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Chapter 2

Artificial intelligence in medical diagnostics: Enhancing accuracy and speed in disease detection

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Abstract:

AI is transforming medical diagnostics by enhancing the accuracy and speed of disease detection. Through advanced machine learning algorithms and data analysis, AI improves diagnostic precision, reduces human error, and accelerates decision-making, enabling earlier interventions and better patient outcomes.

Keywords

AI, Disease Detection, Diagnostic Accuracy, Machine Learning, Medical Diagnostics, Precision Medicine

2.1. Introduction

Advancements in the technological landscape over the past few decades have allowed artificial intelligence (AI) to integrate into many aspects of everyday life, including the delivery of healthcare. In addition to streamlining hospital operations, AI has significant implications for patient care, being a popular topic in biobanking news. One of the areas where AI is expected to have the largest impact is medical diagnostics. More accurate and speedier diagnoses can be made using AI technologies. In medicine, where innovations can significantly improve the world's quality of life, research and development must continue. Although recent advancements in drug discovery and vaccine engineering have contributed to medical progress, innovations in medical testing are also needed. Automated medical diagnostic machines, particularly AI-driven image recognition systems, are predicted to greatly reduce patient mortality by addressing the lower laboratory and advanced medical imaging infrastructure and expert supply in developing and underdeveloped nations. One in ten people in the world do not have access to basic healthcare due to a lack of essential services and technology. With the assistance of AI, upgrading laboratory and advanced medical imaging infrastructure with smart technologies such as AI-empowered diagnostic tools might produce additional diagnoses globally per year. In the diagnostic sector, AI systems that include sophisticated data analysis techniques, such as machine learning and deep learning methods, are expected to reduce time to diagnosis, increase diagnostic accuracy and efficiency, and improve diagnostic decision-making (Nampalli, 2024).

2.1.1. Background and Significance

Accurate and rapid diagnosis is essential for effective disease prevention and treatment. Various diagnostic methods are used in today's clinical practice, including biochemical, electron microscopic, and technological assays. Other tests involve visual observation of samples under a microscope, physical examination, and asking for a medical history. However, the traditional method is manual, wherein the heavy involvement from the diagnostician causes delays in processing the medical diagnosis. Advances in data analysis, machine learning, and artificial intelligence have the potential to transform medical diagnostics. Rather than being solely dependent on the judgment of the diagnostician, AI could operate with a high degree of accuracy and savings in time resulting from quicker diagnosis. In many scenarios, delayed diagnosis may result in loss of life.

AI in medical diagnostics could streamline processes, flag more accurate results, and generally improve the management of healthcare appointments. Moreover, while the initial cost for setting up AI in medical diagnostic tools might be high, they should result in cost savings in the long run as they automate key processes currently carried out by expensive human specialists. Finally, a timely diagnosis has been proven to reduce treatment costs, as diseases at early stages are easily controlled. The use of artificial intelligence is clearly a sign of a rapidly improving systems approach to both diagnosis and treatment that must be explored and controlled. In the present work, we have attempted to discuss the application of artificial intelligence in medical diagnosis.

