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The Role of Artificial Intelligence in Early Disease Detection: Current Applications and Future Prospects

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ABSTRACT

Artificial intelligence (AI) has evolved as an innovative technology in the field of health care and the diagnosis of diseases at an early stage. AI systems employ large data sets, including medical images, patient history, and continuous real-time tracking, to diagnose diseases at early stages and thus learn how to act and bring about a healthier change. This paper focuses on the current uses of AI in early disease detection, its efficiency, and its drawbacks. The paper also attempts to conceptualize the future application of AI technologies for enhancing diagnostic precision, customizing treatment regimens, and providing economical solutions to healthcare organizations globally. Yet, there are certain drawbacks, such as data privacy, the issue of algorithm bias, and the problem of regulative efficiency in health care with the help of AI. The further advancement and evolution of AI applications in disease diagnosis are in machine learning and deep learning technologies, including establishing guidelines as prerequisites for making diagnostic AI services safe and effective in healthcare.

INTRODUCTION

The healthcare industry is experiencing a major shift, and AI is becoming one of the main drivers of change. But that is where AI technologies are now exhibiting the unique capability to diagnose diseases at an early stage than ever before, thus providing an adequate opportunity for early intercessions, better treatments, and better patient results [1]. Diseases like cancer, cardiovascular diseases, and neurological diseases can only be treated easily if diagnosed in their initial stages because, in most cases, when the diseases become severe, treatment becomes very expensive, and

patients' quality of life is affected. Through AI, enhanced with cortical computing and ML systems, huge volumes of healthcare data, including medical images, patient records, or even genomics, can be processed quickly and are often more accurate than manual input. Using Through all these technologies, healthcare providers can find concealed relationships between medical information for better diagnosis and forecasting risks.

Focusing on routine diagnostic tasks and clinicians' decision support, AI is now underlining the effectiveness of the providers themselves as well as the general effectiveness of the healthcare system. But, as is evident in the introduction of any new innovative technology type, the application of AI in clinical practice also comes with certain drawbacks [2]. Even though the generalization of AI for quickly identifying early signs of potential diseases has its benefits, several issues need to be resolved before AI can become a mainstream instrument in Healthcare. Such areas are data protection and security, fairness and transparency of the AI systems used, and other legal or ethical competencies.

Furthermore, implementing AI technologies in healthcare involves acquiring new resources, developing human capital and a new organizational culture to support the deployment of AI technologies. This paper provides a current review of AI in early disease diagnosis, emphasising on how machine and deep learning ang used to enhance diagnostic precision and consequent health outcomes [3]. It also offers a brief on how AI improves healthcare systems, including diagnostic accuracy, individualized care and timely diagnosis that can, ultimately, lead to improved patient outcomes and the healthy use of resources. In this paper, the benefits of AI integration will also be explored, and potential risks such as data privacy, algorithm bias, and ethical use of AI in patient care will also be discussed.

The future possibilities of utilizing AI within the realm of healthcare are almost endless, and AI instruments will dramatically change the approaches to the early diagnostics of a disease. When better algorithms continue to be created, the efficiency and performance of these systems should increase faster. It is not just making a diagnosis more accurate [4]. It is suggesting what disease risk factors are, what can be prevented, and what treatments and drugs would work best for certain patients based on their genetics or previous medical ailments. Of course, with the help of AI, healthcare can become not only a system that treats diseases but also a system that prevents them from happening. The subsequent parts of this paper will explore contemporary usages of AI in early disease diagnosis.

AI has achieved much progress in a somewhat long-time task, specifically in enhancing the analysis of X-rays, CT scans, MRI scans, and mammography. It has also proved its capabilities in detecting diseases like tumours, lesions and fractures at very initial stages than the conventional diagnostic techniques [5]. This is well illustrated in the application of AI integrations in radiology,

where mistakes made by man have been greatly eliminated. Apart from diagnosis through images, AI is applied in big data analytics for risk assessment on the propensity of patients to develop specific diseases such as cardiac diseases and diabetes. Such predictive tools are already implemented in some healthcare systems to act as early warning systems to detect patients at greater risk and perform interventions to halt the disease before it advances. One of AI's most promising applications in healthcare is genomics; agents here are learning how to identify hereditary illnesses in their early stages [6].

