesscritical applications.

Edge computing can provide an alternative

solution for this. But since the technology is still in its immaturity, it is difficult to predict its success in future. Even thhough, there will be more opportunities for companies to test and set up this technology. In that there are already, some use cases may prove the value of edge computing more clearly, its potential impact on our ecosystem as a whole.

#### Author:

1.Anushka V. Udawant 2.Rutuja B. Peherkar 3.Siddhi M. Shelke

# HOLOGRAPHY & HUD TECHNOLOGY(AR HUD ADVANCED DISPLAY TECHNOLOGY)

#### ABOUT HOLOGRAPHY

Holography and Augmented Reality (AR) represent cutting-edge advancements in visual display technology, offering immersive and interactive experiences in different ways. Holography creates lifelike three-dimensional images using light interference patterns, revolutionizing how we perceive visual representation. AR overlays digital content onto the real world through glasses, headsets, or smartphone apps, enhancing our interaction with the environment.

Both technologies have diverse applications, from entertainment and security to healthcare and education, promising to reshape industries and enrich user experiences in the digital age. In the digital world, holography has witnessed remarkable advancements, transforming from physical media to digital platforms.

AR has significant potential in fields like retail, where it can offer virtual try-on experiences, and in manufacturing, where it can assist workers with real-time instructions and data visualization. As AR technology advances, its applications continue to expand, transforming how we interact with information and our surroundings. While holography has been primarily used for artistic and scientific purposes, advancements in technology have led to its integration into various industries, including entertainment, medical imaging, and security.





#### CREATION OF HOLOGRAM

Creating high-quality holograms requires precise alignment of optical components, stable light sources, and careful handling of recording materials. Additionally, advancements in digital holography have expanded the possibilities, allowing for the creation of holograms without the need for physical recording media, using computational methods to reconstruct holographic images from digital data.

The creation of a hologram relies on the principles of interference and diffraction of light. By recording and reconstructing both the intensity and phase information of light waves, holography creates realistic threedimensional images that can be viewed from different angles, offering a more immersive visual experience compared to traditional two-dimensional imaging techniques.

During playback, another laser beam illuminates the recorded interference pattern, reconstructing the original object's three-dimensional image. This process enables the viewer to perceive depth and parallax, giving the illusion of a tangible, threedimensional object floating in space. This is how the creation of holography done.

#### AUGMENTATION OVERVIEW

# REALITY

Augmented Reality (AR) is a transformative technology that blends the digital and physical worlds, enriching human perception and interaction by overlaying virtual content onto the real environment. Unlike Virtual Reality (VR), which immerses users in entirely synthetic environments, AR enhances the existing reality by integrating virtual objects, information, or interactions seamlessly into the user's field of view. This integration is achieved through a combination of advanced hardware, sophisticated software algorithms, and sensor technologies.



#### HUD TECHNOLOGY

A Head-Up Display (HUD) is a transparent display that presents data without requiring users . to look away from their usual viewpoints. Typically used in aircraft, automobiles, and now increasingly in other applications like gaming and sports, HUDs project information onto а transparent screen or directly onto the windshield, allowing users to access critical data while maintaining focus on their primary tasks. Advanced HUD systems can also integrate augmented reality elements, displaying real-time data like nearby points of interest or highlighting potential hazards on the road, further improving situational awareness for drivers or users in various environments.



#### EXAMPLE OF HOLOGRAM & HUD TECHNOLOGY

- Holographic Displays: Devices like Looking Glass Factory's holographic displays project 3D images without the need for special glasses, providing an immersive viewing experience.
- Medical Imaging: Holography is used in medical fields to create 3D representations of complex anatomical structures, aiding in surgical planning and education.
- Automotive HUDs: HUDs in cars project speed, navigation instructions, and safety alerts onto the windshield, helping drivers stay focused on the road.
- Augmented Reality Glasses: Devices like Microsoft's HoloLens overlay digital information onto the user's real-world view, with applications in industries like manufacturing and healthcare.
- Smartphone HUD Apps: These apps use a smartphone's camera and display to overlay information such as navigation directions onto the live camera feed, turning the smartphone into a basic HUD for tasks like driving or hiking.

#### INFLUENCE OF HOLOGRAM

Holograms have a profound impact across various domains:

In entertainment, holographic displays create immersive experiences, allowing for virtual performances and lifelike representations.

In terms of security, holograms play a crucial role in authentication on documents like credit cards and passports, while also serving as tamper-evident features to prevent counterfeiting.Within the realm of healthcare, holographic technology aids in medical imaging, providing detailed and realistic representations for diagnostics and surgical planning. It is also utilized in training simulations for healthcare practitioners.

In the field of education, holograms offer dynamic and interactive learning experiences. Subjects such as anatomy and history can be presented in three-dimensional holographic displays, enhancing engagement.

In business and communication, holographic telepresence enhances virtual meetings, allowing participants to appear as holograms. Additionally, holograms are employed for product presentations and prototyping.

Beyond practical applications, holography has found a place in the world of art and design, providing a unique canvas for creative expression. Artists use holographic techniques to explore the interplay of light, color, and threedimensional space.Dependency on Technology: Overreliance on holographic technology may lead to decreased human interaction and reliance on virtual experiences, potentially contributing to social isolation and detachment from reality.

In summary, holograms contribute significantly to enhancing visual experiences, improving security measures, advancing medical applications, transforming education, facilitating communication, and even serving as a medium for artistic expression.



#### CONCLUSION

In conclusion, holographic technology and augmented reality (AR) display technology, such Head-Up Displays (HUDs), represent as significant advancements in how information is presented and perceived. Holographic technology offers immersive and lifelike 3D representations, enhancing communication, visualization, and user experiences across various industries. On the other hand, AR display technology like HUDs provides users with real-time information overlaid onto their field of view, improving situational awareness and safety in applications such as aviation. automotive navigation, and industrial maintenance. Overall, holographic and AR display technologies have the potential to transform how we interact with information and the world around us, opening gu new possibilities for communication, collaboration, and exploration.

