A Review on Meta-Health – Metaverse challenges and role of XAI to improve the Healthcare 5.0

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Abstract: The scientific field, the educational system, and the medical field are all interested in the metaverse because it is now a reality.[2] The purpose of the current study was to review the available literature to find any studies that linked the metaverse to prevention and treatment, education and training, and research settings. XAI is explored as a tool that AI-based systems can utilize to analyze and diagnose health data and is described along with the difficulties in attaining accountability. Narratively, it has been discussed how this virtual environment relates to clinical conditions' prevention and treatment, teaching and training, and research. In a conclusion, the metaverse might be thought of as a helpful tool for getting information to the general public swiftly and simply. Due to its significance, various studies and investments are needed today to create appropriate health promotion programs that are viable and effective in the metaverse.

Keywords: *Meta-health, Metaverse, healthcare 5.0, virtual reality, extended reality (XR), Metaverse, consolidative review, Explained AI*

1 Introduction

The science fiction book Snow Crash describes an immersive and alternate virtual world in which the internet-connected cosmos becomes a reality. Neal Stephenson coined the term "metaverse" in 1992. The metaverse is a 3-dimensional (3D) online virtual environment where users interact with one another using avatars that are either fictitious or "real" versions of themselves.[2] In other words, a virtual world became the real world for an alternate reality in which avatars or digital profiles engage in social interactions and virtual cultural events while also leading economic lives that have an impact on various professions such as healthcare, education, transportation, gaming, and others.

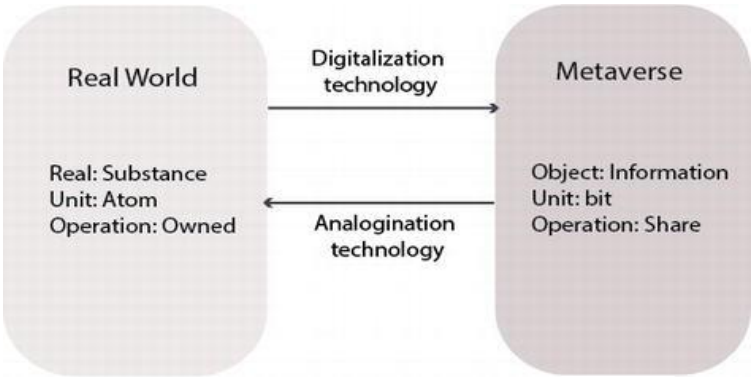

Figure 1: Relation between the real world and the Metaverse.[3]

1.1 Introduction of XAI

An effective, convenient, and personalized healthcare system is made possible using technologies like artificial intelligence (AI), the internet of things (IoT), and cloud computing (AI). [4] With the aid of wearable technology or smartphone healthcare apps, real-time health monitoring is made possible, empowering people to take charge of their own health. In addition to being shared with doctors for further diagnosis, user-level health data can also be used in conjunction with AI for illness screening, early disease diagnosis, and treatment plan selection. A lack of trust in the black-box operation of AI systems in the healthcare sector and the ethical conundrum of openness surrounding AI have led to a desire for AI models that can be explained. Explainable AI (XAI) methods are the AI techniques used to explain AI models and their predictions.[5]