By machine learning algorithms, new genetic sources associated with diseases, including cancer, cardiovascular diseases, neurological disorders, etc., can be discovered, and a patient's profile provides effective diagnosis and treatment protocols. There is more to AI integration in healthcare, than the differential diagnostic accuracy; there is a definite advantage in healthcare costs. AI systems can perform sophisticated analyses that could generally take days using traditional diagnostic methods and tests that can, in many instances, be expensive and lead to prolonged hospital admission of the patient [7]. In addition, leaning on AI for early screening and diagnosis of diseases means getting conditions spotted before they worsen, requiring drastic therapies.

When it comes to the identifying issues and initial AI-based treatment, this approach yields substantial financial benefits, while patients receive individualized early on. Nonetheless, several challenges can be identified that need to be solved to make full use of the opportunities that AI provides for enhancing the state of health care. I believe that one of the most important and burning topics is the problem of data privacy and protection. Healthcare data, in general, is very sensitive, and AI systems need large data a lot of this healthcare data for refining their algorithm. Some questions need to be answered regarding the management, storage and security of patient information [8]. AI that is adopted in healthcare systems is bound by strict guidelines concerning data privacy; this includes the HIPAA of the United States and the GDPR of the European Union. Further, there are questions regarding the superiority and fairness of algorithms used in AI and their fairness and non-implementation of bias.

Machine learning and AI models are only as strong as the data sets that feed them. If these datasets are weeks, months, years, or completely lacking, or contain brokers' bias, then the resultant models and output will be similarly dubious. Machine learning models e.g., Chat Gpt is being used in health care sector [9], farming [10] and Education [11]. This could result in disparities in access to and quality of care experienced by members of several minority populations. It will be crucial to demand that AI algorithms have been tested for fairness and transparency to gain trust from patients, regulators, and medical providers. However, there are some important technical issues, or one must

consider AI's regulatory and ethical aspects in the healthcare sector. One of the issues is who is to blame for it: if an AI system identifies a patient's condition incorrectly or suggests an improper treatment regimen.

These ethical issues will need to be solved with specific regulatory measures and ethical standards for the application of AI in the healthcare industry that will protect patients' rights while allowing AI applications AI has an auspicious future in early disease diagnosis. In the future, as AI technologies advance, diagnosing these diseases will be done even earlier, eliminating, the loss of many lives. Write the purpose or benefits expected to come with integrating Artificial intelligence in the health care systems to include efficiency, effectiveness and cost, and timely and quality patient care. However, these require questions on data privacy, algorithm bias problems, and regulation issues to be tackled if AI is to be used effectively, responsibly, and ethically. Therefore, it is important that future work involves the cooperation of computer scientists and engineers, doctors, politicians and ethicists so that the future of healthcare can be at its best so that patients all over the world will get the maximum benefits of AI.

I. CURRENT APPLICATIONS OF AI IN EARLY DISEASE DETECTION

AI technologies are gradually replacing traditional methods of disease diagnosis across several fields of medicine and are offering greater precision and efficiency, not to mention the timely nature with which various diseases can and are being diagnosed [12]. These innovations have credited the ML and DL methods and are now showing unprecedented advancements to diagnose diseases in their nascent stages, sometimes even before the clinical signs begin to show. Below are some of the primary applications of AI in early disease detection:

i. AI in Cancer Detection

Cancer is a global health problem; it is ranked as the second leading cause of death, and early diagnosis reduces mortality rates among patients. With the help of AI algorithms, it became much easier to identify different types of cancer in its initial stages, presumably easier to treat. Deep learning, a kind of AI, has been practised in screening possible cancers in modalities like mammography, CT scans, and MRI, among others [13].

- ***Deep Learning for Cancer Detection:*** Specific to image data, one of the most popular deep learning algorithms is known as the Convolutional Neural Networks or CNN. CNN are inherently(seq) used for understanding hierarchal visual patterns like detecting cancerous tissues from medical images.