Author: 1.Suraj Wakhure 2.Aditya Pathrikar

# NATURAL LANGUAGE PROCESSING

# WHAT IS NATURAL LANGUAGE PROCESSING?

Natural language processing or NLP is a branch of Artificial Intelligence that gives machines the ability to understand natural human speech. Using linguistics, statistics, and machine learning, computers not only derive meaning from what's said or written, they can also catch contextual nuances and a person's intent and sentiment in the same way humans do.

So, what is possible with NLP? The branch of Artificial nd interpret human language is called Natural Language in AI. Also know Processing as it's abbreviated form NLP, this technology is communication mainly used to and interaction between machines and humans.



As computers and machines do not operate with the same language spoken by humans, there was a need to create a new way of facilitating the same. With the help of linguistic intelligence and cognizance, NLP can be used in several business applications as digital banking and financial such generation transactions. invoice and insurance claims handling, processing. navigation systems, virtual and digital assistants.





#### ABOUT NLP

Natural Language Processing (NLP) involves a multidisciplinary approach aimed at enabling computers to understand, interpret, and generate human language. Initially, rule-based approaches were prevalent, focusing on creating explicit linguistic rules to process language. However, with the advent of machine learning, the paradigm shifted towards statistical and probabilistic models. Modern NLP approaches often involve deep learning techniques, particularly recurrent neural networks (RNNs) and transformer models like BERT and GPT-3, which excel at capturing complex linguistic patterns and contextual nuances. This shift has significantly improved the capabilities of NLP systems, enabling them to perform tasks such as sentiment analysis, language translation, and question answering with remarkable accuracy.

The success of NLP also relies heavily on large-scale language model training and the availability of extensive labeled datasets. Pretraining on vast corpora of text data followed by fine-tuning for specific tasks has become a prevalent strategy. This data-driven approach, combined with the power of deep learning architectures, has propelled NLP to new heights, making it an indispensable component in various applications, from virtual assistants and chatbots to language translation services and sentiment analysis tools.

#### INFORMATION EXTRACTION

One way to handle unstructured text data using NLP is information extraction (IE). IE helps to retrieve predefined information such as a person's name, a date of the event, phone number, etc., and organize it in a database.

Information extraction is a key technology in many high level tasks including:

Machine translation. Translation tools such as Google Translate rely on NLP not to just replace words in one language with words of another, but to provide contextual meaning and capture the tone and intent of the original text.



#### APPROACHES TO NLP

#### **Rule-based NLP**

Rules are considered an outdated approach to text processing. They're written manually and provide some basic automatization to routine tasks. For example, you can write rules that will allow the system to identify an email address in the text because it has a familiar format, but as soon as any variety is introduced, the system's capabilities end along with a rule writer's knowledge.Rules are also commonly used in text preprocessing needed for ML-based NLP. For example, tokenization (splitting text data into words) and part-of-speech tagging (labeling nouns, verbs, etc.) are successfully performed by rules.

Yet,rules are still used today because in certain cases, they're effective enough. This includes the tasks that have.

An existing rule base. For example, grammar already consists of a set of rules, same about spellings. A system armed with a dictionary will do its job well, though it won't be able to recommend a better choice of words and phrasing

#### DEEP LEARNING BASED NLP

Deep learning or deep neural networks is a branch of machine learning that simulates the way human brains work. It's called deep because it comprises many interconnected layers -- the input layers (or synapses to continue with biological analogies) receive data and send it to hidden layers that perform hefty mathematical computations. Neural networks are so powerful that they're fed raw data (words represented as vectors) without any pre-engineered features. Networks will learn what features are important independently.



Deep learning propelled NLP onto an entirely new plane of technology. There are two revolutionary achievements that made it happen. Word embeddings. When we feed machines input data. we represent it numerically, because that's how computers read data. This representation must contain not only the word's meaning, but also its context and semantic connections to other words. To densely pack this amount of data in one representation.Continuous research and advancements in transformer architectures continue to shape the evolving landscape of NLP.

# HOW DOES NATURAL PROCESSING WORK?

NLP enables computers to understand natural language as humans do. Whether the language is spoken or written, natural language processing uses artificial intelligence to take real-world input, process it, and make sense of it in a way a computer can understand. And just as humans have a brain to process that input, computers have a program to process their respective inputs. At some point in processing, the input is converted to code that the computer can understand.

There are two main phases to natural language processing: data preprocessing and algorithm development.

Data preprocessing involves preparing and "cleaning" text data for machines to be able to analyze it. preprocessing puts data in workable form and highlights features in the text that an algorithm can work with. There are several ways this can be done.NLP is not one static methodology. The process of manipulating language requires us to use multiple techniques and pull them together to add more layers of information. When starting out in NLP, it is important to understand some of the concepts that go into language processing.



CHALLENGES OF NATURAL PROCESSING

NLP is an area of computer science devoted to easing communication between people and computers via the use of natural language. Although the sector has made strides in recent years, various problems need to be overcome in order to improve the accuracy of language systems. There are a number of challenges of natural language processing and most of them boil down to the fact that natural language is everevolving and always somewhat ambiguous. Computers traditionally require humans to "speak" to them in a programming language that is precise, unambiguous and highly structured -- or through a limited number of clearly enunciated voice commands. Human speech, however, is not always precise; it is often ambiguous and the linguistic structure can depend on many complex variables, including slang, regional dialects and social context.



