

# Investigating Role of Deep Learning in Metaverse

Himangi<sup>1,\*</sup>, Prof. (Dr.) Mukesh Singla<sup>2</sup>

<sup>1</sup>PhD Scholar, Department of Computer Science and Engineering, Baba Mastnath University, Rohtak, Haryana, India Email: himangiverma2021@gmail.com

<sup>2</sup>HOD, Department of Computer Science and Engineering, Faculty of Engineering, Baba Mastnath University, Rohtak, Haryana, India Email: mukesh27singla@yahoo.co.in

\*Corresponding Author: Himangi (himangiverma2021@gmail.com)

<b>Article History</b>	<b>Abstract</b>
<b>Article Submission</b> 24 December 2021 <b>Revised Submission</b> 14 February 2022 <b>Article Accepted</b> 28 February 2022 <b>Article Published</b> 16 March 2022	<p>Avatars are computer-generated digital representations that people may use in the metaverse to communicate and interact with one another as well as with digital goods. Imagine a setting that combines elements of virtual reality, an online performance game, and the World Wide Web. In the modern world, one does not have the option of avoiding the usage of bitcoin. In this rapidly evolving hybrid setting, Bitcoin is the proper medium of exchange because of the inherent decentralisation it has. In addition to this, it is essential to integrate data compression and safety precautions. Compression is an area of study that is constantly undergoing new developments as well as technological leaps and bounds. This study looks on other aspects of the metaverse as well, such as data compression and security concerns related to the metaverse. Before training and testing the DL model, an image processing approach was included in order to reduce its size. This was done so that object identification may be improved even more.</p> <p><b>Keywords:</b> Software Development, Artificial Intelligence, Metaverse, Virtual reality, image compression, deep learning.</p>

## I. Introduction

People are able to communicate with one another and digital objects while simultaneously operating virtual representations of them in the metaverse. These interactions take place in persistent virtual environments. All that is required to make this a reality is the internet, a virtual reality that is immersive, and an online role-playing game. People in the metaverse may interact with one another and digital objects by taking on the form of a digital representation of them known as an avatar. The only things that are necessary are a computer, a virtual reality headset, and an online role-playing game. The subfield of computer science known as "software development" is concerned with the conception, planning, execution, and upkeep of various computer programmes. Programmers, software engineers, and those that specialise in software development are primarily responsible for developing software. Even while the details of these professions interact and overlap in a variety of ways, each department or community has its own own set of dynamics in which they do so. The creation of bespoke software is differentiated from the production of software that is commercially accessible by a variety of reasons. As its name indicates, "bespoke development" refers to the practise of developing software particularly for a certain user population, set of functions, or set of features.

In artificial intelligence (AI), the cognitive processes of humans are modelled and replicated using computer technology. A few examples of applications for artificial intelligence include machine vision, voice recognition, and processing of natural language. The work that McCarthy did (AI) was crucial in laying the framework for the creation of artificial intelligence. The capacity of a computer to do skills that are often associated with humans, such as learning, thinking, and problem solving, is referred to as artificial intelligence (AI). As the metaverse develops, Artificial Intelligence (AI) has the ability to free individuals from arduous and time-consuming data processing chores. In this part, we will be concentrating on taking a look at how artificial intelligence (AI) has been

implemented into the structure and functioning of the metaverse. Applications of artificial intelligence in the Metaverse may be broken down into three primary groups: self-aware avatars, digital twins, and computer agents.

### 1.1 Metaverse

The "mega smart space" combines real and virtual environments to simplify people's everyday lives. A new planet and economy could be possible. Metaverses, also known as virtual worlds, provide users with an alternate reality in which they may do a variety of tasks and have meaningful social interactions with others. The introduction of holograms, video, and other types of digital media marks a significant step forward towards a digital world accessible online. Hyper-real other realities will become accessible as the metaverse develops. They want to contribute to the expansion of the metaverse as well. Combining virtual reality, augmented reality, and video might allow users to "live" in a computer-generated environment. A metaverse is a huge digital arena where individuals may interact in real time and perhaps feel the same experiences as they would in the real world. The fundamentals of the Metaverse are broken out here.

