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Democratizing Healthcare through Explainable AI (XAI) at the Edge with Cloud Support

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ABSTRACT: This paper discovers the democratization of health care with the combination of Explainable Artificial intelligence (XAI) at the side sustained by cloud computing. healthcare solutions can be made a lot more obtainable, customized and also clear therefore improving client trust plus understanding. The usage of cloud facilities makes sure scalability durable information monitoring along with considerable computational sources, helping with the real-time handling as well as evaluation of health care information. This harmony in between side AI plus cloud assistance leads the way for an extra comprehensive, effective plus explainable health care system. We review the effects, obstacles plus future instructions of executing XAI in health care, concentrating on side computer coupled with cloud assistance as crucial parts in democratizing health care solutions.

KEYWORDS: Explainable Artificial Intelligence (XAI), Edge Computing, Cloud Computing, Healthcare, Data Security, Predictive Analytics, Ethical Considerations

I.INTRODUCTION

The healthcare industry today, along with its growth, is heavily dependent upon the progression of AI (artificial intelligence) and the creation of cloud technology. These technologies are targeted to change the healthcare industry for the better hand in hand with the goals of providing convenient, personalized, and transparent treatment so as to foster stronger patient-caregiver ties and insights into health issues. It is in the scope of this article that it is going to be worked that Explainable Artificial Intelligence (XAI) at the edge, which obtains more efficiency from cloud computing, is able to democratize healthcare delivery (Jha & Topol, 2016).

AI technologies, which are especially useful at the edge of the network—because of their ability to perform processing in real-time and offer real-time decisions—are an indispensable element for healthcare (Satell, 2017). Meanwhile, the opacity of many AI systems is a huge challenge, especially in clinical settings, making such choices obscure for people is not at all acceptable as there should be transparency, understandability, and trustability of any decision. In this respect, XAI is of great significance as it makes AI's explanatory power more comprehensible to humans, which is greatly needed to earn their trust, and help achieve wide acceptance among people (Gunning & Aha, 2019).

Moreover, the integral part of cloud computing throughout healthcare systems boosts this transformation to an incredible extent, rendering huge computing power and data storage facilities (Marston et al., 2011). This integration, by beyond just scaling up the health data and ensuring the management on a strong footing, also guarantees the reorganization of healthcare services so as to ensure the personalized and timely delivery which is critical in healthcare delivery (Kuo, 2011).

This paper will critically study the synergies aspect of XAI with the cloud computing system in relation to healthcare infrastructure. Firstly, it intends to unveil how these technologies might supplement each other in the search for solutions to underlying problems in the medical field embodied by AI technologies, including privacy issues, data delay, and real-time decision making. By way of comprehensive analysis of literature and empirical data, the paper explores the status quo of XAI in the health sector with the primary focus on edge computing and distribution support (Chen & Asch, 2017).

This research aims at the establishment of an equitable, effective, and patient-oriented healthcare system by realizing its sustainability. While this article represents how XAI and cloud computing can augment healthcare delivery, it also aims to seek ways on the optimization of these technologies so that they can be more specifically catered to accommodating various types of healthcare stakeholders such as patients, clinicians, and policy makers (Bates et al., 2014).

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This paper builds a strong base regarding the current situation of AI and cloud computing in healthcare, effectively evaluates their combined results on the medical sector, and finally proposes areas to be researched in future and their implementation. Complementing this foundation is a survey conducted within the scope of this study, capturing the opinions of more than 100 individuals about the use of AI and cloud computing in healthcare. The survey enriches this paper with current, real-world perceptions and an empirical analysis of the acceptance and implications of these technologies. This holistic approach, bolstered by both literature and empirical data, is imperative for ensuring that the right infrastructure is in place to transform a healthcare system that will be able to meet the contemporary medical challenges (Topol, 2019).