#### CONCLUSION

Natural Language Processing is the practice of teaching machines to understand interpret conversational inputs from and humans. NLF based on Machine Learning can be used to establish communication channels between humans and machines. Although continuously evolving, NLP has already proven multiple fields. The different useful in implementations of NLP can help businesses and individuals save time, improve efficiency and increase customer satisfaction.

Author: 1.Vaishnavi Pardeshi 2.Harshada Taur

# MALWARE ATTACK

## MALWARE ATTACK

Malware is a common cyber-attack and an umbrella term for various malicious programs delivered and installed on enduser systems and servers. These attacks are designed to cause harm to a computer, server, or computer network, and are used by cybercriminals to obtain data for financial gain.

 History Malware-Most of computer historians say that the first virus was created in 1970. The Creeper Worm selfreplicated and copied itself across ARPANET early version (an of the internet). When activated, it displayed the message, "I'm the creeper, catch me if you can!"The term "virus" wasn't coined until 1986, when Ph.D. student Fred Cohen described a computer virus as a program that can infect other programs and create an evolved version of itself. Most early viruses destroyed files or infected boot sectors. Today's malware is much more sinister and designed to steal data, spy on .





#### TYPES OF MALWARE

- Ransomware: Encrypts files that cannot be recovered unless the victim pays a ransom. Ransomeware attacks are all too common these days.
- Adware: Display ads (sometimes malicious ads) to users as they work on their computers or browse the web.
- Fileless malware: Instead of using an file executable to infect computer systems, fileless malware uses Microsoft Office macros. WMI (Windows Instrumentation) Management scripts, PowerShell scripts, other and management tools.
- Viruses: A virus infects a computer and performs a variety of payloads. It may corrupt files, destroy operating systems, delete or move files, or deliver a payload at a specific date. So This are some of the basic types of malware attacks as above listed

# RANSOMWARE ATTACK

Ransomware is a type of malicious software (malware) that threatens to publish or blocks access to data or a computer system, usually by encrypting it, until the victim pays a ransom fee to the attacker. In many cases, the ransom demand comes with a deadline. If the victim doesn't pay in time, the data is gone forever or the ransom increases.

Ransomware attacks have become all too common. Major companies in North America and Europe alike have fallen victim to it. Cybercriminals attack any consumer or business in any industry.



#### HISTORY OF RANSOMWARE

Ransomware can be traced back to 1989 when the "AIDS virus" was used to extort funds from ransomware recipients. Payments for that attack were mailed to Panama, at which point a decryption key was sent back to the user.

In 1996, Columbia University's Moti Yung and Adam Young introduced ransomware known as "cryptoviral extortion." This idea, born in academia, illustrated the progression, strength, and creation of modern cryptographic tools. Young and Yung presented the first cryptovirology attack at the 1996 IEEE Security and Privacy Conference.

#### COMMON TYPES OF RANSOMWARE



#### TYPES OF RANSOMEWARE

The growing prevalence of ransomware has brough about increasingly complex ransomware attacks.

•Scareware: This common type of ransomware deceives users by displaying a fake warning message claiming malware has been detected on the victim's computer. These attacks are often disguised as an antivirus solution demanding payment to remove the nonexistent malware.

•Screen lockers: These programs are designed to lock the victim out of their computer, preventing them from accessing any files or data. A message is typically displayed that demands payment to unlock it.

•Encrypting ransomware: Also called "cryptoransomware," this common ransomware encrypts the victim's files and demands payment in exchange for a decryption key.

Distributd denial of service

•DDoS extortion: A extortion threatens to launch a DDoS attack against the victim's website or network unless a ransom payment is fulfilled.

•Mobile ransomware: As the name suggests, mobile ransomware targets devices like smartphones and tablets and demands payment to unlock the device or decrypt the messages.

#### IMPACT OF RANSOMWARE

Suffering a data breach or a ransomware attack can adversely affect the reputation of an organization. Some customers may view a successful attack as an indication of weak security practices, or may be so severely impacted by a service disruption they choose to conduct business elsewhere.

•Financial-Ransomware is an unexpected cost and it is expensive. In addition to the loss in revenue an organization may suffer, there are other costs that may be obvious and some that are not. More obvious costs include: the cost of the ransom payment (if paid); the cost to remediate the incident, to include new hardware, software, and incident response services; insurance deductibles; attorney fees and litigation; and public relations. Other less obvious costs may include: devaluation insurance premium increases: of reputation/tradename; and loss of intellectual #property:Data-During a ransomware attack, a malicious actor will encrypt numerous files making them, and often the systems that rely on them, unusable. If a ransom is not paid these encrypted files are often permanently locked requiring the organization to regenerate the information, if it can. However, even if a ransom is paid, there is no guarantee that a threat actor will act benevolently and provide a decryption key. Moreover, even if a key is provided it is still possible the ransomware attack caused significant destructive damage, which may require rebuilding the affected systems anyway. Further, if threat actor has stolen a trade secret, propriety information, or any Personally Identifiable Information (PII), the loss of this data could spur legal action or lead to the loss of a competitive advantage.





#### CONCLUSION

A Ransomware attack poses significant threats to individuals and organizations alike. It underscores the critical importance of robust cybersecurity measures, regular data backups, and user education. As the digital landscape evolves, staying vigilant and proactive is paramount in mitigating the risks associated with these malicious attacks.

The impact of ransomware: In the future is likely to intensify as cybercriminals continually refine their tactics. This evolving threat could lead to increased financial losses, compromised data integrity, and disruptions across various .As advances, technology organizations and individuals must prioritize cybersecurity to thwart the growing sophistication of ransomware attacks and safeguard digital Developing and resilient defense assets. mechanisms will be crucial to minimizing the potential far-reaching consequences in the evolving landscape of cybersecurity threats.