- a) As far as we're concerned, the metaverse is just another dimension. If it's not limited by where they live or where they work, it may as well be infinite. Human imagination can go as far as it wants in the metaverse.
- b) In a Metaverse, synchronised communication between people located all over the world is essential. Millions of individuals will be able to talk to one another instantly because of this.
- c) In continuation of the prior piece, the economy of the Metaverse is thriving. Since VR is a simulation of our actual surroundings, the user's experience is indistinguishable from the real thing.
- d) Due to the controversial nature of the topic, remember this. It's possible that many parallel realities coexist with one another. My character's skin tone and appearance might be imported into a separate metaverse concept being investigated by a different company.

The metaverse may one day make the internet even better. Metaverses may be accessed via general-purpose computers, cellphones, augmented reality, mixed reality, virtual reality, and virtual world technology. AR and VR allow for the addition of visual elements, audio, and other sensory signals to real-world settings. Smartphone owners may now direct virtual objects in the real world with the help of AR. However, virtual reality is completely fictitious and only serves to enhance made-up realities. The user wears a headset that transmits commands to the system.

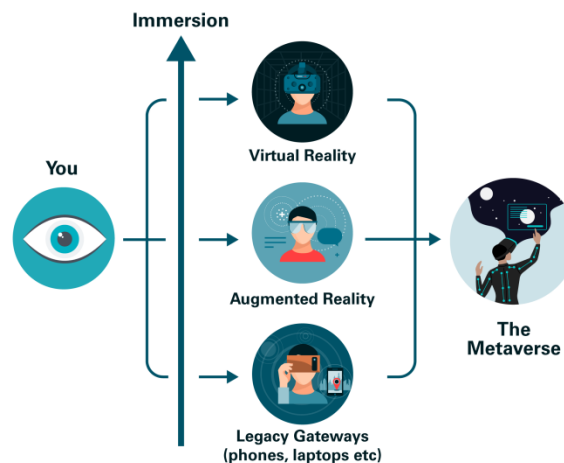


Figure 1: Making Metaverse

Software developers and engineers will always be in demand in the metaverse. Companies like Facebook, and Snap, to name a few, are filling a wide variety of metaverse roles. Innovative and forward-thinking organisations like OpenSea and Roblox are always on the lookout for new employees. There is a wide variety of uses for the metaverse. Its applications span from the commercial to the creative. It is most often used for interacting on social media. Here are a few illustrations before we go into the details:

- **Commercial purpose:** Businesses may also benefit from the new technology possibilities. In the world of digital marketing and advertising, social media has allowed for a more comprehensive strategy that employs consistent marketing materials and commercials, online shops, and more personal interactions with customers.

- **Education sector:** Remember that the video conferencing technologies and asynchronous courses used for online learning are passive and indirect in nature.
- **Entertainment:** Theme parks and amusement parks, unlike the real world, may already have a virtual reality system in place, making them suitable locations for virtual reality.
- **Lifesaving Simulation:** This new social economy and experience may be tough to access for those who aren't used to the internet environment. That's why it's so important to use AI to level the playing field in the Metaverse for humans of all talents. Several technologies have the potential to be of use in this setting:

Image recognition might help the visually impaired.

- a) Automatic translation by a machine.
- b) Communication-capable robotic exoskeletons
- c) being the most vulnerable in terms of brain-computer interactions
- **Social Interaction:** The one-way nature of Facebook and Twitter conversations means they lack depth. This technology enables real-time interaction and the use of digital material acquired or created in the virtual environment.

## 1.2 Crypto Currency as a Metaverse Pillar

In the real world, people utilise fiat money, which doubles as a medium of exchange and a store of wealth. We need a simple and quick method of purchasing artwork, real estate, and tickets to a Taylor Swift performance in your virtual environment. Digital currencies are the way to go. It's hard to imagine life without digital currencies like Bitcoin and others like it. As a result, crypto has become not only necessary but fundamental to modern life. Due to its decentralised nature, cryptocurrency is the preferred medium of exchange in this dynamic hybrid setting. Time to give it some thought. Quick, frequent transactions, such as selling your vintage and buying a new one or even getting your hands on that NFT, necessitate decentralisation and transparency so that the authority to approve and validate your desired transactions does not rest with a single centralised authority or hub but rather with all participants in the network collectively. You wouldn't place all your trust in just one person. Second, when using a public ledger like blockchain, all of your transactions are permanent, auditable, and safe since cryptocurrencies like bitcoin use very robust encryption technology to encrypt and protect cash.