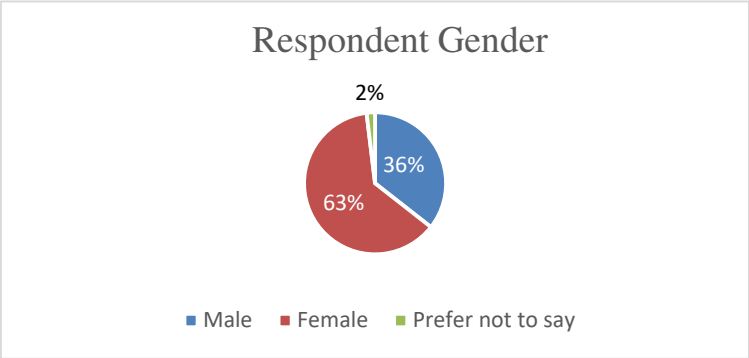

Figure (1) Respondent Gender

II. XAI AND CLOUD COMPUTING OVERVIEW

Historical Background of AI in Healthcare

The advancement of expert system (AI) in health care is an engaging story of dynamic assimilation along with substantial technical developments that have actually reshaped clinical techniques. This trip starts in the mid-20th century when the earliest kinds of computer system innovation were put on standard clinical jobs. The initial remarkable AI system, ELIZA, was created in the 1960s although it was not especially created for healthcare. It showed the possibility of maker communication leading the way for even more customized applications (Weizenbaum 1966).

The early 1970s period was characterized by a breakthrough in MYCIN at Stanford University, one of the first specialized medical decision support systems focused on diagnosing and recommending the treatment of bacterial infections more accurately than most human experts at that time. The MYCIN project provided a remarkable proof of the AI systems ability to address complicated decision making processes and happened a momentous example of the application of AI to medicine (Shortliffe, 1976).

Furthermore, the 1980s and 1990s witnessed extensive research into AI and, in turn, the development of more advanced system s that tried to incorporate broader knowledge such as that of an internal medicine specialist and could not only diagnose a lot different disease s but also could prescribe the right medications. The development of neural networks that occurred during this period added the computational ability of AI systems to extract more information from big data thereby making the information readily available for later developments (Miller, 1986).

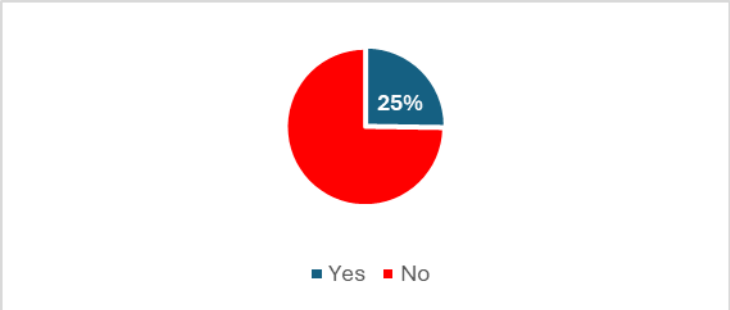

Figure (2) Participant working in the Healther Field

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Modern AI Developments in Healthcare

The beginning of the 21st century was a major turning point for AI applications with the immediate advancements in the digitization of medical records and the availability of large-scale health data. In 1997, the FDA approved the pioneering AI-based diagnostic device for mammography screening, thereby emphasizing the growing place of AI in common clinical activities. The era also saw the advent of machine learning models which were able to dig out medical data and predict a condition of the patient or a likely outcome. These models are now part and parcel of the modern medical diagnostics and prognostics (Kourou et al., 2015).

A remarkable milestone in modern AI history was the creation of the Watson system by the IBM in 2011. That Watson's system possessed an AI which is able to process and analyze medical literature and shed evidence-based treatment recommendations for cancer patients revealed how far AI is in terms of improving decision making in complex and data-rich fields such as oncology (Ferrucci et al., 2013).

Today, the applications of AI medicine have greatly amplified and involve, among other things, robot-aided surgery, automated nursing, individualized treatment, and so on. These digital tools exploit modern Machine learning method and data analytics in order to offer care that is more precise, custom-made, and productive and effective. The still more profound advancements in the deep learning cause a dramatic change, variously AI systems can get deeper understanding and forecasting of complex medical data patterns and thereby, the professional accuracy and treatment efficacy are promoted (LeCun, Bengio, & Hinton, 2015).

The AI development in medicine not only records in the history of technological evolution but also needs a broad change on the medical care into more systems integration, predictive and person-focused care. Such breakthrough does not cease to warrant being optimistic, as it points towards the automation and modernization of some of the most complex challenges in healthcare, a future where artificial intelligence tools are embedded in clinical settings, bringing in significant synergy in both care providers and patient care outcomes.