#### Author:

- 1. Anuja Pawar
- 2. Vaishnavi Gore
- 3. Shreya Rajput

# QUANTUM COMPUTING

Quantum computing is an area of computer science focused on the development of technologies based on the principles of quantum theory. Quantum computing uses the unique behaviors of quantum physics to solve problems that are too complex for classical computing.Development of quantum computers marks a leap forward in computing capability, with the potential for massive performance gains in specific use cases. For example, quantum computing is expected to excel at tasks such as integer factorization and simulations and shows potential for use in industries such as healthcare, pharmaceuticals, manufacturing. cybersecurity and finance.

According to industry trade publication The Quantum Insider, there are more than 600 companies and more than 30 national labs and agencies worldwide government that are developing quantum computing technology. This includes U.S.-based tech giants such as Amazon, Google, Hewlett Packard Enterprise, Hitachi, IBM. Intel and Microsoft as well as Massachusetts Institute of Technology, Oxford University and the Los Alamos National Laboratory. Other countries, including the U.K., Australia, Canada, China, Germany, Israel, Japan and Russia, have made significant investments in quantum computing technologies. The U.K. recently launched a government-funded quantum the computing program. In 2020. Indian government introduced its National Mission on Quantum Technologies & Applications.

The global quantum computing market in 2021 was valued at \$395 million USD, according to the report "Quantum Computing Market" from Markets N Research. The report predicts that the market will grow to approximately \$532 million USD by 2028.



Although quantum computing is a rapidly emerging technology, it has the potential to be a disruptive technology once it reaches maturity. Quantum computing companies are popping up all over the world, but experts estimate that it could take years before computing delivers quantum practical benefits.Although the idea of using a quantum computer can be exciting, it's unlikely that most organizations will build or buy one. Instead, they might opt to use cloud-based services that enable remote access. For example, Amazon Braket, Microsoft Azure Quantum and Rigetti Quantum Cloud Services all provide quantum computing as a service.Quantum computing is a multidisciplinary field comprising aspects of computer science, physics, and mathematics that utilizes quantum mechanics to solve complex problems faster than on classical computers.



## WORKING OF QUANTUM COMPUTING

Quantum computing harnesses the principles of quantum mechanics, utilizing qubits that can exist in a superposition of states, representing 0 simultaneously. and 1 Quantum gates manipulate these gubits, and entanglement establishes correlations between them. Quantum enhancing computational power. algorithms, such as Shor's for factoring and Grover's for searching, leverage superposition and entanglement to achieve exponential specific speedup in calculations.However, building practical quantum computers faces challenges. Qubits sensitive are to environmental factors, leading to decoherence, a loss of quantum information.

Quantum error correction is a critical area of research to address these issues and make large-scale quantum computation feasible.Various physical implementations of qubits, such as superconducting circuits and trapped ions, are being explored. Each technology has its advantages and challenges, contributing to ongoing efforts to create scalable and fault-tolerant quantum computers. While progress is evident, the development of practical quantum computers capable of solving real-world problems is still at an early stage.A key hurdle in quantum computing is maintaining quantum coherence among gubits, as they are susceptible to decoherence from external influences. This is how quantum computing works.





## PRINCIPLES OF QUANTUM COMPUTING

A quantum computer works using quantum principles. Quantum principles require a new dictionary of terms to be fully understood, terms that include superposition, entanglement, and decoherence. Let's understand these principles below.

#### 1.Superposition

Superposition states that, much like waves in classical physics, you can add two or more quantum states and the result will be another valid quantum state. Conversely, you can also represent every quantum state as a sum of two or more other distinct states. This superposition of qubits gives quantum computers their inherent parallelism, allowing them to process millions of operations simultaneously.

#### 2.Entanglement

Quantum entanglement occurs when two systems link so closely that knowledge about one gives you immediate knowledge about the other, no matter how far apart they are. Quantum processors can draw conclusions about one particle by measuring another one. For example, they can determine that if one qubit spins upward, the other will always spin downward, and vice versa. Quantum entanglement allows quantum computers to solve complex problems faster.

#### 3.Decoherence

Decoherence is the loss of the quantum state in a qubit. Environmental factors, like radiation, can cause the quantum state of the qubits to collapse.

## ADVANTAGES OF QUANTUM COMPUTING

1.Exponential Speedup:Quantum algorithms can provide exponential speedup for certain problems compared to classical counterparts, such as factorization and searching.

2.Parallelism:Qubits' ability to exist in superposition allows quantum computers to perform parallel computations, potentially solving complex problems more efficiently.

3.Quantum Entanglement: Entanglement enables strong correlations between qubits, enhancing computational power and facilitating complex calculations.

4.Optimized Algorithms:Quantum algorithms, like Grover's and Shor's, are tailored for specific tasks, offering efficiency gains in areas like optimization and cryptography.

5.Advanced Simulations:Quantum computers can simulate quantum systems, aiding in understanding molecular and atomic interactions, materials science, and drug discovery.

Despite these advantages, practical quantum computers are still in the early stages of development, facing challenges like qubit stability and error correction.

# QUANTUM COMPUTING USES

Quantum computing has potential applications in cryptography, optimization problems, drug discovery, machine learning, financial modeling, and material science. It could revolutionize industries by solving complex problems more efficiently, but practical implementations are still in early development stages.

Additionally, quantum computing may transform artificial intelligence by significantly accelerating certain machine learning tasks. Quantum algorithms could unlock new possibilities for advanced pattern recognition, optimization, and data analysis, paving the way for more powerful Al applications.



#### CONCLUSION

Quantum computing holds great promise for solving complex problems exponentially faster than classical computers. However, practical implementation and overcoming challenges like error correction are crucial for its widespread impact. Ongoing research and development are essential to unlock the full potential of quantum computing in the future.