Metaverse, Version

## 1.3: The Function of Deep Learning

Scientists are aiming to reduce picture size to facilitate faster object detection in the meta-verse. Combining picture compression and deep learning, we have successfully detected objects in the metaverse.

- **Image processing:** There are several methods available for improving or extracting relevant data. The input is a picture, and the output might be a replica of the original, or it could be a set of features or qualities that are indicative of it.
- **Image compression:** Image compression allows you to decrease the size of a graphic file without compromising the quality of the original. More pictures may be kept in the same quantity of disc space or RAM if they are compressed.
- **Edge detection:** Edge detection is a technique in image processing that may be used to locate the borders of objects in a picture. The sensor is successful in its mission since it detects the target. Edge detection is used in image processing, computer vision, and machine vision for picture segmentation.
- **Deep learning:** In machine learning, many approaches are used to construct artificial neural networks and study representations. It is also possible to learn in an unsupervised or semi-supervised manner. "Deep learning" AI technology simulates how humans remember and learn. Deep learning is crucial in the field of data science, which includes applications such as statistical analysis and predictive modelling.

## 1.4 Security Concerns Relating to Metaverse

Unprotected digital devices, such as VR headsets, make it easy for hackers to enter the metaverse. The information gathered by these headsets, or any future wearable devices, may be very confidential. Information that falls into the wrong hands might be used for cyber blackmail or social engineering. When individuals and companies have a presence not just in the real world but also in the metaverse, it might be harder to protect their intellectual property. Politicians are often sluggish to act on technology challenges, which is unfortunate. The fast development of online communication and engagement is seldom considered in legislation. The people who write the laws in the United States are often ignorant about cutting-edge technologies. This is one explanation for cybercrime's

enduring appeal in the twenty-first century. When developing and releasing new technologies, cyber security is routinely disregarded. Customers' realisation that current IoT gadgets like smart assistants, smart home security systems, fitness monitors, and the like have insufficient cybersecurity safeguards built in prompted calls for new laws to defend these products.

There is a possibility that stricter regulations may be imposed on the internet. One of the last places where people may speak their minds freely and have access to information is the internet. Control by the government over the internet is not only unrealistic but also immoral. The greatest way for individuals and businesses to safeguard their information in the future is via training and precautions taken now. In this age of cyber resilience, it is crucial to have a firm grasp of the threats posed by the internet and to have the means to protect against them deployed.

- **Advanced Encryption Standard (AES):** NIST created the Advanced Encryption Standard in 2001 as a standard for encrypting digital information. AES is used to safeguard sensitive data held by the United States government. AES is frequently used in both software and hardware to protect private information. This is crucial to the safety of computers, networks, and electronic data.
- **RSA Encryption:** The RSA (Rivest-Shamir-Adleman) method is used by modern computers for encrypting and decrypting communications. It's a method of asymmetric cryptography. It is called "public key cryptography" because one of the keys may be given out to anybody who asks for it. It's important to hide the second key.

Table 1 Comparison of AES, and RSA

Keywords / Parameters	AES	RSA
Key Type	Symmetric	Symmetric
Key Size	128 bits	64bits
Block size	128, 192, 256 bits	64 bits
Computation Time	Faster	Moderate
Memory Utilization	Requires moderate memory space	Requires least memory space

## II. Literature review

Previous studies and polls on the metaverse are discussed here. This problem has been the subject of several investigations. This study investigates data compression and security concerns in the metaverse. In what follows, authors from many disciplines share their perspectives.

If a comprehensive framework for evaluating changes inside the metaverse has been established, then a digital "big bang" is possible, as suggested by Lik-Hang Lee et al. [1]. The shift from an Internet-based system to one based on the metaverse could not have been accomplished without significant advances in technology. Mobile networks, augmented reality, artificial intelligence, blockchain, computer vision, and the edge and cloud computing of the future were all explored in depth by the researchers. Apps developed as part of the metaverse ecosystem might allow users to take part in a virtual environment that can maintain itself.