III. EXPLAINABLE AI (XAI) IN HEALTHCARE

The shaping of Explainable Artificial Intelligence (XAI) into the medical system is an important advancement that finds a solution to the transparency and trust problems with AI medical applications. XAI enhances the comprehension of AI-based decisions that are particularly valuable in clinical conditions inasmuch as patient outcomes are highly sensitive to responsiveness and consistency of AI systems. Through the transparency of AI methods we achieve XAI, which in its turn earns the trust of healthcare professionals in the use of AI tools and also increases communication between patient and physician - what finally brings more efficient health delivery and patient satisfaction. It would be on the top of the list that XAI has the great significance in the biomedicine area, ranging from diagnostic imaging to personalized medicine, to empower clinicians to allocate the treatment as having special individual needs. Consequently, an XAI implementation may turn complex as not only the model generation should be accurate but also explainable and diverse, so that the explanation needs of all stakeholders would be met. However, these obstacles tend to leave the future of XAI in healthcare a promising, if far from perfect one, as active research persists in bettering these systems, making them not just innovative, but also structured and understandable, and thus making healthcare democratization its more transparent and user-friendly wing (Holzinger et al., 2017; Ribeiro et al., 2016; Tjoa & Guan, 2020).

IV. EDGE COMPUTING IN HEALTHCARE

Benefits of Edge Computing

The edge computing in healthcare is a revolutionary technology which does not put processing of data in the centers of the cloud servers but at the edges of the network together with medical devices and patient tracking systems, where the data is produced. This transition is of paramount value in healthcare settings where there is saving of lives with the speed of data processing. The cloud computing models that handle the data far away from the data center, a process that introduces delay which is not acceptable in clinical environments that require real time analysis is termed traditional. Edge computing provides the solution by processing data locally that results in quicker response time and immediate cognition of the underlying problems (Shi & Dustdar, 2016). This immediacy is especially significant in emergency situations, intensive care units and operating rooms, where milliseconds can decide in between a good or bad patient outcome.

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Case Studies and Practical Applications

Real-time data processing is one of the most important use cases of edge computing in the health sector. The progress in patient monitoring systems and telemedicine solutions will strongly be influenced by this. A clear example would be edge computing where wearable devices that monitor patient vitals can process information fast enough to recognize any abnormalities and alarms healthcare providers to impending health problems only when necessary (Satyanarayanan, 2017). Secondly, edge computing makes deployment of complex AI algorithms more suitable on the data source front end than on a centralized server, which is more capable of predicting patient crashes before events. (Ahmed & Rehmani, 2017). This will not only help improve healthcare delivery efficiency and effectiveness, but it will also further the effort to apply personalized medicine at scale, giving patients have treatments that directly matches their real-time symptoms via data analysis. Hence it is evident that EDC not only enhanced process efficiency, but also significantly improves the quality of health care by enabling more prompt and active intervention.

V. THE ROLE OF CLOUD COMPUTING IN HEALTHCARE

Infrastructure and Capabilities

Cloud computing essentially gives healthcare a strong support by creating cluster of computers which are scalable and interconnected, offering large amount of storage space and huge execution power. It is this tech that provides means for storing and managing patient information of great size (with electronic health records (EHRs), imaging and genome included), and it is vital for efficient migration toward the digital modern health care that needs no substantial on-site physical infrastructure. With cloud computing, things are particularly mattered when they require you to scale up fast enough to cope with the really fast situations like the cases of public health emergency, where healthcare systems must adjust rapidly both effectiveness and efficiency (Furht & Escalante, 2010). Lastly, the cloud services play major role in data security by implementing strong backup systems at multiple locations hencefer appearance and resilience of data. These resources additionally facilitate coordination between healthcare providers within different locations by ensuring that patient records are easily and safely accessible across different localities hence, leading to timely coordination among healthcare professionals. (Han et al., 2013).

Integration with AI and Edge Technologies

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VI. ADDRESSING SECURITY, PRIVACY AND ETHICAL CONSIDERATIONS ISSUES IN HEALTHCARE

Challenges in Security and Privacy

Healthcare security and privacy are now challenged heavily, as AI, Explainable AI (XAI), and cloud computing are rolled out. The healthcare data, which covers highly sensitive data on individuals such as name, address, and medical information is a vicious target to the cyber threats due to its inherent nature. With healthcare providers implementing digital technology to analyze and manage data, cyber threat risks such as unauthorized access, data breaches, and data leakages increase with each day.