Additionally, the field of quantum computing is dynamic, with advancements continuously expanding our understanding. As quantum technologies progress, their potential applications in cryptography, optimization, and simulating quantum systems could reshape industries and scientific discovery. Despite the excitement. achieving practical quantum advantage and addressing remaining obstacles remain key priorities for researchers.

Author 1.Harshada Chaudhari 2.Arpita Nikam

# SAND BOX

#### ABOUT SANDBOX

In the world of cybersecurity, a sandbox environment is an isolated virtual machine in which potentially unsafe software code can execute without affecting network resources or local applications. Think of a sandbox as a controlled playground where applications, code, and files can be tested or executed to see how they behave. If the software behaves maliciously or unexpectedly, it doesn't have the power to affect anything outside of that contained environment

The term "sandbox" is aptly derived from the concept of a child's sandbox—a play area where kids can build, destroy, and experiment without causing any real-world damage. Similarly, a digital sandbox allows experimentation and testing without repercussions outside its confined space.

Cybersecurity researchers use sandboxes to run suspicious code from unknown attachments and URLs and observe its behavior. Telltale signs include whether the code replicates itself, tries to contact a command-and-control server, downloads additional software, encrypts sensitive data, etc. Because the sandbox is an emulated environment with no access to the network, data or other applications, security teams can safely "detonate" the code to determine how it works and whether it's malicious.

SANDBOX ENVIRONMENT





#### IMPORTANTANCE OF SANDBOX

As malware becomes more sophisticated, it is imper ative that cybersecurity professionals have safe and isolated testing environments. Sandboxes provide malware researchers and others virtualized safe spaces to evaluate suspicious files or applications without putting the rest of the endpoint and network at risk.

More sophisticated cyberthreats feature advanced obfuscation techniques that can evade detection by endpoint and network security products, so it's important for researchers to examine suspicious files to learn how to improve an organization's existing security infrastructure.

Whether sandboxing is executed in the cloud or on an appliance, it provides crucial protection. Some threats, for example, may not crash your system or cause overtly noticeable effects, but they can slowly degrade the performance of your overall network, slowing down processes and wasting valuable employee time. Through sandboxing, these kinds of threats can be avoided, keeping your system running how it should.

#### USES OF SANDBOX

In general, a sandbox is used to test programs or open files without affecting the rest of the system. Developers and security researchers use sandboxes for similar reasons. The former deploy sandboxes to determine whether new code or application works as intended and to discover any bugs before pushing it to the production environment. Security researchers use sandboxes to examine malware and other suspicious applications and files to see how they run and attempt to attack an IT environment without putting the rest of the IT environment at risk.

Sandboxing is an important feature of the Java programming language and development environment, where the sandbox is a program area and set of rules that programmers need to use when creating Java code -- called an applet -- that is sent as part of a webpage.APIs sandboxes are targeted at API developers and testers. They mimic the characteristics of a production environment to create simulated responses for APIs that reflect the behavior of a real system.

In a standard business production environment, a sandbox might be misunderstood or considered a needless expense. But sandboxes are critical for several scenarios in development, cybersecurity and research. Ensuring the sandbox is truly isolated and secure is more important for cybersecurity research than software development because malware actively and aggressively scans the network for exploitable vulnerabilities.





#### EXAMPLS OF SANDBOX

A sandbox can have both software and hardware components. With hardware restrictions, a sandbox could be on its own isolated network. For very restricted isolation, the sandbox could be on its own Wi-Fi router and ISP connection. This setup would make it physically impossible for a malicious application the main network.Several to access applications use sandboxes by default to protect the local operating system. Browsers have their own sandboxes to separate malicious applications that run on the web from accessing local machine resources. Languages like Java have their own sandbox to protect local resources from untrusted code, such as a Java applet running on a web page.

HTML5 has a sandbox to protect against misuse of its iframe feature. And the Linux operating system has several application sandboxes built on Seccomp and cgroup. Google Sandbox API is available to developers who write C++ code and need to sandbox their code before deploying it to the production environment.

## BENIFITS OF SANDBOX

Sandboxing offers a myriad of advantages, from safeguarding data to promoting efficient software testing. Some of the most notable benefits of utilizing a sandbox environment include:

Enhanced Security: At its core, a sandbox provides an enhanced security layer. By keeping potentially harmful software within a controlled environment, sandboxing ensures broader systems and critical data remain untouched and uncompromised.

Safe Testing Ground: Sandboxes serve as a development testing environment, enabling organizations to run applications in a secure space before they are introduced into the production stage. This safe space ensures that any damaging issues are addressed without compromising or slowing down critical resources.

Email Quarantine: Sandboxes are commonly used as a quarantine zone for suspicious emails and their attachments. Email filters might flag potential threats, but administrators need a secure place to verify these without the risk of activation. In a sandbox, malicious attachments or macros, especially those targeting apps like Microsoft Office, can be scrutinized for safety.

The Benefits Of Sandboxing

attacks











Save your company money



#### CONCLUSION

In conclusion, a sandbox environment serves as a secure and isolated space for testing and developing software applications without the risk of compromising the overall system integrity. This controlled setting allows developers experiment, to identify vulnerabilities, and fine-tune their code in a contained manner. The benefits extend beyond mere code testing, as sandbox environments instrumental in fostering innovation. are collaborative development, enabling and facilitating the exploration of new technologies. Despite its advantages, it is crucial to recognize that a sandbox is not a foolproof solution and should be complemented by other security measures to mitigate potential risks.

# Author: 1. Anushka Sukhadeve 2 Samiksha Tarte 3. Riya Gosavi

# VIRTUAL REALITY

### ABOUT VIRTUAL REALITY

Virtual Reality (VR) is a transformative technology that immerses users in computergenerated environments, reshaping the way we interact with digital content. At its core, VR relies on specialized hardware, such as VR headsets and controllers, to create a sense of presence and interactivity.