John Ferraioli [2] James As the globe became increasingly "distant," COVID-19 emerged as a vital tool. The widespread use of digital tools in many different types of organisations increased dramatically after the epidemic. Investment in virtual reality and augmented reality technologies is expected to increase in the coming years. Virtual and augmented reality (VR/AR) technology has advanced, which might eventually allow for a more natural blending of the digital and physical worlds.

Marc Bridger et al. created the term "metaverse sight" to describe this phenomenon. [3] A nebulous anthropomorphic metonym for the incorporation of overt quiddity into the metaverse, "extended metaverse simultaneity" is a mouthful. Misinformation, such as Twitter tantrums and disinformation, erupted in the aftermath of headlines and other storms.

The 'Internet of Bodies,' a concept coined by Ghislaine Boddington [4], was the subject of her talk. Thirdly, when the boundaries between the actual and virtual worlds blur, our identities expand to include many senses and become hyper-enhanced. At long last, the bodies of these people have been revealed to be the interface.

Ben Falchuk [5] conducted studies with a focus on the methodical development of privacy architectures. This section provides an outline of how a deployment strategy that satisfies the requirements of social metaverse privacy plans may be implemented, but does not go into detail. Cloud-based servers will provide access to the necessary metaverses for playing these games.

Two Greek-speaking researchers and a doctoral student found that bridging cultural gaps through Second Life in transatlantic conversation was challenging. Thirteen American college students participated in the research. [6] This culminated in a virtual Green Data Centre hosted by IBM, where students and faculty discussed sustainability policies from IBM, the European Union, and the United States.

A conscious metaverse was built as a topological model of reality by Shelli R. Joye and coworkers [7]. Both local and nonlocal features of the observable universe were included into the model. The theory originated from (a) ontological readings of quantum mechanics and (b) Karl Pribram's holonomic theories of the mind and brain. There is a school of thought in ethics that holds that intuition, rather than reason, is the primary source of moral direction.

According to his sources Esther Swilley et al. [8,] physical stores have given way to online marketplaces. The shop has to shift from concentrating on selling items to focusing on providing a satisfying shopping experience for its clients. They wanted to find the right balance between business and technology to pique consumers' interest in their research.

According to John David N. Dionisio et al.[9], four areas need to be addressed to go from a collection of virtual worlds to an integrated Metaverse network. Each sector was given an overview of the Metaverse's present status and what needs to be done to make it operate.

To perform a thorough investigation, Sang-Min Park et al. [10] separated metaverse concepts and fundamental technique into three parts, bypassing the hardware approach. Researchers in film, video games, and academia have used these three components and methodology as a basis for outlining the most important approaches.

The term "distributed self" was first used by Richard Gilbert and his coworkers [11]. Before performing the investigation, the researchers developed two hypotheses. As a consequence of these cultural and technical shifts, we no longer perceive ourselves as we once did. Second, humanity was undergoing a profound change in terms of its cultural norms and technological capabilities.

The acceptance of metaverse services was investigated by Sang-Gun Lee et al. [12]. What we call "metaverse services" encompasses the fields of augmented reality, lifelogging, the mirror universe, and virtual reality. T.G.I.) is the year's most popular item in terms of demand. This poll found that IP traffic and iPhone sales were the most common indicators of product and service success.

### III. Problem statement

The concept of a "meta-verse" was gaining popularity. However, many studies have been conducted on the subject in the past. In contrast, this study had no practical implications. They also failed to account for the importance of data compression. Moreover, they zeroed in on the crypto-connected metaverse in particular. The metaverse, for instance, entered popular discourse after Covid-19. However, many previous research have been conducted on the topic. Many individuals think there's potential for these lab results to be used in practical settings. As a result, they didn't think to compress the data they were collecting. Therefore, a virtual world, rather than a crypto-linked metaverse, was of more importance to them. Loka App's virtual object identification has been demonstrated to need photo reduction and edge detection to make deep learning training and testing more efficient.