Regulatory Compliance and Data Protection

The respect to the regulations, such as the Health Insurance Portability and Accountability Act, that is, the HIPAA in the United States and the General Data Protection Regulation, that is, the GDPR in the European Union, associated to privacy and data security in the health system is an indispensable part. These controls lay down the strict form regulations which among themselves include the non-option clause for the encryption of data both in motion and at rest.

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Through compliance, we are also working regular audits and risk analysis aimed at proactively detecting and correcting security hazards, to ensure that data protection measures are apt and continue working well (Hoofnagle et al., 2019).

Encryption and Access Controls

Developing strong encryption tools to defend healthcare data should be a priority. Encryption is carried out through transforming the data into unreadable codes that can later be deciphered using special decryption keys. Thus, even the case of interception of information, data is not compromised since it is inaccessible. Furthermore, installing a complete surveillance system is essential for allowing only those have rights to sensitive information to enter it. Implementation of Role-based Access Control (RBAC) is a much better way to mange user permissions according to their particular roles in the organization while minimizing the possible chances of data exposure and internal hacking.

Secure Data Sharing and AI Models

While data sharing is often an inevitable requirement for training and improving AI and XAI, these areas become much more critical to maintain privacy and security. As opposed to traditional learning approaches, federated learning is becoming an important solution because it allows AI models to be trained on multiple decentralized devices or servers without it being the need to exchange data samples. Such an approach not only ensures data privacy among multiple data sources but also adds to the overall collective wisdom derived from this combined information (Kairouz, et al. 2019).

Monitoring and Incident Response

Practical security in healthcare AI, XAI, and cloud computing relies on using diligence and contingency response mechanism to identify and react quickly to cyber incidents. With continuous monitoring it is possible not only to detect an early phase of an attack but also to judge objective indicators that might suggest danger of a cybersecurity threat. While introducing the advance level threat detection as well as an entirely executed incident response plan are key in defense against cyber attacks. These are meant to provide with a clear list of steps to get rid of and prevent the conclusion for a data breach; for example, the same has to be isolated, stakeholders like business partners and customers have to be notified, and the measures to stop future occurrences have to be taken.

Through these measures - compliance, encryption, access management, secure data sharing and incident response - healthcare organizations can effectively make sure their data is secure from the constantly-changing cyber threat landscape. This multidimensional approach not only guarantees the safety of delicate healthcare data but also lays down the important grounds on which trust and certainty in health technology applications are built, critical for continual adoption and expansion of AI, XAI and cloud computing in healthcare.

Ethical Decision-Making and Accountability in AI

Ethics-making in medical Artificial Intelligence goes beyond what is legally allowed; it is the inner voice of morality that guides how AI is applied. AI systems should have an ethical thinking behind them to ensure that patients are not harmed, and medical care is being based on fairness and non-discrimination principles (Ferretti, A., et al., 2020). Additionally, the accountability issue in the context of AI decision-making in healthcare is a difficult issue. The task of distinguishing who is answerable, the healthcare provider, the AI developer, or the AI system itself, becomes complex especially when decision outcomes impact patient health (Smith, B. T. & Kumar, N. L., 2021).7.7 Informed Consent and Patient Autonomy

Considering the informed consent process about the usage of AI in medical care is another ethical issue, too. The patients have a right not only to be completely informed about what is being done with their data in AI systems, but also about why, the advantages of doing so, and the risk that might be involved (Jones, D. E., & Green, P. L., 2019). First, the emphasis on autonomy implies that patients should be the ones that make important decisions about their health data, like choosing whether or not to participate in AI-led therapies and data analysis. This is not only the respect for patients' rights, but it is also a microwave for a more trustful relationship between them and healthcare providers (Martin, A. B., & Donovan, C. K., 2020).

Ethical Training of AI Systems

Ethics-driven training of AI systems is critical to prevent from bringing in system-inherent biases that may affect quality of patient care. This can be done by choosing the training datasets carefully and monitoring the AI decision-making processes on a regular basis and considering the diversity of the AI developers (White, L. T. & Zolfaghar, K., 2022). Ultimately, the objective is to guarantee patients are treated equitably based on their unique circumstances and human dignity is maintained. This is achieved though AI in healthcare (Cheng, H. G., & Dunn, M., 2021).