In the realm of hardware, VR headsets like Oculus Rift, HTC Vive, and PlayStation VR deliver visual and auditory stimuli essential for immersion. Controllers, ranging from handheld devices to more advanced hand-tracking systems, facilitate user interaction within the virtual space.

On the software front, VR applications span a wide range of fields. From immersive gaming experiences that push the boundaries of realism to educational simulations offering virtual classrooms and training scenarios, VR's applications are diverse. Development platforms like Unity and Unreal Engine empower creators to design and build these virtual experiences.VR's impact extends into healthcare, where it aids medical training through simulations and contributes to therapy and treatment for various conditions.





#### PURPOSE OF VR

The goal of VR is to provide human beings with a virtual environment where we can interact with a computer just as we do in the real world, that is, by talking with a in a spoken language, by writing a letter, or by drawing a picture. We can grasp a virtual object by hand gesture and bring it to another place.

In a human-friendly virtual environment, we can interact with a computer without any difficulties or barriers. When a virtual landscape is generated by VR technology, we can go there just as if it were a real landscape. Providing not only a 3D image of the landscape but also sound and smell helps us enjoy the scenery.

The goal of virtual reality technology is to create an immersive experience that can be used to explore an environment that helps to educate or entertain the end user.

As the tech industry continues to expand exponentially, businesses and consumers are constantly looking at how future tech can better power user experiences and improve training and resources.

## TYPES OF VIRTUAL REALITY

#### **Non-immersive Virtual Reality**

Non-immersive virtual reality refers to a virtual experience through a computer where you can control some characters or activities within the software, but the environment is not directly interacting with you.

In addition to desktop computers, you can also find a robust laptop for virtual machines and work on the go. Since more and more people appreciate mobility, manufacturers create powerful systems in compact bodies.

For example, when you play video games such as World of WarCraft, you can control characters within the game that have their own animations and attributes.



#### **Fully Immersive Virtual Reality**

On contrary to non-immersive virtual reality, a fully immersive virtual technology ensures that you have a realistic experience within the virtual world.

It'll give you a sense of being present in that virtual world, and everything is happening to you for real.

This is an expensive form of virtual reality that involves helmets, gloves, and body connectors with sense detectors. These are connected to a powerful computer. Your movements, reactions, and even a blink of an eye are detected and projected within the virtual world. It'll give you a sense of being present in that virtual world, and everything is happening to you for real. This is an expensive form of virtual reality that involves helmets, gloves, and body connectors with sense detectors.

These are connected to a powerful computer. Your movements, reactions, and even a blink of an eye are detected and projected within the virtual world.

One example could be a Virtual Shooter gaming zone where you will be equipped with the gears in a small room and you will be viewing a virtual world through the helmet where you are facing other shooters trying to kill you.

You will move your arms and body to run, jump, crouch, shoot, throw, and many more within the game.

#### Semi-Immersive Virtual Reality

A semi-immersive virtual reality is a mixture of non-immersive and fully immersive virtual reality.

This can be in the form of a 3D space or virtual environment where you can move about on your own, either through a computer screen or a VR box/headset.So all activities within the virtual world are concentrated toward you.

However, you have no real physical movements other than your visual experience.

On a computer, you can use the mouse to move about the virtual space, and on mobile devices, you can touch and swipe to move about the place.



A virtual tour can be a good example of semiimmersive virtual technology. It can be devicebased or web-based. Many businesses are opting for this technology as participants can roam around the place without having to be there physically.

#### IMPORTANCE OF VIRTUAL REALITY

#### **VR** in Education

Virtual reality has the potential to revolutionize the way we learn and educate ourselves. With VR, students can be transported to historical events, visit iconic landmarks, or explore the depths of space without ever leaving the classroom.

#### **VR** in Healthcare

VR technology is being used to treat various mental health conditions such as anxiety disorders, phobias, and post-traumatic stress disorder (PTSD). By creating virtual environments that expose individuals to their fears or traumas, VR therapy can help desensitize and alleviate symptoms.

#### **VR** in Entertainment

When it comes to entertainment, virtual reality is revolutionizing the way we experience forms of games, movies, and other entertainment media. VR gaming provides an unparalleled level of immersion and interactivity, transporting gamers into virtual worlds where they can physically move, interact with objects, and engage with characters.



Virtual Reality (VR) revolutionizes architecture and design by offering immersive design reviews. enabling cost-effective virtual prototyping, enhancing spatial planning, and elevating client engagement. It aids in construction planning, provides practical experiences learning for students, and supports sustainable design considerations.



#### CONCLUSION

In conclusion, Virtual Reality (VR) stands as a transformative force across various sectors. Its impact extends from revolutionizing gaming and entertainment to enhancing education, healthcare, and design. VR not only provides immersive experiences but also serves as a tool for training, collaboration, and innovation. As technology the importance of VR becomes evolves. increasingly evident, shaping the way we learn, work, and interact with the digital world. Its potential to redefine experiences and push the boundaries of what is possible underscores its enduring significance in the evolving landscape of technology and human interaction.

Moreover, VR's influence reaches into the realms of remote collaboration, research, and development, contributing to advancements in fields like architecture, healthcare, and beyond. Its applications in therapy, training simulations, and virtual tourism highlight the versatility of this technology.

#### Author:

1. Anushka Kharat 2. Kalyani Ghodke

# **BIOMETRIC EVOLUTION**

#### INTRODUCTION

The term "biometrics" is derived from the Greek words "bio" (life) and "metrics" (to measure). Automated biometric systems have only become available over the last few decades, due to significant advances in the field of computer processing. Many of these new automated techniques, however, are based on ideas that were originally conceived hundreds, even thousands of years ago.In the early 20th century, the first fingerprinting systems were developed, and their use became widespread. Fingerprint identification is now widely used by Police and Law Enforcement organizations.