These models can be trained on a large image database of medical images, and without

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requiring a human to label the images, the models can detect signs of cancer that could be unnoticed by the human eye [14]. Specifically, in breast cancer detection, for example, AI systems' efficiency is higher than traditional methods. Some recent studies have demonstrated that the AI-based analysis of mammoses can decrease the number of false-negative and false-positive screens and can be beneficial for diagnosis. Likewise, in lung cancer detection, AI has applications in CT scans, where a radiologist scans early signs of cancer to better understand early cancer and intervene before tumours are visible. The parking of cases under the new AI system has not only enhanced the efficiency of diagnosis but has also eased the burden on radiation specialists in handling numerous inconsequential ones.

ii. AI in Cardiovascular Disease Detection

Non-communicable diseases such as CVDs, coronary diseases, heart attack, stroke, and irregular heartbeat are among the leading and fatal diseases in the world. One of the priorities is the identification of developing cases and the beginning of interventions since such cases might have more critical outcomes; AI can also help establish diagnostics for CVDs at their early stages.

- ***AI for Predicting Heart Disease:*** The existing AI technologies, but primarily predictive analytics, are now used to estimate an individual's likelihood of developing CVD based on information from EHRs and genetics, as well as lifestyle data [15].

Machine learning models can analyse massive data processing to recognize illness's main signs and risky factors. For example, you may be able to anticipate the probability of the next cardiovascular episode in a patient by combining recorded history, cholesterol level, blood pressure, and family history of such related disorders [16]. These predictions help healthcare providers to step in earlier for changes in behaviour or administration of drugs and more frequent follow-ups. The diagnosis of the problem, like arrhythmias or coronary artery disease, suggests possible preventive measures to prevent the occurrence of heart attacks and strokes. AI has also been incorporated into testing techniques that identify abnormal physiology in the form of arrhythmias through ECG interpretation [17].

iii. AI in Neurological Disease Detection

While Cognitive disorders, including Alzheimer’s, Parkinson’s, and multiple sclerosis, are making their early manifestation challenging to diagnose due to apparent signs of the disorders that are not easily associated with an illness. However, AI is showing great potential to help diagnose these illnesses earlier using sophisticated information like MRI scans and other patient records.

- ***Brain Imaging and Disease Detection:*** There are algorithms used in brain imaging, and these assist developers in identifying early signs of neurological disorders such as Alzheimer's disease. For example, artificial intelligence algorithms can parse MRI scans and positron emission tomography (PET) scans of the brain to trace structural patterns linked with the first stages of Alzheimer's disease [18].

Such modifications may be hippocampal shrinkage or a decrease in the brain's activity in certain areas, which may point to the development of the disease even before such signs as impairments in memory, attention, or concentration. AI is also applied to diagnose the initial stages of Parkinson's disease. There are now algorithms used by doctors that can diagnose Parkinson's even with no clinical manifestations by analysing lost and distorted patterns of brain scans and motor skills [19]. Further, AI technologies can presume speech and handwriting data because they are initial manifestations of Parkinson's generally. Using AI approaches to analyse patient's ability to speak and write, clinicians can identify signs of the start of neurological diseases in time to try to reduce the progression of the selected disease. In multiple sclerosis (MS), AI is used to analyse MRI images to identify brain and spinal cord lesions typical for the disease. These AI systems can even distinguish tender lesions toward the start of the disease, and often, the symptoms are negligible [20]. Therefore, the ailments can be detected at a very early stage.

A. BENEFITS OF AI IN EARLY DISEASE DETECTION

The use of AI particularly in early disease diagnosis is a plus to both the health care systems and the patients as it changes the way diseases should be diagnosed and handled. Some of the key benefits include:

i. Enhanced Diagnostic Accuracy

The applications of AI technologies in handling data include the ability to discharge large volumes of data within a short duration and accurately diagnose patterns and irregularities in medical data clinicians. For example, in medical imaging, AI algorithms such as Convolutional Neural Networks (CNN's) can detect slight variations in the medical images like X-rays, CT scans and MRI that can be symptoms of diseases at their preliminary stages, such as cancer and cardiovascular diseases . This increases diagnostic accuracy, decreases human error during treatment, especially in difficult cases, and guarantees that ongoing treatment is adequate for patients' needs. In some instances, it has already been seen that AI performs better than the medical profession in diagnosing certain conditions, thus emphasizing the importance of AI in enhancing healthcare [21, 22].

ii. Faster Diagnosis and Intervention

The time taken to reach a diagnosis is minimal since artificial intelligence can scan, analyse, and offer insights quickly, such as real-time data processing. In many cases, this is an incredibly rapid diagnostic approach that can be extremely helpful in an emergency or a time-sensitive situation, like a cancer or cardiovascular event, where timely detection may be life-saving [23]. Timely diagnosis means that the required types of treatment can be begun sooner, which raises the likelihood of a cure. For example, in oncology, early detection of cancer results in better management of the condition and decreased use of highly interventional procedures.