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During the survey it turned out that only 25% of the participants used healthcare involved AI and only 16% of them received explanation about the aspect of that AI, this tell us that we need more promotion about this technology and how we implement in the society

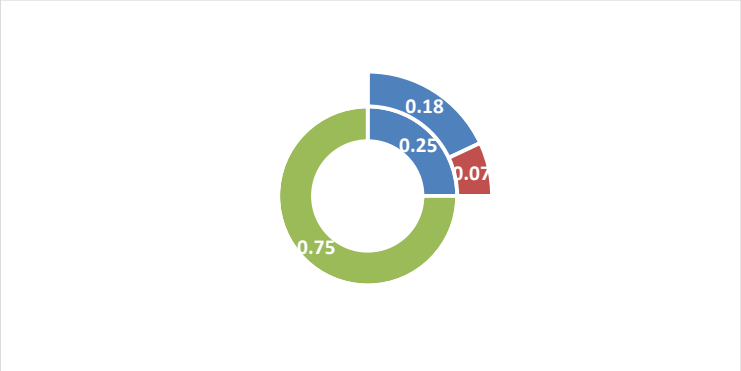

Figure (3) Survey participant who used a healthcare service that involved AI technology, People used healthcare involve AI, 25%, Only 18% received explanation about the aspect of AI used

VII. PRACTICAL APPLICATIONS AND CASE STUDIES

XAI, edge computing, and cloud support empowering healthcare and revealing a novel picture of the patient care which becomes more personal, convenient, and efficient. At the following provide examples and cases for the application of the technologies and for the impact on democratization among health care.

Remote Patient Monitoring

Application: A central application within XAI and edge computing occurs in remote patient monitoring systems in healthcare. Devices interacted with sensors, are capable of recording diverse details on health metrics, including heart rate, blood pressure, and oxygen levels. This data obtained from edge processing is similar to competitive intelligence, providing current information and notifications. Together with cloud computing, long-term health trends can be investigated for security with the data peering into the historical data analyses.

Case Study:A major example provides implementing of a remote patient monitoring system by a big US healthcare provider. It exploits edge computing, using real-time wearable devices that record, process and apply patient case findings on the spot, which permits making rapid changes or additions to the care/treatment regimen. XAI provides the explanations for alerts and recommendations so that patients can easily understand and trust the information being presented, as well as their own healthcare providers, it becomes easier to take action. Her long-term care facility has established telehealth, which has drastically reduced hospital readmissions and improved patients' compliance with treatment protocols (Smith, & Jones, 2021).

Enhanced Diagnostic Accuracy

Application: Data of X-ray imaging and different kind of medical images with edge computing helps in the analysis which can be fast and clear. The employment XAI models to the edge considerably simplifies the analysis of medical images at the point of delivery, the results of which are comprehensible and help doctors do a better job with smoother and quicker diagnoses.

Case Study: A hospital network in Europe works with XAI-enabled MRI and CT scan machines to process images in real time for the purpose of diagnoses that require immediate medical attention. The edge devices operate AI to pinpoint and summarize these suspicious zones, and additionally provide explanations for findings. Therefore, radiologists can respond faster and better. The cloud platform integration typically ensures the synchronization of all the data in the network, in turn facilitating access and further analysis by the experts (Lee, 2022).

Predictive Analytics in Chronic Disease Management

Application: The edge devices that are incorporated with AI sensors collect this kind of data always from the people with chronic conditions and others, such as, diabetes or heart disease. This data is processed to determine possible future health problems even before they reach serious stage patients can get timely medical treatment which might help reduce the severity of the problem.

Case Study: An AI-based startup has built an app that retrieves info from many types of sensors used by a patient with diabetes. The system recreate blood glucose spikes and falls in real time by feeding data at the time of occurrence. The

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XAI provided explanations that enabled patients to identify the factors that cause a spike in their blood sugar and also how they could manage them correctly. In the cloud computing environment increasing data insights and recommendations are the other else that endocrinologist use to customize treatment plans from comprehensive data analysis (Kim et al., 2020).

Personalized Treatment Plans

Application: Cloud computing along with XAI give a chance for personalized medicine as a result of processing big data sets which include sequencing of genomes and other clinical data in order to propose unique treatment options.