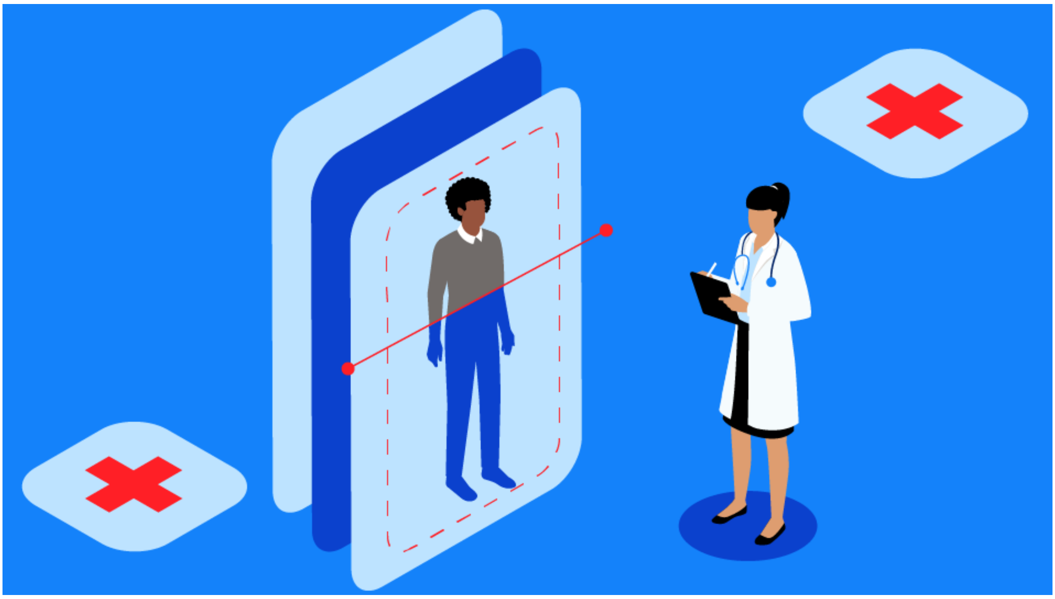

Fig 2.1: Artificial intelligence in diagnostics

2.1.2. Purpose of the Paper

The purpose of this paper is to exemplify AI capabilities within the field of medical diagnostics, and more specifically, clinical disease detection (Danda, et al., 2024). This paper has three aims: (1) to equip healthcare professionals, researchers, and policymakers with knowledge about the burgeoning area of AI and its potential to disrupt healthcare practice and policy; (2) to shed light on the behavior and dynamics of AI in diagnostics from a theoretical and practical standpoint; (3) to critically explore the current AI applications in medicine. We aim to enlighten both the pros and cons that are related and provide some food for informed discussion. In our paper, we overview different forms of AI with practical examples – those that are widespread and those that are still emerging within the clinical workflow. The paper aims to present case studies that exemplify how AI is currently being used in the clinical decision-making process of diagnostics. The overview is mainly from a technology and usability standpoint. We also include some prominent ethical implications and debate about the impact and effect of AI in clinical diagnostics. This paper provides an informed overview of AI in medical diagnostics through data analysis. In this context, AI is one of the most promising application fields and could help overcome the substantial challenges in diagnosis and support early detection, initiation of therapy, or prediction of prognosis in many diseases. This paper addresses the current AI applications within the clinical decision-making process .

2.2. The Role of AI in Medical Diagnostics

AI techniques are fundamentally transforming medical diagnostics by bringing about innovations across different technologies such as machine learning, deep learning, and neural networks. By making full use of historical and real-time patient data, AI converts regular clinical devices into smart devices capable of analyzing biological signals for diagnosing diseases more accurately and quickly compared to humans with variable expertise. High accuracy achieved mainly by deep learning and neural network systems improves the predictability and preemptiveness of associated diagnoses and thus can be prioritized for therapeutic considerations and personalized treatment. Unlike conventional methods, AI systems have shown an advantage in dealing with a large amount of longitudinal, heterogeneous, or multilevel data, along with novel data types such as molecular pathways or imaging-based phenotypes. The integration of AI-based automated systems as tools to complement the physician’s judgment represents the increase of artificial intelligence in the area of medical diagnostics, since it frees the lab technician and the physician from decision-related problems to focus on the understanding of the present treatment-pathology relationship. There are risks and promises during the introduction phase of AI-based technologies and diagnostic resources for clinical field applications.

Evidently, AI is ready to take over some of the tasks from general physicians. AI tools are available that claim to find rare bone diseases, triple-negative breast cancers with the best survival chances, or brain tumors in a genetic diseases database. Companies are selling a type of applied DNA test in which AI learns what healthy skin looks like and searches for abnormal skin compared with its dataset to spot skin cancer. The global market for AI-based medical diagnostics is expected to grow, driven in part by the demand for early detection of diseases. The value of the AI-based medical diagnostics market is estimated to surpass $6 billion by 2027.

2.2.1. Overview of AI Technologies in Healthcare

The most recent report on AI in healthcare indicates that the applications for AI and ML are extensive and continue to create powerful diagnostic tools, as well as fuel pharmaceutical and biotechnological advancements (Shakir, 2024). The application of machine learning algorithms in medical diagnosis is responsible for the creation of predictive and diagnostic models. By classifying data, the algorithms help diagnose diseases such as cancers or develop segmentation techniques to identify and diagnose abnormalities, lesions, or tumors in radiographic images. Also part of AI, natural language processing is applied to understand and identify with great accuracy a range of data from diverse sources and eliminate unnecessary information. The medical community uses computer vision to diagnose medical images, analyze biopsies, radiographs, MRIs, or use vision-based systems to scan patient documents, digitize and process healthcare photos. Used together, AI technologies build deep learning algorithms that simulate the human brain and produce high-level representations of the image pixel images by processing the data through a cascade of multiple layers.

