Artificial Intelligence in Healthcare: Safeguarding Data and Enhancing Information Access through Cybersecurity

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Abstract

The use of AI in healthcare cybersecurity is rapidly growing, transforming how organizations protect patient data from emerging threats. This article highlights key considerations when integrating AI to enhance cybersecurity, focusing on risk prediction, vulnerability detection, cryptography, and compliance with essential security requirements. AI can proactively predict risks, enabling mitigation of cyber-attacks. Additionally, block chain enhances data integrity for IoT and IoMT security, while AI strengthens user authentication. These innovations offer promising solutions to future threats. However, improving AI's role in managing cybersecurity requires expanding AI-based technologies to enhance data protection and response times. Advances such as federated learning ensure patient privacy while improving data security. Despite AI's benefits, healthcare organizations must navigate ethical, legal, and technological challenges to prevent further erosion of patient trust. A balanced approach is essential to leveraging AI's potential while maintaining security and compliance in an evolving digital healthcare landscape.

Keywords: AI in healthcare, cyber security in healthcare, predictive analysis, threat detection, data security and compliance, block chain.

Introduction

Technology is widely used in contemporary healthcare setting in order to enhance patient satisfaction, operational, and research functions. But this advancement on the part of the digital platform has posed a great danger because health facilities have increasingly become the soft targets of cybercrimes. That is why, at present, the healthcare entities stay at a high risk of damaging data losses and cybersecurity threats including the ransom ware attacks because of the collection and storage of large volumes of personal identifying information from the patients. Hence, both the healthcare managers, clinicians and the IT specialists have taken cybersecurity as one of their central issues of concern [1]. Nevertheless, the availability of Artificial Intelligence (AI) is a powerful opportunity to raise the security of a healthcare system. Almost all the technologies of AI like machine learning, natural language processing and deep learning are being deployed in the health care departments in order to upsurge the security of data and efficiency of information. It is imperative for security to have

dependable technologies to detect abnormities, possible future threats, and early responses to Security violations concerning the patient data as well as system settings [2].

It is crucial and cannot be overemphasized that cybersecurity is vitally as crucial as in any other industry, and in fact, more heightened within the healthcare sector. Medical data is important – medical records, patient's information, and clinical history – this type data to hackers is pure gold. There has been a significant increase of cyber threats including ransom wires, phishing scams, denial-of service (DoS) in health care. They also give a raw deal to privacy of their customers who are patients and infringe on essential services delivered in the health facilities. For instance, ransom ware on a hospital system regularly locks patient record and hence slow thirds in important treatments [3]. Even more to it, any person can obtain an unauthorized access to such medical data and conduct identity theft or fraud, or even misuse some confidential information. Thus, the roles of medical care providers have been changing to maintain this information confidential and, simultaneously, allow the users with a proper right to access this data as soon as possible.

On the other hand AI offers the best chance to solve these problem with higher efficiency. AI based security can process immense amount of information within shortest time, hence it can provide real time monitoring as well as real time identification of any odd occurrences. Some of such systems can be used specially with machine learning approach that allows to establish what is appropriate for one particular user and then notify the info-tech personnel in case this user deviates from normal behavior which might be attributable to hacking. Also AI is useful when applying many security measures for example encryption, user's authentication and data access [4]. This means that the healthcare organizational information can be protected at the same time as the information is shared with the appropriate people at the right times. In this section, we will briefly discuss AI's role in the current context of cybersecurity in healthcare delivery organizations, the potential of AI to strengthen patient data security, and the challenges that health care organizations face when trying to implement AI-based security solutions and tools. We also included the following research questions: how AI can help in improving the important and freely accessible healthcare data, when data security should be in focus? This review has the goal of assess the current position of AI concerning cybersecurity and health information; in addition, make an initial approach about how AI can be an optional instrument to safeguard the digital health landscape [5].

Figure: 1 showing best practices for achieving data security

AI Technologies to Reconfigure the Face of HCIS Cybersecurity

In general, AI has become an increasingly recognized actor in the cybersecurity landscape across industries, and like any other industry, it has adopted the healthcare industry. Because of frequently established cyber threats and constant emergence of improved and dangerous attacks, the implementation of AI to healthcare data is highly essential. The three main specialties for COMs regarding healthcare cybersecurity and preceding both considered and real threats are: ML and NLP, DL [6].

Machine Learning and Predictive Analytics for Threat Detection: AI is composed of one part called Machine learning which have great contributions in the field of health care for detecting and dealing with cyber threats. Unlike traditional rules and model based security systems, they use a set of seed values and learn from experience in order to identify what constitutes normal and, therefore, what is not normal, new and unknown threats [7]. An example of use of big volume of healthcare data such as network traffic, user activity and system logs by machine learning model that can detected an uncommon or out of pattern activity that may indicate a cyber-attack such as intrusion or exfiltration.