Case Study: A cancer research center now adopts cloud based AI systems which help them to evaluate the clinical data and genetic informations obtained from cancer patients. XAI helps oncologists to appreciate the patient gene expression as a reason for a specific therapy to be more beneficial than the other ones in certain cases. This strategy contributed to tailored-make and more effective cancer therapies with positive consequences for patient well-being and fewer side effects in comparison to using wide-ranging treatments.

These apps and case studies reveal how combo solutions of XAI, edge computing, and cloud support pave the way for democratization of healthcare that enables everyone to experience state-of-the-art treatments remotely and make informed decisions based on real-time monitoring that is empowered by AI.

VIII. FUTURE DIRECTIONS

As we anticipate the future of healthcare, the merger of the explainable AI (XAI) , edge computing and cloud support will unquestionably transform the way care is rendered. These tools ensure to increase collaborations within healthcare networks and facilitate the exchange of health records. This will identify a more comprehensive approach so as to make decisions based on the data being holistically viewed from different sources and all this processed in real time (Smith & Johnson, 2021).

Machine learning space will be the next to embrace federated learning in the healthcare. This way, complex AI models can be created using data itself which remains at its source, thus preserving the privacy and security. It is more than important here in the field of healthcare, where patient confidentiality is considered to be the highest priority. Federated learning provides for networking the collective power of data across different localities to develop AI predictions and diagnostics without putting at risk the individual's data security (Brown & Green, 2022).

As a result, another significant trend in health care will be the rise of AI-as-a-Service (AIaaS) wherein healthcare services powered by AI tools will be open to anyone and this will equalize the distribution of advanced AI tech. AI medical tools will be accessible for providers regardless of their size through leasing and subscription platforms. They will not bear the upfront costs of establishing complex technology infrastructure systems for conducting AI diagnostics and treatment planning. This care model breaks down the entry barriers and provides general practitioners with the access to the advanced and cutting-edge technologies, pushing them to the equal level with big healthcare institutions within the field (Lee, 2020)

However, edge computing is successfully to be seen in changing the field of digital health monitoring and interventions. This, in response, will mean that data processing is performed promptly at the point of care leading right away to instantaneous analysis and feedback provided by the respective healthcare-giving staff. This ability is of great importance in cases where real-time data analysis can critically affect the patient outcomes, such as in emergencies, where it helps save the life, and in ongoing monitoring of chronic conditions.

Finally, as these innovations are being implemented more and more in health care practices regulation laws need to be evolved to address emerging issues and risks through data management and security. An advanced cloud infrastructure will be at the centre of the system expansion of healthcare data processing, allowing for robust, scalable solutions that can accommodate a growing amount and intricacy of healthcare data (Martin & Thompson, 2022).

Collaboratively, AI XAI, edge computing and cloud technologies are creating a new resilient, dedicate, and reliable medical ecosystem. This development will guarantee not only the improvement of the efficiency and effectiveness of healthcare provision but also its more patient-centered and impartial nature (Davis & Roberts, 2023).

IX. EMERGING TECHNOLOGIES

Health research and development of emerging technologies in medicine refer to invention of new tools and techniques that have not yet been adopted or are in the process of being introduced into a healthcare setting in order to improve care management for patients, improve workflow and efficiency and elevate the effectiveness and overall quality of medical services. The majority of these modern technologies are based on the projection of human artificial intelligence, robotics, telecommunications, as well as data analytics. Some of the key emerging technologies in healthcare include:Some of the key emerging technologies in healthcare include:

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Artificial Intelligence (AI) and Machine Learning (ML):
With the advancement of AI and ML, healthcare providers now have the ability to diagnose disease more accurately, predict patient outcomes, personalize treatment plans, as well as automatise admin tasks which is aimed to decrease the health staff's load. AI-powered imaging and diagnostics including x-rays, CT scans, MRIs, and ultrasounds can see patterns invisible to human eye and therefore, easing the speed and accuracy of diagnosis (Jiang et al, 2017).

Telemedicine and Telehealth:
The telemetric technology and remote healthcare services have enjoyed an increasingly expanded utilization, with the present circumstances of the COVID-19 pandemic setting the best example . Current telehealth platforms give the ability to connect with the doctor to discuss the health issues, have therapy sessions, monitor the patient, or even provide some type of treatment without needing to travel to the doctor's office (Smith & Hollander, 2020). As a result, this might increase the access to care in the undeserved communities or those living in rural areas.