Resulting from these deep learning algorithms are AI analytics, which produce powerful diagnostic tools for patient care. Medical professionals perform pre- and post-therapeutic monitoring, and radiologists rely on AI-based predictive analytics, patterns, and diagnoses for multimodal imaging that detect antecedents to diseases and provide accurate diagnoses. AI-empowered predictive analytics help create an individually tailored patient prescriptive plan, future therapies, interventions, and prognostications. AI nursing care using extensive AI tools and healthcare-related devices better interprets the continuously obtained data saved in an internet-based database. These large databases house significant information about patients and their diseases collected from multiple diversified sources that not only merge research from multiple academic hospitals, institutions, and systems, but also combine outcome data from other healthcare settings. This valuable data includes electronic healthcare records such as social determinants of health and journals and other pertinent clinical data sources (Vankayalapati et al., 2021). Data analytics from the continuous iteration of data accumulating in a real-time setting has resulted in the development of digital health analytics. Data infrastructure advancements in AI technology have allowed the development of interoperability and an extensive digital platform connected by and working with a vast array of smart devices with analytics capabilities, labor-intensive workflow assistance, and diagnostic aids that access huge data stores created through high volume imaging workflows, electronic healthcare records, and systems.

Equation 1 : Feature Extraction:

$$z = W \cdot x + b$$

z: Extracted features,

W: Weight matrix for the layer,

x: Input data (e.g., medical image pixels, lab results),

b: Bias vector.

2.2.2. Benefits and Challenges of Implementing AI in Medical Diagnostics

There are various advantages associated with integrating AI in medical diagnostics. It is argued that AI algorithms can improve accuracy. Furthermore, AI enhances workflow by prioritizing tasks. This facilitates the optimization of a physician's time and is economically beneficial. Moreover, decisions made by AI consider extensive biological data and can aid in diagnosing subtle and complex diseases. AI technologies may also reduce human error that contributes to diagnostic inaccuracies. A timely and accurate diagnosis may lead to enhanced patient outcomes. AI algorithms developed for chest radiographs can identify a possible diagnosis of tuberculosis. These AI tools have the potential to speed up diagnostic results for an illness that affects millions across the world.

Nevertheless, there are a number of challenges that the medical field must overcome to implement AI algorithms in diagnostics. A lack of patient data consisting of medical images can limit the AI algorithm's ability to be trained. Healthcare institutions may be slow to integrate AI due to existing concerns about privacy and data protection. Furthermore, various health facilities use different electronic health record systems that are not compatible. Data must be able to move within these systems to effectively integrate with an AI algorithm. Some medical conditions could be ambiguous for an algorithm to interpret, especially if the algorithm is not trained with data for relatively rare risk factors or disease patterns. Healthcare professionals have been trained to make valuable decisions based on gathering limited information, clinical judgment, and interactions with the patient. Comprehensive training and educational approaches that educate healthcare professionals about the capabilities and limitations of AI technology in diagnostics will be necessary. Furthermore, an ethical concern arises in the event an inappropriate decision is made by an AI tool as a result of error in input data (Kothapalli et al., 2021). Defining responsibility in these cases is problematic. In addition, AI decisions possess the propensity to be biased, making it conceivable that people can experience unequal outcomes in patient care. Any pattern of bias could negatively influence patient care, cost an institution in legal matters, and tarnish the reputation of the AI tool and/or institution. It is necessary to evaluate the interpretability of AI decisions in the context of ethical decision-making.