For instance, by applying ML in IDS, healthcare networks can be scanned without any interruption and alert security teams about assumed threats for instance multiple login attempts and unlawful access to patient's records. These systems accumulate over time and would just as well and just as efficiently highlight finer dangers. Another process often used alongside the machine learning is the predictive analytics that helps the healthcare organizations to make some kind of prognosis and expect a cybersecurity attack [8]. As shown with previous attacks and understanding the mode of attack essential elements of the predictive models' structure can help healthcare organizations to get prepared better.

Natural Language Processing (NLP) in Identifying Security Breaches: One of the newest specialties in artificial intelligence, natural language processing addresses the dialogue of a human being with the computer in the course of language, is now actively used to resist healthcare cybersecurity threats. These include emails, clinical notes and other patient's communication; all these can be easily searched for threats using NLP. It can be easily monitored since it involves impersonation of the attacker who sends emails or messages to employees and management, which is comprehensiveness language and contexts analyzed by natural language processing systems in healthcare. Also, NLP enhances the likelihood of detecting unlawful access or data alteration from the involvement of healthcare staff in systems. Even with the knowledge of the context of a written message, NLP algorithms are also can monitor attempts on how the security protocols are being violated or how data was trying to be acquired illegitimately. This capability applies in security especially in health care where voluminous amount of textural information including health records and diagnosis notes are required to be analyzed [9].

AI-Powered Anomaly Detection Systems: Last but not least, a part of anomaly detection is always exciting in cybersecurity of healthcare as any deviation from the pattern is potentially a violation. The AI automated systems of intrusion detection are intended to know the normality across the network of healthcare IT and if these are improperly abnormal an alarm is raised. Of course, these systems monitor the traffic being exchange, the activities of the users and IT electronic accesses being performed in a round the clock manner and in a way that would trigger the system to alert if, for example, it observes attempts of accessing the patient's information without prior authorization, or recognize any changes not foreseen by the system, or if for instance there are conspiracies to go round some of these security measures among others [10]. For instance, an audit exception detection system will understand that a specific user who would typically request much less data from patients' records attempts to view much larger amounts of data falling under the HIPAA policy. In such a case an alert

will be raised and for the healthcare IT teams a good opportunity shows up for them in that they will be likely to detect and counter it before it becomes a real security issue [11].

The chosen studies identify a wide range of engineering specialties, which are robotics, control systems, fluid dynamics, vibration analysis, and environmental engineering, which are closely connected with the increasing role that AI plays in healthcare. The modeling of a two-link planar robot is indicative of principles used in AI-enhanced medical robotics, where accuracy and controlled actuation is critical to usage in surgery and rehabilitation [12]. Computational Fluid Dynamics It is also important in biomedical uses, as it has been used in modeling stroke [13], cardiovascular or respiratory systems where AI has been used to speed up simulations and increase accuracy of simulations [14].

Feedback and stability presented by control systems such as the ball and beam mechanism are essential concepts applied in AI-based medical equipment and instruments, such as automated infusion pumps and patient monitoring [15]. The vibration analysis originally presented to diagnose problems in mechanical equipment has also found its way to the healthcare field, where AI-based models analyze such physiological signals as the electrocardiogram or brainwaves and identify abnormalities and assist them in early diagnosis. The use of AI can facilitate the improvement of the health of the population by environmental research, including polluted environment (elevated BOD) in wastewater. These papers provide an example of how core knowledge in engineering can enhance the domain of healthcare when integrated with AI, to facilitate smarter diagnostics and treatment automation as well as the prevention of health [16].

Increasing Frequency and Sophistication of Cyber-attacks: They reveal that there are often and big tries to penetration in the health sphere. Cyber criminals are innovative in their approach to their crimes and are increasingly, of late, hybrid in the sense they use ransom ware followed by phishing then DDoS. Why the healthcare industry is probably the most exposed to the ransom-ware attack when the information is encrypted and the attacker asks for the decryption key? They can greatly impact the healthcare system because such attacks primarily focus on mainly healthcare decision Electronic Health Record (EHRs) [17].