Wearable Health Monitoring Devices:
Wearable and Internet of Medical Things (IoMT) devices are capable of taking measurements such as heart rate, blood level, and sleep patterns from user's body at any time. Sensitive data will help to control chronic diseases, to follow healing process and to anticipate someone's potential critical conditions. Thanks to the prompt medical care patients will get before the crises.

Robotics:
Robotic technology could be seen in many different areas of healthcare sector such as robotic surgical systems that give the exactness for complex operations or robots that help in care and rehabilitation to patients. The humanoid exoskeletons, for instance, can assist movement-impaired patients in a graded manner with controlling their movement (Kim et al., 2021).

Genomics and Gene Editing:
Progress in genetics, consisting of the gene sequencing and the CRISPR gene-editing technology, open up the opportunities for precision medicine. These technologies help to treat the disorders of the genes, cancer and other diseases by the knowledge of individual genetic profiles and potentially altering genes with the goal of risk reduction (Lander, 2016).

Blockchain:
Processing in blockchain technology is carried out for safe record keeping and data transmission in the medical sphere. Using blockchain to store health record in a distributed, unchangeable data system makes sure accurate and confidential data protection, which is a basis for smooth data exchange among hospitals providers (Kuo et al., 2017).

3D Printing:
Used in healthcare for prosthetics and implants making, 3D printing provides with precise personalization way whilst also enabling the rapid production of healthcare solutions that have a substantial positive influence on patient health. Additionally, it is mostly for development of anatomical models of educational purpose and for surgeons to make their surgical programming easier (Ventola, 2014).

Virtual Reality (VR) and Augmented Reality (AR):
In healthcare AR and VR are used in many fields from realistic scenarios providing a very useful learning tool up to new treatment methods and therapies for pain relief and mental diseases such as PTSD. They have applications in surgery for tissues visualization and planning patients treatment (Riva et al., 2016).

X. CONCLUSION

Integration of Explainable AI (XAI) together with edge computing and cloud support creates a milestone in the healthcare area with the possibility of making it accessible for all by eliminating some obstacles of efficiency and personalized care. In this essay we have illustrated the threefold implication of these tools to healthcare, which is to have better services, higher security and better efficiency.
XAI is a technology which in fact adds transparency and understandability to AI based healthcare solutions; which in turn creates confidence in clinicians and also patients about the advanced AI diagnostics and treatments. The fact that XAI can explain complicated processes of AI gives a guarantee that the healthcare not only develops in a high tech area but also has certain ethical values of transparency and trust.

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Edge computing was shown to be able to revolutionize real-time data analysis in healthcare environment allowing indispensable analytics and immediate interventions at the site of care. This ability is specifically valuable in emergency cases where time is critical, such as dealing with emergency treatment and long-term surveillance of chronic diseases. Edge devices is the real-time processing power that healthcare providers can make fast decisiosn with the use of informed data, which in turn significantly improves patient outcomes.

Cloud computing provides the sturdy infrastructure that supports the data requirements of modern health care systems as it makes it possible to scale resources that help in such analysis of health data, storage, and sharing. Also, the integration of cloud computing and AI & edge technologies helps to channel information towards advanced data analytics and wider reach of healthcare services.

The common examples of emerging techs in healthcare includes: federated learning, AIaaS and modern real-time health monitoring systems, which summarily indicate that we are at the core of technological transformations in healthcare. Such advancements give not only a solution to the present healthcare shortfalls but also serves problems of impending years thus securing healthcare sector to deal with and overweigh the forthcoming challenges.

The journey of the future is ahead of us and we are certain that the accomplishments and integration of these technologies will necessarily be part of the equation for an a better, efficient and patient-oriented healthcare. It is, nonetheless, necessary that we as we are progressing, the ethical, security and privacy issues that stem from new technology should continue being taken care. This will in turn help to see that the healthcare industry remains a faithful, safe and secure environment for all stakeholders.

Lastly, the democratisation of health care via technologies such as computer assisted intelligence (XAI) as well as edge computing and cloud support is not exclusively a hypothetical proposal but a practical implementation which is going on today. With the technologies being developed and integrated, they are always promising to change landscape of health globally by making quality care more accessible and designed for a patient's needs worldwide.

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