Table 2 Comparison chart of previous and proposed work

	<b>Traditional work</b>	<b>Proposed work</b>
<b>Time consumption</b>	Relatively high	Relatively less
<b>Error rate</b>	Relatively high	Relatively less
<b>Packet size</b>	Relatively high	Relatively less
<b>Flexibility</b>	Less	High
<b>Scalability</b>	Less	High
<b>Reliability</b>	Less	High

#### IV. Need of Research

More and more people started to accept the idea of a metaverse. However, there have been many previous investigations into this topic. In contrast, this study's conclusions were not very relevant in the real world. As a result, they didn't think to compress the data they were collecting. The crypto-linked metaverse was also a primary focus. The metaverse, for instance, entered popular discourse after Covid-19. On the other hand, this isn't the first time this question has been studied. A common misunderstanding is that these studies' findings would be implemented immediately. Research into the Meta-verse includes investigations into software engineering and AI. A researcher in the metaverse does so by reading the scholarly literature and using research techniques. Research designed to put a hypothesis to the test should include both those with technical expertise and those without. There were both women who were technically savvy and those who were not. Faster metaverse object recognition is possible with the help of image processing and deep learning. If the stated conditions about the metaverse's knowledge, interest, technical feasibility, and availability of the proposed project are accurate.

#### V. Conclusion

Like any other IT service provider platform, Metaverse has security vulnerabilities. It is important to create a metaverse-specific security plan in addition to the present protections in place. However, the study was mostly theoretical. Besides that, they disregarded the need of data compression. Not only that, but the whole crypto-linked metaverse was their only point of interest. The metaverse, for instance, entered popular discourse after Covid-19. Despite this, there have been several investigations on this issue. The idea that the results of this research might be implemented is widely held but is not true. As a result, they misunderstood the significance of minimising the size of the data they were collecting. This is why a crypto-linked metaverse wasn't as appealing to them as a virtual one. The suggested approach takes into account encryption and compression mechanisms to improve the safety and efficiency of using huge data in the metaverse. Data compression is used in this system to store and transfer large amounts of data more efficiently. The content replacement strategy is used to compress the data. After that, a polynomial encryption technique is used to encrypt the compressed data. The metaverse serves as a repository for this compressed and encrypted material. The compression and encryption mechanisms have been simulated, and subsequent comparative analyses have been performed.

Table 3 Difference between feature of traditional and proposed security system

Feature	Traditional security systems	Proposed research
Big data compression	No	Yes
Encryption	Yes	Yes
Flexibility	Low	High
Scalability	Low	High
Security of metaverse	No	Yes
Big data storage size	Large size space required	Small size storage is needed after compression
Considered Factors	Security	Security, performance , error rate, packet size

#### VI. Scope of Research

In this part, we'll discuss the scope of the Metaverse in connection to the factors that affect adaptation to the Metaverse. There are as many uses for the metaverse as there are for the metaverse itself. The initial cost of signing up for an account is minimal. Costs may increase if you want to invest in real estate on NextEarth or travel to other parts of the metaverse. The metaverse's applications are just as varied as the metaverse itself. Virtual reality technologies from companies like Oculus are used in the most comprehensive metaverse applications. In order to build a metaverse, we need highly competent programmers. However, you don't need to know how to code in order to utilise it. Even with a fundamental grasp of how computers function, you may put them to good use in your everyday life. The development of commercially viable metaverse technology is in its infancy. As time passes, its beauty will only grow. The "metaverse" is becoming more mainstream. Future demand for cyber real estate is anticipated to increase. This technology can only be used when linked to the worldwide web. Since 4G lacks the necessary bandwidth, you'll need a high-speed Wi-Fi or cable connection to enter the Metaverse. We need a fast internet connection so that we can download the majority of the experience to our local machine. Like any other IT service provider platform, Metaverse has security vulnerabilities. It is important to create a metaverse-specific security plan in addition to the present protections in place. In order to protect the avatars in the metaverse as persons, it is vital to discuss how the various nations' personal data processing rules should be managed, given that the data of metaverse users is held on servers all over the globe. There will be fewer takers for privacy approaches that disrupt the continuity of the metaverse among those who value privacy. Therefore, in the next years, much attention will be paid to the point where algorithms

and user experience meet. The journey has just begun. While it is important to build user-protection systems, it is crucial that the expansion of the metaverse sector not be hampered by onerous regulation.

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