Data Privacy and Compliance Issues: Another huge problem of the considered subject of the healthcare cybersecurity is the undeniable compliance with the severe legislation for the protection of personal information in the US and EU according to HIPAA and GDPR rules respectively. There are many rules and regulations which healthcare organizations have to invest much effort to ensure

that the patients' information as a way that individuals' privacy is protected. But when implementing and experimenting different AI and other related technologies for the enhancement and even the guarantee of the preservation of the data, these healthcare organizations function in compliance with the existing law; otherwise, they will be heavily punished, and consequently, they lose the patient's trust [18]. This makes compliance in an environment spacer with ever changing technological developments and threats quite difficult it extends pressure to healthcare providers because despite the considerable cybersecurity threats and new emergent systems being put into practice they have work within the constrictions of one that is in either a state of overt conflict or is slow to embrace change in order to integrate with the modern digital age [19].

Security Vulnerabilities in Interconnected Medical Devices: The current rise in the usage of mobile healthcare or telemedicine means that more smart and connected medical devices are there and they are pacemakers, insulin pumps, MRI, and robotic surgical tools. Despite the improved health of the patient and overall performance of the organization as a result of these devices, they pose a terrible menace to cybersecurity. A common feature of many medical devices is the lack of indispensable security measures: Their software could not be updated or they could lack any encryption at all hence this can be hacked. For example an attacker can gain control of a surgically implanted medical pacemaker and change the setting for the device and would be a threat to the life of the patient [20]. Such factors are hidden in the name of usability and convenience and solving them is of no different as rewarding and challenging. One of the great challenges of managing heath care network today, would be to make sure that all the hardware and software related to the health care network are safe and at the same time are updated as posed by the manufacturing companies who may not frequently release patches and security updates [21].

Legacy Systems and Lack of Cybersecurity Culture: A large number of the healthcare organizations, including baby hospitals and clinics, still have network IT infrastructure that is obsolete or incompatible with the next generation of security measures. As it has been mentioned before, the idea is that such systems were initially created as a part of working organizations with no account for such scenarios, thus the question on how to protect these systems against contemporary threats of cyber troopers [22].

An important addition to the topic is the fact the defined systems were initially created as a part of working organizations with no account for such scenarios. Peculiarly, the update or redesign of any of these systems is usually costly and uncomfortable at the same time; in sum, reinvention costs of structures halt change in organizations. However, what makes the problem even worse is the fact that

most of the time the identified healthcare staff members have minimum or no cybersecurity training at all [23]. A majority of the healthcare workforce mainly targets patients; therefore, they lack potentiality to identify or discourage cyber vices. Today, stealth attacks for example phishing scams that are as popular as hello are well recognized by cybercriminals to get into a healthcare system. Emails can be deceptive to the laymen and the attacker can plan a phishing attaching to an organization's structures and data [24].

Balancing Security with Accessibility: Therefore, to address the need for a strong protection system in the healthcare context of use, it is necessary to open access to information. All the doctors, nurses, and anybody else who may be involved in the patient's care should be able to pull the data from that record in less than a few seconds and the data should support the patient care. However, making the child more secure and using a method like MFA or even encrypting the data often becomes counterproductive as it slows down the process and the child takes more time to make an entry [25]. For instance where security measures are very stringent even such as the movement of health care workers to for instance glance at a patient record during an emergency will be lacking. This is a particularly a big problem in specialized fields where a prompt decisions must be made such as attending to a patient in the emergency or the intensive care unit. Provision of security of patient information as claimed by Prolusion puts HC under pressure to match convenient and fast access to the information as is desired by HC professionals [25].

Budget Constraints and Resource Limitations: Unfortunately for a lot of healthcare organizations, especially small practice facilities and small community hospitals is information security, or cybersecurity as it is discussed in this paper, is what ends up thrown under the bus for lack of available willing and able manpower. The literature review of implementing advanced securities features such as an artificial intelligence system for the cybersecurity is very costly. Small organizations are lacking in financial assistance and availability of resource as well to be able to offer high quality securities to counter cyber threats [26]. However, there is lack of funds to support the research or development and globally the market lacks too many intelligent people within the IT and cybersecurity fields and most of the IT and cybersecurity industries are within the health sectors. This is a clear indication that a significantly large number of healthcare organizations are facing monumental challenges in attracting qualified and, or equally competent staff to man the healthcare cybersecurity systems. Similar scarcity of such human capital also makes it even more challenging to contain cyber risks in the health sector- which is already messy [27].

This paper discusses that fundamental concepts of sound cybersecurity raise a number of issues for

healthcare management. The every growing level of intelligent cyber-attacks, the objective of safeguarding integrated medical devices and equipment, compliant and non-compliant regulatory frameworks, and existing archaic health care systems add up to create a scenario unenviable for the healthcare segment charged with the responsibility of protecting present not to mention the future generation patient data. However, based on the above challenges, the following improvements are among the best means that AI solutions can still offer to improve cybersecurity in healthcare. But they raise many urgent questions in front of which in order to be solved can to need the application of the announced AI technologies, staff training, adherence to the rules and regulations and providing an acceptable amount of funds. This research also revealed that exclusive and continuing efforts are also necessary to sufficiently safeguard important patient data against the present disruptive threats in healthcare organizations [28].