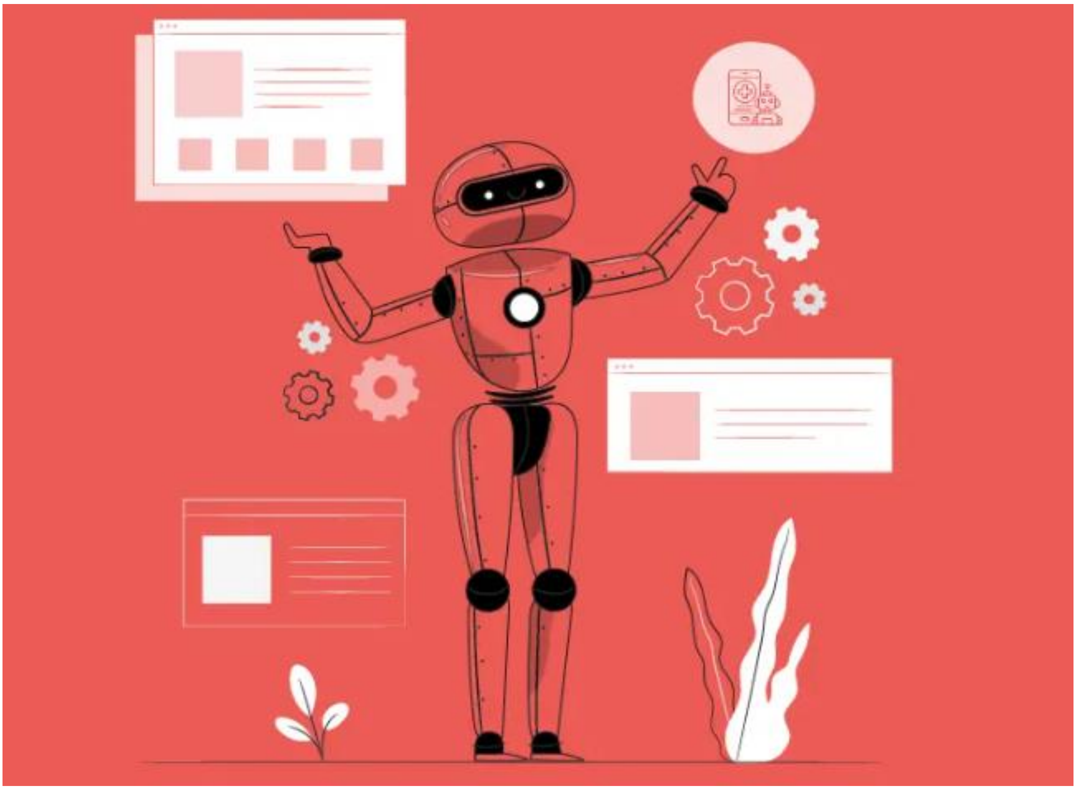

Fig 2 . 2 : Benefits and Challenges of Implementing AI in Medical Diagnostics.

2.3. Applications of AI in Disease Detection

AI is utilized in many areas of medicine for diagnosing disorders that have always been challenging for doctors; it performs diagnostics more accurately and quickly than traditional methods. The AI technologies are widely used for diagnosing cancer. Thus, AI reads and evaluates computer images: X-rays, computed tomography, bone scintigraphy, mammography, positron emission tomography, and magnetic resonance imaging scans, identifying abnormalities missed by a radiologist. AI can also help detect cancers much earlier than a patient may notice any symptoms or a general practitioner may suspect during a physical examination. The use of AI drastically improves the detection of diabetic retinopathy from retinal images. Clinical decision support systems, founded on AI technology, provide early diagnosis and care for neurodegenerative diseases. They enable the non-invasive monitoring of the structural and functional alterations of the brain; early intervention and treatment can prevent or delay the onset of disability. New AI technologies have been developed for diagnosing and monitoring cardiovascular diseases. For example, the AI system utilizes the electrocardiogram to predict patients' chronological age and their biological age; it thus predicts long-term risks of age- and gender-related pathologies.

Using informatics on big data, the electronic health records and other tests of individual patients, together with deep machine learning, a computer program can estimate neurological ages against chronological ages, monitoring changes in a person’s health over time. The same approach is used by a system that offers a multifactorial analysis of patients with cognitive impairment as a basis for therapies to be adopted. An AI approach analyzing the morphology and function of the human heart from cardiac MRI was implemented by a medical AI company to monitor changes in the heart that reflect underlying subclinical conditions or diseases and help identify patients at risk of myocarditis. The application of a convolutional neural network system for analyzing the vascular structure, blood flow, and metabolic activity of the heart simultaneously enables early identification of heart failure at the subclinical stage, when therapy is more effective in preventing illness.