iii. Cost-Effectiveness

The use of AI in diagnosing diseases results in lower diagnostic errors and costs more time and accuracy, reducing the overall cost of healthcare. Screening for diseases is usually cheaper than screening for diseases that have reached an advanced stage, especially when screening for specific conditions such as cancer. Through early detection of ailments, AI helps reduce costs on both the side of healthcare and individual people, increasing spending productivity [24].

iv. Personalized Treatment Plans

AI allows for developing individualized care approaches by considering the patient's genetic makeup, medical history, and social background. Due to the analysis of such datasets, it becomes possible for AI systems to recommend more effective sorts of intervention as specifically relevant to the patient in question, thus increasing the chances of a disease-curing process and reducing the risk of such things as adverse side effects from medication or unnecessary treatments [25]. Personalized care is intended to provide different care depending on the current heath state of individual patients, improving the quality of care and patient satisfaction.

B. CHALLENGES IN THE IMPLEMENTATION OF AI IN EARLY DISEASE DETECTION

However, there are several issues that need to be resolved so that the use of AI in the early diagnosis of diseases is effective in healthcare systems. These challenges include data privacy and protection, the problem of fairness in machine learning algorithms, regulatory and ethical barriers, and interface with the current state of healthcare systems.

i. Data Privacy and Security

In healthcare, AI systems must process large volumes of highly personal, often protected,

patient treatment data from medical records, images, and genetic tests. This is a significant issue in protecting this data against unauthorized examination or breach. Information such as data protection laws like the Health Insurance Portability and Accountability Act (HIPAA) in the United States or the General Data Protection Regulation (GDPR) in the European Union outlines how healthcare data must be processed [26]. Failure to adhere to these regulations puts the patient's rights at risk, and the patient's personal health information may be abused. Any AI system should be deployed with substantial security assets for protecting the data, such as encryption, data storage and control to access for making unauthorized entries.

ii. Algorithmic Bias

AI systems deploy GANs trained on large datasets, and the data quality influences the models' effectiveness. Consequently, if the data used in developing AI models and systems is either biased or lacks sufficient information, then the outcome from an AI system will be either inaccurate or inclined towards a specific point of view [27]. This remains a significant worry in healthcare because a biased AI model means a wrong diagnosis or different treatments for different individuals based on their demographic data. For instance, if an AI model is trained from one ethnic group's data, its performance will likely be poor when handling issues about other ethnic groups. To this concern, great emphasis should be placed upon training samples being unbiased and inclusive of as many realistic scenarios as possible [28]. Further research is still required to design algorithms that recognize the bias and make the proper adjustments to treat all patients fairly.

iii. Regulatory and Ethical Concerns

Since practically all spheres of health care are looking to implement AI systems, proper regulatory structures should be in place to govern the usage of AI. How AI can determine candidates that human recruiters cannot retain is a discussion that brings forward this critical concern: how transparent are those processes? AI systems and intense learning models are often called 'black boxes', making it hard to understand why a particular decision was made or that specific diagnosis was concluded. Such opacity damages trust between caregivers and consumers of health care and can negatively impact health care delivery [29]. Moreover, responsibility for the mistakes made by robots and AI should also be determined unambiguously. For every case in which an AI model produces a wrong diagnosis or recommends a bad treatment, it must be determined who is at fault: the AI developers, the healthcare providers, or the healthcare institution.

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C. Integration with Existing Healthcare Systems

The prospect of deploying AI in alignment with current prescribing infrastructures forms both technical and operational difficulties not only in the integration of AI into a complex and diverse ecosystem but also the practicalities of working with large existing databases. AI systems are not only costly but require the healthcare organization to modify their operations in order to incorporate the technology [30]. For example, built-in AI applications have to be embedded into the EHR systems in order to provide real-time extraction and analysis of patient data. This means there must be a direct investment in information technology and the education of health care workers. Also, AI systems should be integrated into various devices and software that are employed in numerous healthcare settings making integration a more challenging process. These impositions have to be surmounted so as to facilitate the enhancement of AI prospects in actual healthcare platforms [31].