Information Security as Software Solutions to the Problems of Access and Protection of Artificial Intelligence

With the increased threat level for cybersecurity, the best improvement that can be used to let people get access to data securely is Artificial Intelligence. Some of the artificial intelligence technologies include; Machine learning, NLP and deep learning which would create new ways of ensuring patient's information security despite the added means that healthcare providers can use to access and share information during volatile times. Such solutions offer healthcare organizations considerably more sophisticated instrumentations for managing information security, in addition to improving the overall security conditions within the domain of healthcare [29].

AI in Securing Patient Data and Ensuring Confidentiality: The information connected with patients is, as a rule, of the confidential character in the sphere of health. The violation of this information can cause identity theft, or fraudulent/ deceptive practice, and loss of trust in healthcare personnel. One must also point out that patient data protection is one of the primary objectives that are accomplished by AI. The most fundamental area in which AI can support in this vision is in terms of encryption. Another advantage of using AI as a Cloud Security approach is that AI can encrypt data using algorithms in transit and data at rest. Such AI tools use more enhanced forms of cryptographic algorithms to provide far improved defense against such emerging threats [30]. Which AI knowledge management can apply data masking techniques for deep copy retention while healthcare practitioners are essentially practicing on realistic datasets? for example, AI can hide patients' identification data and replace these data with pseudonyms so that the information continuously remains analytically valuable, for example, for utilizing in research or improving the functioning of

the health care system [31].

AI-Driven Encryption and Secure Data Transmission: Another benefit of AI technologies is that they help healthcare institutions to improve communication of data also. AI based systems can then interconnect and exclude data change or duplication during transfer from one node to the next. Complete ENDE-TO-ENDE encryption using AI algorithm for data integrity can secure data from interception by undesirable source during data transfer in between two different separate healthcare systems or in between the different medical devices. One also can monitor, for instance, the security of data transfers in real-time: If the security status of data changes or if it is accessed without authorization, if the speed of data transfers is altered, then an alert is issued [32]. There is an important field, illustrating the use of AI for improving encryption – it is quantum cryptography. Since quantum computing is a threat to conventional encryption processors AI can help in the development and deployment of new Quantum resistant, encryption processors. This in a way plays a role in maintaining a good situation for the healthcare organizations as new technologies are being invented and quantum computing progressively expands [33].

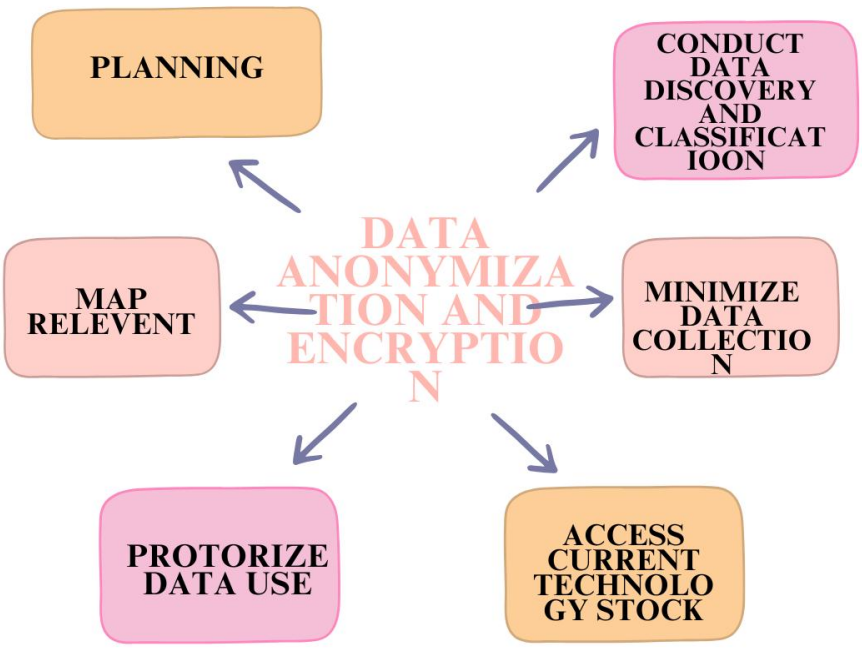

Figure: 2 showing data anonymization and encryption

Authentication Technologies Using AI: That is why access control can also be regarded as the important elements of protection of patient data. In using simple security features, notably passwords or PINs, have been shown to be susceptible to cyber threats including phishing and the brute-force attack. AI introduces the notion of facial recognition, fingerprint scanning, and voice recognition which shall work under psychological feature and provide higher level of security as they are the most excellent mode of identifying users. Biometric aid systems are even more challenging for the fraudster than typical approaches to establish identity since it is based on characteristics that cannot be faked easily. For example, in facial recognition, there are deep learning algorithms for analyzing individual features of faces but only the staff with access to the patient's data can do that. In the same respect, voice recognition and other aspects of voice are used by AI technologies to ascertain the identity of health care providers who requires permission to access some information. It reduces the chances of break-in because the systems use, or are based on the unique and immutable characteristic of an individual other than a password that is vulnerable to hack attack [34].