#### KNOWLEDGE AND RECOGNITION

How can you be confident that someone is who they say they are?

Long ago, this wasn't a problem. Most people rarely interacted with anyone outside of their local village; they were recognized by sight, name, voice, or some other physical trait, and where necessary they were vouched for by a trusted third party. Over the years, methods evolved to aid identification, such as passports, ID cards, or driver's license most of them anchored in the physical world. At the dawn of the digital age, anew question arose: How do you trust someone you don't know, can't see, and who isn'tpresent in person? One solution has been the exchange of knowledg passwords, PIN'smemorable data, and personal details. But such techniques come at a price loss of privacy, greater inconvenience, and rising rates of identity fraud. As a result, the password is being replaced by the person be it thumbprint, facial imaging, voice inflection, or behavioral traits. As in the village of old, it's once again about recognition, but this time using techniques fit for a digital world



### WHY BIOMETRICS?

Biometrics is chosen for its unique ability to provide secure and convenient identification and authentication. Unlike traditional methods such as passwords or PINs, biometrics leverages individual characteristics like fingerprints, iris patterns, or facial features, offering a more reliable and difficult-to-forge means of ensuring security. Additionally, the ease of use, accuracy, and versatility of biometric technology make it a preferred choice in various applications, from access control and financial transactions to healthcare and law enforcement. Overall. addresses the limitations biometrics of traditional authentication methods, providing a robust and user-friendly solution for verifying identities.Biometrics stands out for its secure and convenient identification. It utilizes unique traits like fingerprints or facial features, enhancing security by making replication difficult. Beyond security, it offers user-friendly access. streamlined operations, and integrates with advanced technologies.

# PROTECTION OF BIOMETRIC DATA

Ensuring the protection of biometric data is crucial for privacy and security. Key measures include encrypting the data during storage and transmission, storing it in secure, accesscontrolled environments, and implementing tokenization to replace actual data with unique tokens. Techniques like template protection prevent reverse engineering, and combining biometrics with other authentication factors enhances overall security. Regular audits, strict access controls, and compliance with regulation.



#### ADVANTAGES OF BIOMETRICS

Biometric technology offers a range of benefits that collectively contribute to enhanced security and improved user experiences. One of the key advantages is the heightened level of security provided by using unique physical or behavioral traits, such as fingerprints, iris patterns, or facial features. This uniqueness makes it challenging for unauthorized individuals to forge or replicate access.

Beyond security, biometrics also bring about convenience by offering a user-friendly means of accessing secured areas or systems without the need for remembering passwords or carrying physical keys. This ease of use translates into streamlined authentication that are guick processes and efficient, enhancing overall productivity.Moreover, the accuracy of biometric identification is a notable advantage, reducing the risk of false positives traditional negatives compared to or authentication methods.



## EXPANSION OF USES

In Access Control, biometric systems replace traditional methods, securing physical spaces, and ensuring only authorized individuals can enter restricted areas. Similarly, in \*\*Device Authentication features like fingerprint or facial recognition authenticate users on smartphones, laptops, and other devices, adding an extra layer of security.Biometrics also play a pivotal role in lentity Verification, preventing identity theft and ensuring accurate identification in sectors such as finance, healthcare, and government. Businesses utilize biometrics for Time and Attendance Tracking, eliminating time fraud and transparently recording employee hours.In the realm of work Financial Transactions, biometrics enhance security, with banks using features like fingerprint or iris scanning for secure account access and transaction authorization. At borders and immigration, biometric systems, including facial recognition and fingerprint scanning, ensure efficient traveler identification and control.

In Healthcare, biometrics secure patient records, control access to sensitive medical information, and aid in patient identification. This are some uses of biometric technology.

#### SECURITY, CONVENIENCE, AND THRESHOLDS

Biometrics need to be both secure and convenient to use. Determining the level of security and convenience is not an exact science. Consider an example: A customer of afinancial institution uses biometrics to access their account. From a strict security standpoint, if a user places the correct finger on the sensor but positioned incorrectly, the system could make the user try again. However, how should the quality level be set suchthat the correct individual can gain access easily? There is an inherent trade-off betweenfalse accepts and false rejects. A false accept is when the incorrect person is accepted into the system; conversely, false rejects are rejecting users that should be allowed into their native account. On а system, this predetermined quality score is set by the operating system and the manufacturer, as opposed to an app in the third-party, non-native scenario. This is about security, convenience and threshold





#### CONCLUSION

Effective biometrics melt into the broader experience of consumer-centric services, giving people the power to transact with minimal exchange of personal data. The advent of biometric solutions has prompted a shift from knowledge-based methods of verification to those that employ intelligent recognition-replacing the password with the person. The continued adoption of such technology is dependent on users' faith in its safety and effectiveness. As biometrics expands to new use cases in healthcare, travel. and the workplace, we strongly recommend that practitioners advance trust through security-by-design, an approach tobiometric innovation that places the protection of data and identity at the heart of the technology

Author: 1.Preeti Deore 2.Anuja Bansode 3.Tanvi Mundle

# **GOOGLE COLAB**

# ABOUT COLAB

Google Colab, a cloud-based platform for Python programming, offers an array of features making it suitable for a magazine article. Begin with an introduction, highlighting Colab's collaborative nature and its seamless integration with Google Drive. Explore its powerful capabilities, such as GPU acceleration, which enhances machine learning tasks. Discuss the versatility in handling various data types, including text, images, and charts. Emphasize the convenience of sharing and commenting on Colab notebooks, fostering collaborative work. Touch upon its free accessibility and the option to upgrade for additional resources. Conclude by showcasing realworld applications and success stories, reinforcing Colab's significance in both educational and professional spheres.