D. THE FUTURE OF AI IN EARLY DISEASE DETECTION

The prospects of AI in early disease detection are bright, with more adaptive progress in the field and broader utilization of the technology, which is soon seen to improve health care immensely. With the further development of AI, a primary diagnostic tool for diseases at an early stage will be provided in the future, and more personalized, accurate, and diverse health care will be provided. Here are several significant concepts that will define the further evolution of AI in healthcare.

i. Advancements in AI Technologies

Today, AI heavily relies on machine learning (ML) and deep learning (DL) algorithms to scan for early diseases. However, as these algorithms continue to enhance, AI systems will improve precision and depth for diagnosing other diseases [32]. One of the most promising developments for the future is reinforcement learning, where AI systems can gradually learn from the flow of data feeding it. Future advancements in this technique will only make such AI-driven diagnostic tools more accurate and adaptable since we are dealing with a real-time learning model that can consider updated research findings, new disease patterns, or individual patient data. The future models will be extended beyond diagnosing disease and will also be able to forecast trends of disease changes, giving specific data to different patients.

*a) **AI in Preventive Healthcare***

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In the future, AI will be used to identify diseases and act as an identifier of diseases before they occur in the body. Based on big data from patients' histories, personal behaviors, genetics, and environments, AI systems can forecast with certainty that a patient will be at risk for developing chronic diseases such as heart disease, diabetes, cancers, etc. [33]. These predictions will enable one to avoid the onset of symptoms or progression of diseases through early intervention, lifestyle changes and individualized health care plans. Preventive healthcare supported through artificial intelligence will shift from traditional curative to preventive care, enhance patients' well-being, and mitigate the load on the healthcare system because of expensive cures [34].

b) ***Global Health Impact***

Perhaps the most impactful part of AI's future in healthcare is its ability to close the current global health gap, especially in developing and rural regions. Digital diagnostic technologies like mobile Apps and portable diagnostic tools could enable physicians to diagnose and manage patients over a distance in a context that may have even the bare minimum infrastructure for health facilities. As the possibilities of owning a mobile phone and accessing the internet increase, AI can potentially deliver diagnoses and consultations at the patient's doorstep a reality, thus increasing health access for people who cannot easily access health facilities [35]. These tools will not only help diagnose diseases but also help in early diagnosis; hence, these will gradually try to eliminate the health gaps worldwide.

c) ***Ethical and Regulatory Frameworks***

This has given rise to the need for better ethical standards and principles and ratification of AI applications in healthcare. They will prescribe how AI is used in healthcare facilities and whether the AI systems are accurate, equitable, and transparent. To ensure that modern society continues to trust AI decision-making, the above concerns, such as algorithmic bias and patient consent, should be addressed, too [36]. The slow pace with which the regulatory authorities follow means they will always be chasing the emerging trends in AI developments while keeping ethical issues in mind. In addition, patient privacy and data security will still be necessary as patient health information will continue to be a target for wrong-doers who seek to exploit it for their benefit. When there are well-articulated ethical principles guiding the use of AI, it becomes possible to make significant advances in the field since it supports better management of health care while protecting patients' best interests.

Conclusion

AI has the potential to transform early disease diagnosis through improving diagnosis and speed of diagnosis, as well as giving tailored care. They can also predict the onset of diseases, enhance the quality of their treatment, and optimize the medical management process. Nevertheless, there are still issues, for example, regarding data protection, machine learning models' bias, and the IM partnership with the current architectures of the healthcare systems. Ethical concerns in using these technologies, patient data privacy, and biases in AI models are some of the challenges that need to be reclaimed for its successful adoption. However, interoperability with existing healthcare IT systems is critical for achieving this potential. Thus, it can be concluded that the future of AI in healthcare depends on removing these barriers and developing solutions further. In the future, with the development of more advanced technologies, AI will be the key element in enhancing the quality of people's health and making the healthcare system more effective, available for everyone and as individualized as possible. Future growth of ethical frameworks and rules regarding AI will be a significant factor for sustainable AI in the healthcare system.

References

[1] . Tiwari M, Waoo AA. Transforming Healthcare: The Synergistic Fusion of AI and IoT for Intelligent, Personalized Well-Being. InRevolutionizing Healthcare: AI Integration with IoT for Enhanced Patient Outcomes 2024 Sep 24 (pp. 109-149). Cham: Springer Nature Switzerland.