Moreover it also involves behavioral analytics that can enhance the access control in extensive measures. Regarding AI models one can track activity of users within different healthcare applications in order to determine which usage pattern for every user can be considered normal. For example when some patients are introduced they are often recorded by a nurse at a particular time and in some order. If a user attempts to request a large amount of data for which he or she does not normally demands, or at odd hours, or data for which the user does not have rights of access to, then a message appears at the higher level of security, and requests for the additional identities information from the user [35].

Automated User Access Management: AI is also instrumental in enhancing and securing user access in the health care centers. The key type of access control is Role Based Access Control (RBAC), while integrating AI in security goes a step ahead by utilizing Dynamic Access Control by reference to context. For instance, (Type of AI) is capable of determining the position of the user, the time of a day, the particular device used, the extent of the data required, and make instantaneous decisions as to whether or not this particular user shall be permitted access or the access shall be restricted. AI can also ensure the stream and enforcement of least privilege access policies especially when it comes to exercise of the rights of access that the healthcare workers need in their areas of specialty [36]. For example, a surgeon may need some information about the operations of the patient, but in any way he should not have any information about the administrative work performed in that hospital and not connected with his operation. By frequently reviewing the access user has and the alteration of access considered as necessary, AI avails the principle of the least privilege and hinders

the likelihood of unlawful access [37].

Incident Response and Data Loss Prevention: The application of AI technologies with respect to the healthcare cybersecurity systems is quite remarkable in the sense that AI is in a position to enhance the measures and actual responses to the incidents as well. AI can be integrated with the organization's DLP systems on a continuing basis to check out the organization and take corrective measures for a secure system in case there is security breaches. For instance if AI gets a message that a large amount of sensitive data is being transferred to an unauthorized external device or cloud storage then the transfer is halted and security teams are notified even though the data is encrypted in an attempt to prevent a leakage. Other application of Security Information and Event management technology that incorporates artificial intelligence is analyzing security logs to identify one of a kind pattern and correlation in the complete network. AI can also defend itself by assuming that attacks require closing of accounts instantly or quarantining and informing the cybersecurity staff to work on it [38].

Ensuring Secure Data Access without Compromising Efficiency: But then while working in the healthcare sector there are strict security parameters needed, doctors and nurses need patient's records to be easily accessible for proper treatment. AI enables this through having safe work processes which assure availability of critical data with minimal delay. AI can strengthen the safety of the necessary data with depersonalized access, obtained through elements elimination and the reduction of authorization procedures [39]. Examples include; the permission can be granted based on the role and status of the user, user credentials can be checked and necessary patient information can be made available to the healthcare professional eradicating sequences of many authentication processes.

AI has resulted in significant transformation in areas of data protection and in the system of authentication control in health centers. Encrypted implementations, biometric access, smart locker, and artificial intelligence are some of the modern technologically innovative theories through which the patient's information can be protected against any kind of illegitimate inaccessibility while at the same time, it could be made available only for genuine users in healthcare centers. They happen and progress continually, and therefore AI will continue to play a major role in guarding healthcare information from such actors makes healthcare information remain secure and patient information secure [40].

Ethical and Legal Issues in the Health Informatics Cybersecurity Having Ai as A Driver

The adoption of AI in healthcare cybersecurity is bound to have some legal and ethical issues that must be well managed compared to the welfare of patient, the patient's information and the law. On the other hand, the vastness of cyberspace and the threat it poses undoubtedly prove that AI can

significantly enhance the defense of sensitive HHD and by the same token the healthcare sector as a whole However, the applicability of AI in the described context can only be appropriate if the capability is constrained by ethical guidelines and especially legal requirements defining in what way and to what extent AI solutions could and should be used responsibly. Such considerations are most pertinent to healthcare, as a wrong specialist can be called, or a patient's disease can be disclosed to an unworthy recipient [41].