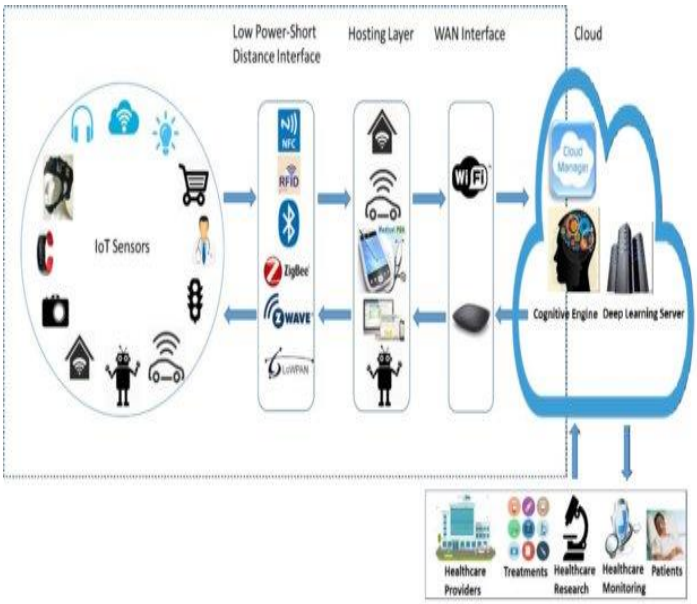

Figure-2: Smart healthcare monitory system

1.2 Metaverse with AI

From the 1990s till the present, the Internet has grown significantly, and numerous cutting-edge technologies have been developed to give people spectacular experiences and more virtual interactions online. Many virtual environments have been created with immersive experiences and digital transformation, containing thousands of services and apps, ranging from social networks to virtual game worlds, but the bulk is still unintegrated platforms that lack coherence. a shared virtual environment supported by a variety of cutting-edge technology, including virtual reality, artificial intelligence, and fifth-generation networks, has been described in this context as the metaverse. The term metaverse is created by combining the words "meta" and "universe" (AI).[6] Among these technologies, AI has demonstrated the critical role that big data processing plays in enhancing the immersive experience and enabling virtual agents to have human-like intelligence. We make an effort to investigate how AI contributed to the creation and growth of the metaverse in this survey. An introduction to artificial intelligence (AI), covering deep learning architectures and machine learning techniques, is given first. Then, we give a thorough review of AI-based methods related to six technical fields with metaverse potential: digital twins, blockchain, machine vision, natural language processing, and neural interface. As a result, research is being done on a number of AI-aided applications for usage in the virtual worlds, such as those in manufacturing, healthcare, smart cities, and gaming. We highlight this survey's key contribution and suggest some potential future study areas in AI for the metaverse.[7].

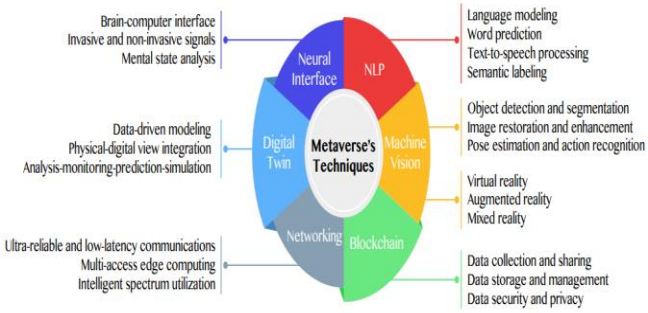

Figure 3: Key logical aspects that represent AI with machine learning algorithms are evolving the user experience in the metaverse.[8]

1.3 Metaverse and XAI in healthcare 5.0

By examining more than 34 thousand pertinent papers published over a 22-year period in the Web of Science database, we conduct a bibliometric analysis to analyze the evolution of the Metaverse in the medical and health fields.[9] We define the conceptual definition, research framework, application, difficulties, and future research directions of the health metaverse based on our findings. Based on the Metaverse, which has knowledge, socializing, digitalization, and intelligence viewpoints, we think that Health Metaverse should be a highly secure, efficient, and skilled medical and healthcare ecosystem. Health Metaverse will be useful to a variety of medical and health business stakeholders, including physicians, patients, regular citizens, and government decision-makers. The application for the health Metaverse can support cutting-edge medical research, operations, therapies, and online health management. The health Metaverse is not without its issues and difficulties, though, including the inability to preserve patient privacy, data security, the gamification of services, the effect on users' mental health, the monopoly of tech giants, and the dependability of medical AI. Regulatory oversight and technological innovation are necessary. In the sphere of medicine and healthcare, the suggested idea and framework for the "Health Metaverse" redefine the use of conventional medical informatics while fostering changes in social governance and public opinion.

2 LITRERATURE REVIEW:

Explainable AI has recently received more interest from both the scientific community and the business community worldwide.[10] The "Explainable AI (XAI) programmed," sponsored by DARPA in April 2017, aimed to make AI decisions more comprehensible. To advance highly explicable AI and the robust extensibility

of AI, the Chinese government published "The Development Plan for New Generation of Artificial Intelligence" in July 2017.

The "General Data Protection Regulation" (GDPR), which the European Union implemented in May 2018, gives its citizens a "right to explanation" if algorithmic decision-making has an impact on them. Explainable AI will become more and more crucial to all stakeholder groups, including users, those who will be impacted, and those who create AI systems. Users of the AI system value AI which is easy to comprehend. The decision-makers would be required to comprehend the underlying cause when the AI proposes a decision.