[2] . Sherani AM, Khan M, Qayyum MU, Hussain HK. Synergizing AI and Healthcare: Pioneering Advances in Cancer Medicine for Personalized Treatment. International Journal of Multidisciplinary Sciences and Arts. 2024 Feb 4;3(1):270-7.

[3] . Chen JJ, Husnain A, Cheng WW. Exploring the Trade-Off Between Performance and Cost in Facial Recognition: Deep Learning Versus Traditional Computer Vision. InProceedings of SAI Intelligent Systems Conference 2023 Sep 7 (pp. 400-412). Cham: Springer Nature Switzerland.

[4] . Khan M, Shiwlani A, Qayyum MU, Sherani AM, Hussain HK. Revolutionizing Healthcare with AI: Innovative Strategies in Cancer Medicine. International Journal of Multidisciplinary Sciences and Arts. 2024 May 26;3(1):316-24.

[5] . Saeed A, Husnain A, Zahoor A, Gondal RM. A comparative study of cat swarm algorithm for graph coloring problem: Convergence analysis and performance evaluation. International Journal of Innovative Research in Computer Science and Technology (IJIRCST). 2024;12(4):1-9.

[6] . Husnain, A., Alomari, G., & Saeed, A. (2024). AI-driven integrated hardware and software solution for EEG-based detection of depression and anxiety. International Journal for Multidisciplinary Research (IJFMR), 6(3), 1-24. https://doi.org/10.30574/ijfmr.2024.v06i03.22645

[7] . Husnain A, Saeed A. AI-enhanced depression detection and therapy: Analyzing the VPSYC system. IRE Journals, 8 (2), 162-168 [Internet]. 2024

[8] . Sherani AM, Qayyum MU, Khan M, Shiwlani A, Hussain HK. Transforming Healthcare: The Dual Impact of Artificial Intelligence on Vaccines and Patient Care. BULLET: Jurnal Multidisiplin Ilmu. 2024 May 27;3(2):270-80.

[9] . Samad A, Jamal A. Transformative Applications of ChatGPT: A Comprehensive Review of Its Impact across Industries. Global Journal of Multidisciplinary Sciences and Arts. 2024;1:26-48.

[10] . Patel H, Samad A, Hamza M, Muazzam A, Harahap MK. Role of artificial intelligence in livestock and poultry farming. Sinkron: jurnal dan penelitian teknik informatika. 2022 Oct 7;6(4):2425-9.

[11] . Shihab SR, Sultana N, Samad A. Revisiting the use of ChatGPT in business and educational fields: possibilities and challenges. BULLET: Jurnal Multidisiplin Ilmu. 2023 Jun 4;2(3):534-45.

[12] . Madani M, Behzadi MM, Nabavi S. The role of deep learning in advancing breast cancer detection using different imaging modalities: a systematic review. Cancers. 2022 Oct 29;14(21):5334.

[13] . Dar RA, Rasool M, Assad A. Breast cancer detection using deep learning: Datasets, methods, and challenges ahead. Computers in biology and medicine. 2022 Oct 1;149:106073.

[14] . Krittanawong C, Johnson KW, Hershman SG, Tang WW. Big data, artificial intelligence, and cardiovascular precision medicine. Expert Review of Precision Medicine and Drug Development. 2018 Sep 3;3(5):305-17.

[15] . Krittanawong C, Johnson KW, Hershman SG, Tang WW. Big data, artificial intelligence, and cardiovascular precision medicine. Expert Review of Precision Medicine and Drug Development. 2018 Sep 3;3(5):305-17.

[16] . Pryor DB, Shaw L, McCants CB, Lee KL, Mark DB, Harrell FE, Muhlbaier LH, Califf RM. Value of the history and physical in identifying patients at increased risk for coronary artery disease. Annals of internal medicine. 1993 Jan 15;118(2):81-90.

[17] . Pryor DB, Shaw L, McCants CB, Lee KL, Mark DB, Harrell FE, Muhlbaier LH, Califf RM. Value of the history and physical in identifying patients at increased risk for coronary artery disease. Annals of internal medicine. 1993 Jan 15;118(2):81-90.

[18] . Sharma R, Goel T, Tanveer M, Suganthan PN, Razzak I, Murugan R. Conv-ervfl: Convolutional neural network based ensemble RVFL classifier for Alzheimer's disease diagnosis. IEEE Journal of Biomedical and Health Informatics. 2022 Oct 19;27(10):4995-5003.