Data Privacy and Patient Consent: One of the most contentious ethical concerns arising from the application of AI technology to security of patient data is the maintenance of Patients' privacy. Hospitals and other medical service providers have to process large quantities of confidential patient information such as records of treatment, histories of diseases, and other information that patients cannot trust their physicians and other caretakers without. Different AI models applied in cybersecurity will need big data to learn patterns of the several anomalies that exist in a cybersecurity system [42]. But what do we do with the patients' information? Process their records, their forms, all the details that are entered into the computer for the process? Ideally, the AI-based cybersecurity software should align with some of the guidelines for handling data that have been adopted by the industry such as the HIPAA for the USA or GDPR for the European Union.

The first of these is that patients' data are to be fed into AI systems the only ethical concern of this is how the consent of the patient will be sought regarding the use of his or her data. Every time patient information is being processed, the patient should be fully informed on how that data will be processed and for what, and at times the risks associated with it; the patient should also have the freedom to decide not to share the information, or to withdraw their consent if they so wish. Biomedical engineers, thus, have to ensure that the use of the AI systems, in most scenarios, should be based on anonymized data only or where data has been de identified, to circumvent the situation where PII information could be leaked by the systems [43].

Transparency and Accountability: The more the AI systems get to a position wherein they are offering advisory decision making or the detection of threats like #cybersecurity or access control or patient diagnosis for the hospitals, then suddenly questions of Transparency And Accountability are triggered. The majority of classification models cannot be well explained this is because all AI models under the Deep Learning concept fall under the Black Box Effect. The issue that arises with exposition is the lack of a way to describe why a particular decision was made, or how an AI system came to reach a particular conclusion in the process and, in turn, this has implications in a health care scenario since decisions made will lead to patient outcomes directly.

It is very important that the security measures that are employed to safety health organizations are open to the public but simultaneously this has to be done without profiling particular organization, group or person [44]. For example, in intelligent access control, added control measures just should be provided to avoid discriminating the patient or the health worker because a patient or the health worker belongs to some group which should not be provided with information. Apart from that, one must identify the responsibility for the failure of an AI system or putting at risk in any cyber-attacks or data. On the other hand, clear accountability lines must to be set so that there is someone to blame when AI used in cybersecurity fails, or someone must suffer the loss arising from the mistakes done by the artificial intelligence [45].

Bias and Fairness in AI Algorithms: prejudice, the latter is another set of ethical problems as a component of the healthcare field: AI algorithms Machine learning distinguished for being capable of discriminating the world based on the data input into the system which in this case is biased. When it comes to health care cyber security, bias causes models to overlook certain threats that might impact some patients or health care facilities. For instance, training an AI system on large hospitals in large cities makes it to be unreliable whenever dealing with small town hospitals that can thus leave them vulnerable to attack [46]. Some new data suggest that using AI systems with different data to learn can reduce existing prejudices inherent in the system; people have become even more sensitive to issues of security; as mentioned earlier, this will need to cover all fields of health care. Moreover, frequent modification can be performed in order to continuously observe the new bias in the AI systems and, thus, audit them [47].

Security of AI Systems Themselves: Nonetheless, it is crucial to reveal that AI contributes to healthcare cybersecurity and the following AI systems should be named as being also potentially capable of cyber-attacks. The aggressive types include hackers especially trying to compromise or manipulate the threat intelligence, that exist in the system and the AI models in a way that causes the system to either fail to recognize actual threats or on the other extreme, flag normal activities as threats. Considering that, the security of the models which is based on the support of AI technology should not remain unnoticed. The data that are fed in the AI systems have to be modified or updated regularly to avoid moment where the systems are hacked or tricked by the attackers. Also, the training should have some levels of security to the information, which is to process to prevent such things as changes, or prejudice. This is why the cybersecurity community has to come up with other mechanisms to safeguard the AI models from adversarial attack if such systems are to be used in protecting other health care associated data [48].

Compliance with Legal and Regulatory Frameworks: Some other components of ethical and legal aspects to AI in healthcare cybersecurity that exist also depend on the current laws. This implies that any healthcare organization implementing the AI-based cybersecurity technology has to meet numerous requirements in protection of data. For instance, all AI systems employed in the United States requiring access control on data should obey HIPAA guidelines that were set to warrant only authorized person's access patient data. Likewise, GDPR offers suitable remedies for protecting personal data in the EU and any IT system containing the patient's data in healthcare has to GDPR regulations to protect patients' data and their interest, respectively [49].

However, some legal specifications concerning the application of the AI in the context of the health field are in existence. For instance, applications in the health sector, including any application with health technologies and incorporating AI components, have set rules governing their use and origin from either the FDA in America or the EMA in Europe. They assist voluntary health care organizations to attain optimal safety and efficacy on AI in cybersecurity [50].