2.3.1. Cancer Diagnosis

Cancer diagnostics wield the highest promise of revolution with AI-based systems, and that is evident by the surge in research articles solely investigating these settings. Tools such as Inception and CellNet have paved the way for AI algorithms that help screen and diagnose a variety of cancers—not just predicting diagnosis but also classifying them. Cancer, which arises due to genetic anomalies, is currently diagnosed using department-specific imaging techniques such as mammograms, PET scans, and tissue biopsies, which are visualized using optical microscopes (Kothapalli et al., 2022). Therefore, multiple AI-powered imaging and pathology technologies have been developed for a myriad of organs and tissues, assisting in the early detection of disease as well as classification. Indeed, some AI tools are already part of hospital workflows with proven sensitivity.

AI is already improving medical imaging directly; thus, the exponential growth of validated AI solutions in medical imaging signifies this. For example, 9,000 DIMs are added to PubMed yearly, with 85 PET and 20 mammography AIs in clinical trials. However, it is also analyzing data such as genetics. AI has jumped onto genetics for many different purposes, such as predicting patient diagnosis, drug response, or patient survival from genetics. Although the genetic data available is still lower than the imaging data, with 500 DNA Dexcoms analyzed last year as opposed to 1.5 million digital mammograms, genetic data is easier to acquire than imaging data, requiring less data cleaning. Using both genetic and electronic health records results in 1.15 million data points monitored by AI—an amount of data that is available today. However, AI has the perception of not just drug response and diagnosis, but the prediction of mutations to potentially offer personalized treatments. The combination of AI-powered imaging and AI-powered genetics will revolutionize healthcare—they can and will be integrated.

2.3.2. Neurological Disorders

Neurological disorders: The growing widespread availability of medical imaging has generated massive amounts of data that can be analyzed by AI. The beginning of deep learning and, in particular, machine learning has vastly improved the ability of these systems to interpret, for example, EEG and MRI scans in a manner that is isomorphic to trained human neurologists. These systems have been shown to identify subtle imaging features that drive complex modeling processes that aid with diagnosis. This relatively impenetrable series of statistical heuristics relies on cloud-based processing power to interpret explicit digital imaging laboratories. Where pathological features can be extracted, particularly in long-term memory processes, for example, concussed athletes or neurodegenerative disorders, we may see application as an aid to existing diagnostic pathways. Other applications are ceaselessly within the pharmaceutical or therapy development platform, where the ability to assess cognitive behavior on a near basis offers an efficient manner in which to track beneficial therapeutic effects. Such use cases are increasingly being developed with a significant market for such platforms being realized.

Another application was a smartphone-based neuropsychological battery as a tool for the assessment of cognitive and mood differences over time in patients undergoing invasive brain procedures. Using deep learning, they began with a dense neuropsychological battery with these unique advantages related to an individual diagnostic footprint with items, which prompts patients to make a range of medical, psychiatric, cognitive, and functional targets between tasks. A series of common behavioral response variables for comparisons of interest were used for this present work in comparison to former work, which included a standard cohort of age and education-matched healthy adults that completed all basic items, of whom completed the follow-up session following functional neuroimaging. Interpretations of the application of AI in neurology are mixed, with many concerned about data use, data storage, consent, data licensing, and as yet unquantified risks associated with the treatment of subjective medical or cognitive dysfunction in neurology, where biopsychosocial information is currently at a per capita minimum. Despite concerns, collaboration between AI digital neurotechnology and traditional clinical expertise could be a strong and relevant digital training for employees. Thus, these AI diagnostics and assistive digital technologies, if built from reliable neuroscience, need to depend on modally inclusive neuroscience. In AI digital neuroprosthetics, the conceptual framework leaves no doubt as to the centrality of neuroscientific knowledge, augmented and integrated through the principles of AI. The new revolution is not in the description, but in the modularity – in the execution, and the cascade inception and sensory real estate opportunities in the installation of AI latticework both for devices (Subhash et al., 2022).