[19] . Ibrahim AM, Mohammed MA. A comprehensive review on advancements in artificial intelligence approaches and future perspectives for early diagnosis of Parkinson's disease. International Journal of Mathematics, Statistics, and Computer Science. 2024 Jan 26;2:173-82.

[20] . Vercellini P, Somigliana E, Viganò P, Abbiati A, Barbara G, Fedele L. Chronic pelvic pain in women: etiology, pathogenesis and diagnostic approach. Gynecological Endocrinology. 2009 Jan 1;25(3):149-58.

[21] . Fan W, Liu J, Zhu S, Pardalos PM. Investigating the impacting factors for the healthcare professionals to adopt artificial intelligence-based medical diagnosis support system (AIMDSS). Annals of Operations Research. 2020 Nov;294(1):567-92.

[22] . Topol EJ. High-performance medicine: the convergence of human and artificial intelligence. Nature medicine. 2019 Jan;25(1):44-56.

[23] . Haleem A, Javaid M, Singh RP, Suman R. Medical 4.0 technologies for healthcare: Features, capabilities, and applications. Internet of Things and Cyber-Physical Systems. 2022 Jan 1;2:12-30.

[24] . Lee D, Yoon SN. Application of artificial intelligence-based technologies in the healthcare industry: Opportunities and challenges. International journal of environmental research and public health. 2021 Jan;18(1):271.

[25] . Turabian JL. The Care and Cure Process in General Medicine. Public Health and Epidemiological Implications. Medp Public Health Epidemiol. 2022;2(1).

[26] . Yuan B, Li J. The policy effect of the General Data Protection Regulation (GDPR) on the digital public health sector in the European Union: an empirical investigation. International journal of environmental research and public health. 2019 Mar;16(6):1070.

[27] . Schwartz R, Schwartz R, Vassilev A, Greene K, Perine L, Burt A, Hall P. Towards a standard for identifying and managing bias in artificial intelligence. US Department of Commerce, National Institute of Standards and Technology; 2022 Mar 15.

[28] . Khan AH, Zainab H, Khan R, Hussain HK. Deep Learning in the Diagnosis and Management of Arrhythmias. Journal of Social Research. 2024 Dec 6;4(1):50-66.

[29] . Zainab H, Khan R, Khan AH, Hussain HK. REINFORCEMENT LEARNING IN CARDIOVASCULAR THERAPY PROTOCOL: A NEW PERSPECTIVE.

[30] . Al-Jaroodi J, Mohamed N, Abukhousa E. Health 4.0: on the way to realizing the healthcare of the future. Ieee Access. 2020 Nov 18;8:211189-210.

[31] . Feijóo C, Kwon Y, Bauer JM, Bohlin E, Howell B, Jain R, Potgieter P, Vu K, Whalley J, Xia J. Harnessing artificial intelligence (AI) to increase wellbeing for all: The case for a new technology diplomacy. Telecommunications Policy. 2020 Jul 1;44(6):101988.

[32] . Shen J, Zhang CJ, Jiang B, Chen J, Song J, Liu Z, He Z, Wong SY, Fang PH, Ming WK. Artificial intelligence versus clinicians in disease diagnosis: systematic review. JMIR medical informatics. 2019 Aug 16;7(3):e10010.

[33] . Reddy MS, Sarisa M, Konkimalla S, Bauskar SR, Gollangi HK, Galla EP, Rajaram SK. Predicting tomorrow's Ailments: How AI/ML Is Transforming Disease Forecasting. ESP Journal of Engineering & Technology Advancements. 2021;1(2):188-200.

[34] . Bajwa J, Munir U, Nori A, Williams B. Artificial intelligence in healthcare: transforming the practice of medicine. Future healthcare journal. 2021 Jul 1;8(2):e188-94.

[35] . Feldman RC, Aldana E, Stein K. Artificial intelligence in the health care space: how we can trust what we cannot know. Stan. L. & Pol'y Rev.. 2019;30:399.

[36] . Gill AY, Saeed A, Rasool S, Husnain A, Hussain HK. Revolutionizing Healthcare: How Machine Learning is Transforming Patient Diagnoses-a Comprehensive Review of AI's Impact on Medical Diagnosis. Journal of World Science. 2023 Oct 27;2(10):1638-52.