Ethical Design and Development of AI Systems: The AI systems needed for security of health care's cybersecurity has to put more effort in directing various ethical concerns necessary in the health care sector. This go from come up with the assurance that the implementation of AI systems are privacy preserving safe and explainable to come up how the AI systems can be made to take responsibilities of its actions. Apparently there is need for developers to abide in some ethical standards that are considerate of the patients and the health care workers as well as ensure security measures, which has been portrayed on data security.

Probably there should also be control components of the AI systems through which healthcare workers can help decide how much of their information can be processed in the systems; likewise, the AI systems should be about the aim of enhancing the health care outcomes, not the security systems [51]. AI in the HC cybersecurity has general ethical and legal norms that resembles the information and the professional relationship The legal and ethical considerations and issues that are important while using AI in HC cybersecurity are The patient privacy, transparency of the products, biased result from the AI algorithm, legal accountability, and legislation compatibility.

Boasting of elaborate work in realizing safety of the health care systems, AI solutions shall be engineered, implemented and managed with due consideration to ethics [52]. But if all the above mentioned advanced privacy regulations are being implemented in the healthcare organizations, if all the decision makings right from the use of AI in the healthcare and excluding all the prejudice in AI systems, then all the above mentioned benefits could be derived fully in using AI in the healthcare

and the cybersecurity measures need to be implemented is strong along with fairly and effectively [53].

Ai Advance in Healthcare Cybersecurity: Trends and Development of the Future

Nevertheless, various types of risks in the sphere of cybersecurity are still seen, but innovative technologies and devices to prevent such risks are also being developed. It isn't futuristic to suggest that healthcare cybersecurity through the use of AI is already a reality and is already impacting the healthcare systems approaches to threats [54]. Here are some main trends and development for the future of this area AI in healthcare Cybersecurity:

AI and Predictive Analytics for Proactive Threat Detection: Another relatively recent and unique roles of AI adopted in the context of healthcare cyber-security is the use of Predictive analysis to prevent threats before they occur. In more basic terms current models of cyber security that are in place are labelled as post event mechanisms suggesting that threats are combatted once existent. But it can analyze a huge history data and then after decide trends and possible threats depending on attack history, some activities, behavioral changes in the network etc [55]. On the other hand, healthcare organizations should also apply predictive models with an intention of not only to avoid but to minimize experiencing a cyber-attack; way this can be achieved include: increasing firewall securities, updating software and/or changing user accesses controls. For example, AI system may observe signs of ransom-ware or may observe user login behavior that suggest a breach might have taken place. All these prediction abilities will enable an organization to avoid these attacks before they actualize the harm that they cause, thus minimizing hacking incidences and disease outbreaks with regard to key health care procedures [56].

Integration of AI with Block chain for Data Integrity: We also plan to integrate it with block chain structures so that the data is private and copies of it are made together with tracking any changes made on the data. An example is a popular technology such as block chain which has an invulnerable and cryptographic record can be beneficial to provide a decentralized technique for managing data although it has the characteristic of health related information; which is integration. While block chain and AI are still in state of invention, ai must be able to help block chain for translation of block chain transactions and understand whether the block chain network is experiencing a spoilt event [57]. For example, AI could examine structural changes in block chain for any adverse change or malicious change of data concerning the patient included in records for health care practitioner for the purpose of acquainting them with the risks. Such integration would go a long way in improving the chances of protecting health care data from being tampered to add another dimension of certainty. The

integration could also harness block chain which will give a systematically controlled and recorded means of uploading data among heath care provides on a proactive basis [58].

AI-Enhanced Security for Internet of Medical Things (IoMT): Advanced implementation of connective Technology (IoMT) includes products like pacemakers and insulin pumps as well as imaging systems. Of course, such devices are very useful for the patient's surveillance and status, simultaneously they are highly dangerous in terms of security. A rather surprising fact is the realization that most of the IoMT devices are developed insufficiently from the security perspective and therefore are vulnerable. I think that ability of AI will grow and It will be contribute in security of infrastructure of IoMT to be on high important level. One can program the implantable medical device and observe the behavior of the implantable medical device and if there is a pattern like an attempt to hack remains it's a cyber-attack. For example, if pacemaker is peacemaking in a wrong manner this is due to a cyber-attack, AI will understand this and therefore alert the medical team so that they respond accordingly [59]. Further, distribution of software updates and patches for the devices can also be facilitated by AI which in reality will minimize the risks concerning the medical devices. The ability to monitor and secure these connected devices through information and AI provides the opportunity to lower the odds of attack on crucial healthcare assets for healthcare entities [60].