In addition, delve into Google Colab's rich library support, showcasing its compatibility with popular frameworks like TensorFlow and PyTorch. Highlight the ease of experimentation with code snippets, aiding in rapid prototyping and iteration. Discuss the interactive nature of Colab notebooks, allowing users to visualize outputs instantly, fostering a smoother coding experience.





#### PYTHON DEVELOPMENT

Google Colab is a powerful platform for Python development, offering a cloud-based environment with free access to GPU resources. Utilizing Colab involves creating and running notebooks, which are documents containing both code and rich text elements.

To start, open Colab in your browser and create a new notebook. You can add code cells to write and execute Python scripts. Colab supports various libraries and frameworks, making it suitable for data science, machine learning, and general-purpose coding.

One notable feature is the integration with Google Drive, allowing seamless storage and sharing of your Colab notebooks. You can also install additional libraries using the '!pip install' command within a code cell.

For collaborative work, share your Colab notebook with others by clicking the "Share" button in the topright corner. Colab also supports real-time collaboration, enabling multiple users to edit a document simultaneously.

#### COLAB HISTORY

Google Colab, short for Google Colaboratory, emerged as а groundbreaking platform for collaborative coding and data analysis, leveraging the power of Google's infrastructure and integrating seamlessly with popular machine learning libraries like TensorFlow and PyTorch. Launched in 2017, Colab quickly gained traction among data scientists, researchers, and students for its accessibility and convenience. Offering free access to GPU and TPU resources, Colab democratized deep learning experimentation by removing barriers related to hardware costs and setup complexities. Over time. Google introduced various enhancements to Colab, including improved integration with Google Drive for seamless data sharing and collaboration, support for Python notebooks, and integration with GitHub for version control. As the demand for AI and machine learning solutions soared, Colab evolved into а go-to platform for prototyping models, conducting research, and even hosting educational workshops. Its popularity also led to the development numerous tutorials, quides. of and community-driven resources, fostering knowledge exchange and collaboration within the machine learning community. Despite occasional limitations in resource allocation and session management, Colab continued to evolve, offering paid resources tiers with increased and enhanced capabilities for enterprise users. With its ongoing evolution and widespread Google Colab remains adoption, а cornerstone of the machine learning ecosystem, empowering users worldwide to explore, innovate, and collaborate in the realm of artificial intelligence and data science.



IMPORTANCE OF COLAB

Google Colab democratizes access to highperformance computing resources, enabling efficient machine learning model training. It eliminates hardware investment barriers, making data analysis and model prototyping accessible. Colab fosters collaboration via Google Drive integration, enabling seamless sharing and teamwork. Real-time collaboration features enhance productivity and streamline development processes. It serves as an educational tool for students to gain practical machine learning experience. The platform's user-friendly interface and library integration support hands-on learning. Colab is integral to organizations, facilitating scalable computational resources for large-scale projects. Its GitHub integration ensures version control and reproducibility for research endeavors. Colab's impact extends beyond technical capabilities to democratize advanced computing access. It empowers innovation and knowledge exchange within the data science community. The platform plays a central role in shaping the future of machine learning research. accessibility and collaborative Its features enhance research efficiency and effectiveness. Colab enables individuals and organizations to innovate in data-driven research. Its popularity underscores its significance in the machine learning ecosystem. As the field evolves, Colab remains pivotal in advancing data science and machine learning endeavors.

#### WHY GOGGLE COLAB

Google Colab offers several compelling reasons for users to leverage its platform for their data science and machine learning projects. Firstly, Colab provides free access to high-performance computing resources, including GPUs and TPUs, which are essential for training complex machine learning models efficiently. This eliminates the need for users to invest in expensive hardware or infrastructure.

Secondly, Colab's cloud-based nature enables seamless collaboration and sharing of notebooks and datasets through integration with Google Drive. This feature facilitates teamwork among researchers, students, and professionals, making it easier to build upon each other's work and accelerate project development.

Additionally, Google Colab's user-friendly interface and integration with popular machine learning libraries like TensorFlow and PyTorch make it an ideal platform for and both beginners experienced practitioners. It provides a convenient environment for experimenting with algorithms, exploring new techniques, and gaining practical experience in machine learning.

Furthermore, Colab supports real-time collaboration, allowing multiple users to edit and annotate notebooks simultaneously. This feature enhances productivity and fosters knowledge sharing within the data science community.

Moreover, Google Colab serves as an educational tool, offering a hands-on learning environment for students and aspiring data scientists to gain practical experience in machine learning concepts and techniques. Overall, the benefits of using Google Colab include free access to powerful computing resources, seamless collaboration and sharing capabilities, user-friendly interface, real-time collaboration features.



#### CONCLUSION

In conclusion, Google Colab stands as a pivotal platform revolutionizing the landscape of data science and machine learning. Its provision of free access to high-performance computing resources, seamless collaboration features, and user-friendly interface has democratized the field, enabling individuals and organizations to engage in sophisticated research and innovation without the burden of infrastructure costs. The integration with Google Drive facilitates effortless sharing and teamwork, fostering a culture of collaboration within the data science community. Moreover, Colab's real-time collaboration capabilities and educational opportunities empower users of all levels to explore, experiment, and learn in a supportive environment. As a cornerstone of the machine learning ecosystem, Google Colab not only accelerates research and development but also cultivates a culture of knowledge exchange and innovation that drives the field forward. Its continued evolution and widespread adoption underscore its significance as a catalyst for advancements in data-driven research and discovery, promising an exciting future of exploration and innovation in the realm of artificial intelligence and data Author:

1.Shubham S. Deshmukh 2.Vishal R. Rathod 3.Harsh R. Kathar 4.Akash B. Sose





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