2.3.3. Cardiovascular Diseases

Macrotrends such as aging and the sedentary lifestyle contribute to a rapid increase in cardiovascular and cerebrovascular diseases. Currently, cardiovascular diseases are on the rise for the first time after a large decline; it is predicted that the number of stroke incidents and deaths could rise by approximately 50% by 2025. In such a context, the primary and secondary prevention of these diseases is based on lifestyle advice (diet, activity, etc.) and medical care (treatment of acute diseases and diagnosis of chronic diseases, often using medical imaging). The role of AI can be pivotal in two of these domains. In the early diagnosis of chronic heart disease, the goal is to propose the appropriate surgery more quickly and with the lowest risks. Many research groups have shown that it is feasible to analyze images from various angles to build 3D models of the heart, to collect one or many 3D+time images during each heartbeat cycle, and extract a number of biomarkers or others. One can combine such data with those of the patient and propose intervention strategies that are tailor-made for a given patient. Arguably, the performance of such techniques is often better than that of a human expert.

Other groups focused on the detection of diseases in 2D/3D images such as arrhythmias, hypertrophy, or others. One of the most popular applications of AI is used to assess the instantaneous risk of a disease such as aneurysm or valve dysfunction in real-time. With the advances of imaging devices, echocardiograms and angiograms in particular, we now have the possibility to collect one or many images per second and to perform interpretation in real-time. This is essential when the risk evolves very quickly, as in the case of arrhythmias. A lab has proposed to show in real-time information about flow risk in the heart on models of the heart. They have also shown that it was feasible to propose a graphic tool that uses angiograms to predict stenosis. There is even a startup that uses deep learning to extract real-time information about muscle contractility with convolutional networks and use it to help design medical devices. Examples of successful case studies having developed and validated data-driven tools applied to clinical practice are listed below. Because of the speed and scale of deployment of such systems, some ethical issues must be considered, in particular: patient data protection, auditability, interpretability, transparency, monitoring of systems for hidden bias or unintended consequences, and algorithmic accountability. There is also a movement towards medical crowdsourcing to address the limitations of using clinical experts to label problems and the possibility to capture crowdsourcing via extensive data. While these applications have traditionally been developed in research contexts, we are entering an era where AI systems can be deployed at scale in a clinical context with a view to preventive care and the earlier and more efficient management of patients with or at risk for cardiovascular disease. Relevant skills include: non-medical feature engineering with different data types both from the hospital and from devices, deep learning for temporal and spatial data especially for high temporal resolution signals, Bayesian statistics, etc. The diagnosis of stroke or other acute cardiovascular diseases aims to propose an appropriate treatment as quickly as possible to avoid permanent disability. With the advances in AI, we now have access to machine learning algorithms that are able to predict a given disease in minutes or less compared to a gold standard. They can be directly applied to incoming patients for whom we have several potential diagnoses. This is a game changer for the management of patients: it has been demonstrated that the percentage of patients for whom a correct diagnosis has been made increases significantly when such tools are used (Sondinti et al., 2023).

2.4. Case Studies and Success Stories

In ophthalmology, deep learning techniques were applied to retinal fundus photographs — images of the inside of the eye — to recalibrate AI. The research demonstrated that placing predetermined weights on medical coders' opinions and views allows AI to outperform the interpretation of a single human expert. To do this, leveraging was performed: following an initial pass by the AI, what the AI suspected was the diagnosis was passed on to three medical coders (standard and senior retinal specialists), who corrected or upheld the AI identifications. With a larger dataset, the AI was retrained. Whereas in the first cycle the AI was correct only 16% of the time, after this re-evaluation exercise the prediction rose to 57% for the most pertinent diagnosis and 95% for the top three candidate diagnoses. The AI interpretation was henceforth 13% more accurate than any single individual coder, and more accurate than the adjudicated majority decision of retina specialists. This 'educated guess' was made possible by retraining the AI with a larger dataset and augmenting human sensitivity thanks to their initial corrections of the AI system.

Fig 2 . 3 : AI in Improving Diagnostic Accuracy

In Kansas Hospital, a previously trained algorithm was used as the first reader of all chest X-rays obtained in the emergency department. After this first reading, the requests of the team of radiologists were received through the picture archiving and communication system, and radiologists proceeded to assign an interpretation to the X-rays (Vankayalapati et al., 2023). The software employs natural language processing and relationship analytics, based on both categoricals and continuous variables, to classify the severity of COVID. Being highly predictive of death or hospital admission, the inclusion criteria were met in 10,527 patients. A shortlist for discharge was derived from the patient list using guidance and the expert opinion of four board-certified internists. The models comprising only demographics and comorbidities exhibited discrimination and performed well in hierarchical groupings with a bimodal interpretation. The final model applied to the Kansas cohort effectively discriminated against a large subset of patients that were not likely to be hospitalized. All accuracy scores were superior to random chance.