AI for Enhancing Regulatory Compliance: Due to the fact that there are always new sets of regulations concerning application of health informatics, it will be for this reason that artificial intelligence will need to change the function it performs to ensure healthcare organizations remain operational in HIPAA and GDPR acts adherence. Regarding the overseeing and reporting of compliance while recording the management of patient information and verifying the access log entries, AI can help in response for self-dissemination of patient information to those workers who have privileges to access the information. For example, AI is able to identify cases where the patient data is accessed contrary to the standard or where the data exchange is contrary to the regulation [61]. This will make the health care providers current on their compliance and also reduces the possibilities of human errors. Also, the so-called real-time alerting feature of the applied AI systems and the challenging audit trails that are also offered make compliance during audits and investigations possible.

Enhanced User Behavior Analytics (UBA) and Authentication: UBA will also progress as the analysis components of the artificial intelligence use natural learning for common user activity. The integrated UBA systems will then do a wealth of data processing to arrive at what could best be

described as the reference frame of users' behavior in the healthcare facilities. This means that if an individual is behaving grossly almighty out of its or her normalcy the AI can then mark the activity highly suspicion and leads to an alarm [62]. For instance if an authorized user starts opening files which are not related to his daily operations or if he is attempting to download files during the time or on the day he isn't supposed to, or if attempt it at odd times then such tendencies contrary to security policy AI will notify an extra layer security has to be implemented such as adding MFA or even suspending the account in question until It will make all such insider threat almost impossible; and methods of Among the future healthcare organizations, the pressure to apply more precise methods and CA technique, typing rates, relocation, and biometrics will be more relevant for the improvement of the identity assurance process [63].

Ethical AI and Privacy-Preserving Technologies: The following is a prediction of what is going to happen in the next days with reference to ethical AI practice: There will be a necessity for developers to respond to claims of AI models that are used for cybersecurity purpose by giving an explanation of the following: These are such things as using clean datasets that do not include or exclude certain groups for training in the AI models and avoiding the use of AI that produces discriminatory effects and that the AI made decisions are reversible and explainable. Privacy preserving technologies will also remain very relevant as healthcare takes shape and continued development specifically in the context of cybersecurity and AI [64]. A federated learning which enables the development of AI models based on decentralized data without the data to be transferred to the central data center will ensure privacy-preserving AI in the healthcare organizations. This can help guarantee that the large scale data analysis can still be implemented in AI systems so that patient information security and protection of data privacy act are not violated. There is much to prospect in concerning the future of utilizing AI in healthcare cybersecurity [65].

With AI, the future of the security systems will be improved by advanced threat modeling, integration with block chain technology, better device security, focus on compliance, and better user authentication. However, as these technologies mature, healthcare organizations will need to address normative and privacy issues as well, to ensure the operation of AI-based solutions is forthcoming and compliant with privacy rules [66]. Finally, healthcare cybersecurity will be transformed by AI and will give healthcare organizations the optimal means to safeguard their data alongside improving the treatment and care of every patient.

Conclusion

With the implementation of Artificial Intelligence (AI) into the healthcare cybersecurity, the

protection of patient's data and handling of new and threatening cybersecurity attacks is evolving in healthcare organizations. All these use cases are helping realize a more proactive and efficient protection of data: predictive analytics and AI driven encryption, HIPAA and GDPR, and more. The future of AI in healthcare cybersecurity is bright and there are developments like self-learning user behavior analytics, block chain integration for data security, and threat identification of growing importance for better healthcare cybersecurity. However, as the field of AI will further develop its applications in the sphere of healthcare cybersecurity, some problems can still be identified. Discussion of concerns concerning the patient in terms of consent for the data to be used in training AI, the issue of ethical use of technology, and data privacy. Moreover, problems like bias within algorithms, and even security of the artificial intelligence systems requiring proper solutions to work just to support all the patients and healthcare workers alike.

As recent as the future advancement in techniques relates to AI technology which would aid healthcare organizations, in the future, to prevent emerging threats thus gain the upper hand over them, in addition, there are strategies such as federated learning and privacy-preserving technologies, which would build up the idea of protection of data and maintain confidentiality of patient information. Because advanced technologies are being creatively implemented in the field of cybersecurity, the healthcare organizations need to stick to the ethical formulation of the AI systems, compliance with the laws currently in forces, and the process transparency of the decision-making frameworks in order not to violate the patients' rights. Despite incredible benefits in healthcare cybersecurity AI should be implemented taking into account the ethical, legal, and technological implications. AI, when utilized responsibly, can greatly benefit data protection, increase organizational productivity, and shield crucial health care data, and produce a safer and much more secure future of the medical industry for not only for providers, but for the patient population as well.

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