Before accepting auto-generated diagnosis reports, a doctor, for example, has to understand which problematic input data elements were used to direct the algorithm. Before implementing the repair suggestions, a maintenance engineer must comprehend which aberrant phenomena the inference algorithm captured. Before deciding on the final investment option, a financial investor must be aware of which impacting factors the system algorithm regards to being the most crucial. We need to make sure the AI inference works as expected because making the wrong choice might be costly and dangerous. Caruana et al. cited the well-known case of "Pneumonia - Asthma" to support their conclusion. An artificial intelligence (AI) system that was trained to predict a person's likelihood of contracting pneumonia reached wholly erroneous conclusions. Actual data has taught the model that asthmatic patients with heart conditions have a far lower risk of dying from pneumonia than healthy people. Asthma is a problem that adversely impacts healing; thus, this can't be the case.

3 RESULTS AND CHALLENGES:

A consolidative review is a specific review method that includes both empirical and theoretical literature. Therefore, it can provide a more comprehensive understanding of a specific phenomenon or healthcare problem and it allows for the inclusion of qualitative and quantitative methodology.[11] The analysis of this review included the following steps: (1) identification of the problem, (2) systematic research of the literature, (3) comprehensive evaluation of the data with XAI, (4) data analysis, and (5) challenges.

Challenge 1

The metaverse has the ability to substantially transform the state of healthcare technology in 2022, much as telemedicine and mobile device integration preceding it. The metaverse has incredible promise since it combines augmented reality (AR) and virtual reality (VR) technology to function in virtual environments. [12] There is overwhelming proof that the metaverse will fundamentally alter healthcare, leading to advancements in medicinal use, surgical accuracy, social distance accommodations, and more.

Challenge 2

The present healthcare system as we know it may change as a result of these improvements, though.[13] In order to balance startup costs and data security/privacy concerns, healthcare stakeholders must be aware of the paradigm shift that the metaverse represents. This includes facilitating seamless integration throughout the current medical infrastructure. The use of the Metaverse in healthcare faces several challenges.

Challenge 3

Surgeons today use augmented reality, virtual reality, and artificial intelligence technology in prestigious hospitals and academic institutions. Even though these tools offer a 3D view of the patient's body and aid in the planning and execution of treatments, they have a number of drawbacks, including the creation of realistic surgical objects within a computer-generated space, provision of pocket-sized soaking with a low resolution, and confinement to particular healthcare situations. By enabling genuine interaction between medical professionals, patients, and objects, the metaverse can overcome these obstacles. Other advantages of Metaverse include the whole abolition of physical and paper-based patient records, analysis of patients' clinical data, and individualized health data monitoring.

Challenge 4:

The scenarios in science fiction films may no longer be fanciful when interactive Metaverse technology is developed and the brain's consciousness can be changed, saved, and replicated like computer data. The importance of ethics at this moment increases significantly. The original code of ethics has been impacted, and the new code of ethics is being developed at a slow pace that cannot keep up with the growth of the Metaverse. As a result, the Metaverse's oversight should be improved, and pertinent rules and regulations should be created and promptly updated.

Challenge 5

Firstly, Metaverse applications in immersive 2D or 3D domains pose cybersecurity concerns from phishing and client data disclosure, just like any other digital application. The complexity of endpoints and the potential for incoming gateways for hacking, data analysis, and monitoring by hostile entities rise as a result of applications that need the implementation of additional brand-new networked gear in the clinical

setting. Measures to reduce these dangers have, however, evolved with the creation of hospital and healthcare organization cybersecurity standards. One possible countermeasure is network slicing using ring-fencing of network hardware devices.[14] Using anonymous IDs to tag patients' accounts in hardware devices or establishing rigorous guidelines for communication between network slices that prohibit clinical information can help lower concerns.

Challenge 6

One of the main possible obstacles to the acceptance of a particular solution is ignorance of any new technologies. 96 This might have a variety of various effects on a particular solution, such as a confusing user-friendly interface which might lead to mistakes or misinterpretations of a device's output. 97 Concerns regarding privacy and false perceptions of corporate overreach with regard to the commercialization of behavioral or health data are other potential issues.

Challenge 7

The next section discusses financing sources and their potential influence on the manuscript's creation and choice to be published. Instances of involvement in the research include patient recruiting, trial design, data collecting, analysis, or interpretation. Also, let us know if a pharmaceutical firm or other organization paid you to produce this post. The data here must correspond to the funding source statement in the publication.