Equation 2 : Classification Function:

$$P(y|x) = \frac{e^{f(x,\theta)_y}}{\sum_j e^{f(x,\theta)_j}}$$

$P(y|x)$: Probability of class y (e.g., disease present or not),
$f(x,\theta)$: Model's score for each class,
θ: Model parameters.

2.4.1. Real-world Examples of AI in Medical Diagnostics

4.1. Real-world Examples of AI in Medical Diagnostics. Besides discussing the background, challenges, technologies used, and outcomes, we also provide detailed real-world examples of the application of AI in a number of different disease domains, including macular degeneration, diabetic retinopathy, breast cancer, dermatology, pathology, and infectious diseases. These examples illustrate the range of current applications of AI in medical diagnostics, the real-world challenges and solutions, the range of technology platforms being used, and the specific design choices and expertise required to develop successful AI solutions. An empirical focus is essential to illustrate and evidence the transformative potential of AI in relation to medical diagnostics, real-world clinical pathways, technologies, and disease types. Moreover, AI applied in diagnostic settings can have the ability to produce more accurate and timely disease detection before the disease phenotype can be observed. For detecting diseases, it is particularly important to have evidence of the performance at a patient level and not just an image level.

We also emphasize what can be learned from these examples for future applications and diagnostic practices. In fact, AI continues to have a significant impact in medical diagnostics across different diseases and disease domains. As AI in medical diagnosis continues to grow, AI clinical trials supported by real-world evidence and informative case studies or audit papers are essential to maximize the learning opportunities in designing, interpreting, and implementing machine learning systems for medical diagnostics. A parallel success story in this field is the development and commercialization of AI algorithms that diagnose diabetic retinopathy from retinal images. Similar real-world evidence on the use of AI in other elements of retinal imaging and diagnostics is also available. Interestingly, the ability to diagnose diabetic retinopathy has also created potential applications in other diagnostic areas such as identifying relevant systemic diseases or conditions from retinal imaging.

2.5. Future Directions and Ethical Considerations

In the coming years, better, improved, and more sophisticated AI algorithms will be developed, specially optimized for medical diagnostics. The algorithms will be trained with much more data, providing greater accuracy, early detection, and generating reports. The cost of performing these tests is anticipated to reach a more reasonable price range, primarily due to economies and improvements in the equipment used. Individualization and personalization of medicine will be further explored using AI by combining genomics, microbiomics, and imaging modalities to make results more precise. Also proposed as an option is a continuous health monitoring system that employs machine learning for predictive analytics and the diagnosis of diseases at an early stage and/or prior to the development of clinical symptoms. Today, ethical issues and patient concerns about the potential misuse of personal health information and negative consequences are being discussed. Several questions regarding the use of machine learning within the research domain should be addressed. For example, how much bias is acceptable within ML models used for clinical decision-making and outcome predictions? Further, how can we ensure greater transparency and responsibility of the results and models for the patients and society?

The wider implementation of ML in healthcare will require an extensive regulatory and policy discussion. Informed and explicit consent for data use and the development of AI and ML models is a legal requirement but remains challenging in practice, particularly in population-based screening programs. Moreover, with the rapid spread of AI in medicine and the increasing complexity of the models and data used, it will be important to have guidelines and best practices in place to ensure that both patients and society can trust and pressure test the new technology. The use of systems with unknown decision-making processes can also involve algorithmic accountability if there are adverse outcomes for patients. Indeed, the discussion about the role and responsibility of the people using, developing, and testing the AI and the related algorithms does not touch only the field of radiology and medical diagnostics but involves all the actors within the development of ML algorithms and their clinical deployment. The interest in improving them is high on all sides of the stakeholders. The most interest will take place in seeing how these trade-offs come into play in order to make progress on developing more widespread and responsible uses of these tools (Maguluri et al., 2022).