Challenge 8

frequently target the healthcare sector with cyber threats in order to take advantage of them and modify the data. Additionally, as the number of patients increases, so does the amount of patient data.[15] The early findings of metaverse applications are encouraging, but the full impact of metaverse has not yet been fully realized.

4 CONCLUSIONS:

Physical and eye contact, facial emotions, and gestures are crucial components in the healthcare industry, and the metaverse cannot replace the actual world.[16] The metaverse, however, can be seen as a tool to enhance the standard of the health care system in the areas of diagnosis and treatment, the enlightenment of people worldwide, ensuring consistent training, and assisting research to develop global databases with artificial intelligence. Last but not least, given how much time young people invest in front of screens, the metaverse may be a location where they can begin to learn new skills and practice in healthcare and how much XAI impact in their life. Definitely, there are many challenges as mentioned in my work may affect their health maintenance. Moreover, many other effects and contests can be considered in the future like blockchain, neural-based brain chips, and mixed reality for further justification and enhancement of existing work and challenges

REFERENCES

1. D.Pramanik, “Cloud Security Protocols – To Be Adopted for Safe Cloud Usage”, Journal 2021.
2. Nadia Tabassum, Saleem Khan Khan, Sagheer Abbas, Tahir Alyas, Atifa Athar, Muhammad Adnan Khan, "Intelligent reliability management in hyper-convergence cloud infrastructure using fuzzy inference system."; published by European Alliance for Innovation (2019).
3. S.Abbas, T. Alyas, "Data Breaches Security Issues for Cloud Based Internet of Things”; Journal: International Journal for Electronic Crime Investigation (2018/3/8).
4. W.A Khan, S. Abbas, M.A Khan, W. M Qazi, M.S Khan, "Intelligent task planner for cloud robotics using level of attention empowered with fuzzy system."; published by Springer International Publishing (2020/4).
5. S. Abbas, T. Alyas, A. Athar, M.A Khan, A. Fatima, W.A Khan, "Cloud Services Ranking by measuring Multiple Parameters using AFIS."; published by European Alliance for Innovation (2019).
6. A. Saeed, M. Yousif, A. Fatima, S. Abbas, M.A Khan, L. Anum, A. Akram, "An Optimal Utilization of Cloud Resources using Adaptive Back Propagation Neural Network and Multi-Level Priority Queue Scheduling."; published by Iranian Society of Cryptology (2019/1/1).
7. S.S RIZVI, M.A Ullah, S. Abbas, S. Naseem, "Enhancing Cloud Security Using VKC as a Service."; Journal: International Journal of Computer Science and Network Security (2017/6/30)
8. J. Sen, “Security and Privacy Issues in Cloud Computing”, Book, “Cloud Technology: Concepts, Methodologies, Tools, and Applications”, page:40 (2015).
9. P. Purnaye & V.Kulkarni, “A Comprehensive Study of Cloud Forensics”, / Published online: 29 March 2021 CIMNE, Barcelona, Spain (2021).
10. A.V Bataev, D.G Rodionov, D.A Andreyeva, “Analysis of World Trends in The Field Of Cloud Technology”, IEEE International Conference on Information Networking (ICOIN) - Chiang Mai, Thailand, (2018).
11. M. Alruwaythi, K.E. Nygard, “fuzzy logic approach

based on user behavior trust in cloud computing", Publisher: IEEE, (2019).
12. J. Tang, Y. Cui, "Ensuring Security and privacy Preservation for Cloud Data Services", ACM Computing Survey. 49: 1-39, (2016).
13. M. Jansen, J. Schwenk, N. Gruschka and L.L. Lacono, "On Technical Security Issues in Cloud Computing", publisher: IEEE, (2009).
14. A. Gupta, A. Qureshi, P. Pande," Cloud Computing Characteristics and Service Models: our own interpretation".
15. D. Gozman, &L. Willcocks, "The emerging Cloud Dilemma: Balancing innovation with cross-border privacy and outsourcing regulations.", Journal of Business Research (2019).
16. K. Rajkumar, V. Dhanakoti, "Fuzzy-Dedup: A secure deduplication model using cosine based Fuzzy interference system in cloud application", Journal of Intelligent & Fuzzy Systems, vol. Pre-press, no. Pre-press, pp. 1-14, 2022 (2022).