2.5.1. Emerging Trends in AI and Medical Diagnostics

The domain of AI and medical diagnostics warrants a special mention in their rapid growth and development in terms of technological sophistication and advancements. These include the development of various deep and machine learning algorithms, along with advancements in NLP to make data accessible and analyzable. With the advent of such techniques, machine learning algorithms are continually becoming better in terms of disease diagnostic accuracy as well as diagnostic speed. The integration of advanced techniques in machine learning algorithms has made the diagnostic accuracy reach up to 99.9 percent, with a diagnostic speed of around 4 to 6 seconds. Current technologies and trends indicate that remote monitoring, telemedicine, and other digital resources are transforming the clinical space. However, in order for it to be optimal, doctors will need to stay informed about these technology trends. This describes a number of these trends, including remote patient monitoring integrated with electronic medical records and predictive analytics, smart home technology that can track quality of life, tracking of blood pressure and glucose values by cellphones, and augmented and virtual reality platforms that enable doctors to better collaborate on patient care, illustrating some of the profound patient and provider benefits. There are several other notable emerging trends and uses of AI in the medical field, including Closed Loop Spinal Cord Stimulator, Personalized Medicine, and DNA Analysis.

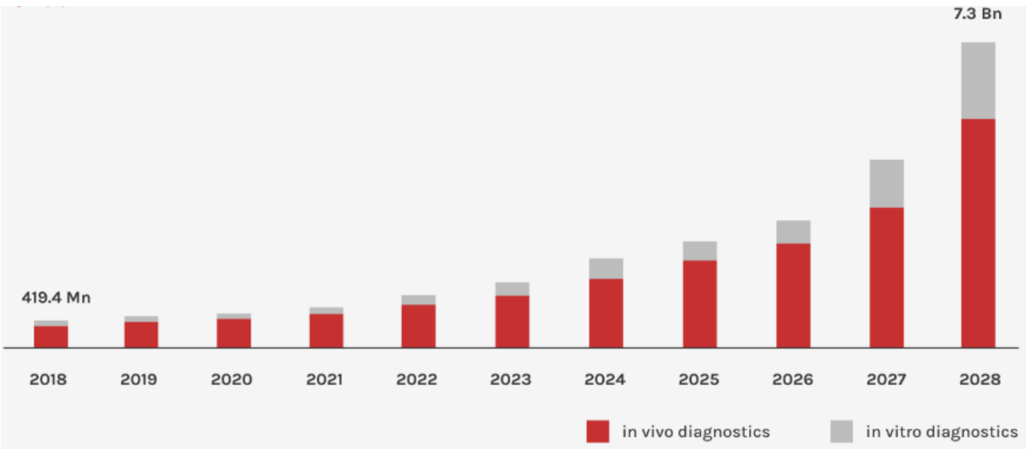

Fig 2 . 4 : Role of AI in Medical Diagnostics.

2.5.2. Ethical Implications of AI in Healthcare

Subsection 5.2. Ethical Implications

Given the potential utility and reliance on data, ensuring human autonomy and privacy will become major concerns. There are several potential societal challenges, but crucial among them will be working to ensure that data privacy is respected. It will not matter if using AI allows for faster, cheaper, and more effective health care if individuals do not trust the technology. AI models developed from data with inequalities may reproduce and reinforce these inequalities. There is, thus, interest in understanding and interrogating sources of AI system inequalities and ensuring that AI tools do not exacerbate bias or lack of fairness. Despite these concerns and issues, AI in medical diagnosis, while an area of use directly impacting patient care, likely involves fewer or less serious ethical issues than in other AI applications. The use or misuse of personalized information and medical health data may be the major motivation for the political and other misuse of medical data.

Medical diagnosis is conducted remotely, rather than with face-to-face interaction; this restriction must be bypassed in some way. There are also concerns surrounding the malpractice of AI algorithms, where computation or regulatory algorithms may create a situation where a data-sharing organization is no longer in legal possession of its own information. As with other settings, the capacity to appeal against the decision that an AI system makes about one's healthcare could be curtailed. Ethical guidelines concerning the ethical use of AI in the medical diagnosis and treatment process are vital. Requirements for making use of AI in health care responsive to human rights need to be put into effect to avoid negative consequences. There is a need for a stronger focus on the ethical use of AI in diagnostic health care to ensure that health care can offer a positive therapeutic benefit to the patient. Policy measures are necessary to create frameworks that guarantee that the development and testing of AI medical-diagnostic algorithms are able to show the trust of all stakeholders. The involvement of possible end users in the testing and validation of AI medical-diagnostics must be in place. Informed consent to make use of AI in medical diagnostics must be freely given.

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