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Role Of AI In Healthcare

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Abstract: **-**The study ends with suggestions for more research aimed at enhancing VHA capabilities and examining the moral issues that arise when AI is employed to provide medical care. One of the main areas of study in computer science is artificial intelligence (AI). AI will be especially useful in ophthalmology and will significantly alter the diagnostic and therapeutic approaches for numerous eye disorders, including diabetic retinopathy, age-related macular degeneration, corneal ectasias, and glaucoma, despite its widespread use in many medical specialties. AI is being used to detect clinical conditions in medical imaging and diagnostic services, control the COVID-19 outbreak with early diagnosis, manage electronic health records, improve patient engagement and treatment plan compliance, reduce the administrative burden of healthcare professionals (HCPs), find new medications and vaccines, identify medical prescription errors, store and analyze large amounts of data, and provide technology-assisted rehabilitation. However, in integrating AI into healthcare, this science pitch addresses a number of technological, ethical, and social issues, such as privacy, safety, the right to choose and try prices, information and permission, access, and efficacy.

***Keywords* -** *artificial intelligence, patient involvement, privacy, safety, and retinopathy*

I. Introduction

The goal of the quickly developing discipline of computer science known as artificial intelligence (AI) is to build machines that are capable of carrying out tasks that normally call for human intelligence. AI encompasses a number of methods, including natural language processing (NLP), deep learning (DL), and machine learning (ML).An AI program known as massive Language Models (LLMs) makes use of deep learning methods and incredibly massive data collections to comprehend, condense, produce, and forecast new textual material [1, 2, 3]. In order to maintain the sustainability of health systems, health systems around the world are at a crossroads due to exponential healthcare cost developments that have significantly surpassed GDP growth rates[4].AI is expected to play a significant part in a number of healthcare delivery domains, such as patient management, prognosis, and diagnosis [5].Robots can use information to solve problems thanks to artificial intelligence (AI), a field of algorithm-based software. It might mimic the intellectual processes and cognitive processes of humans. In the information era, artificial intelligence (AI) is widely used in the medical field and can aid in the development of novel medicines. AI has the potential to reduce medical errors, enhance the treatment of patients with chronic illnesses, and find specific medications for complex disorders [6].The power of AI lies in its capacity to identify patterns and connections in vast multidimensional and multimodal datasets; for instance, AI systems could convert a patient's complete medical record into a Ms Co number that indicates a likelihood Identification [7,8].Artificial Intelligence (AI) is the science and engineering of creating intelligent computers that replicate human cognitive processes like learning and problem solving by using algorithms or a set of rules[9].In the US, there are still several issues with the availability and quality of these services. On the one hand, health data collection and distribution are particularly difficult when compared to other forms of data because of privacy concerns. Furthermore, health data is typically closely guarded after it is gathered because it can be costly to collect, particularly for clinical trials and longitudinal studies. Furthermore, even the most basic computational techniques are hampered by the incompatibility of electronic health record systems [10]. There are now two primary categories of AI. The first category is expert systems. An expert system is a computer program that, when closely watched, can produce forecasts and make judgments more accurately than human decision-makers.It consists of a knowledge base and an inference engine. Foundation, two interdependent subsystems. The inference engine, which functions as a reasoning system, may access the present state of the knowledge base and add new information to it, while the knowledge base itself contains the collection of accumulated experiences. Expert systems can generate more crucial information for the system, speed up prototyping, and make maintenance easier [11].Biased algorithms in the medical field may cause some patient populations' risks to be overestimated or underestimated. Humans are biased, of course, and the concept of bias is complicated. However, it might be feasible—and hence morally required—to create AI systems that counteract human prejudices and produce more equitable, but still imperfect, results [12] Specifically, cloud computing is making it possible for safe and efficient AI systems to be incorporated into the delivery of general healthcare. When opposed to the traditional "on premises" infrastructure of healthcare organizations, cloud computing offers the computational capacity for the analysis of significantly larger amounts of data at faster rates and cheaper costs. In fact, we see that a growing number of technology companies are looking to collaborate with healthcare institutions in order to promote cloud computing-enabled AI-driven medical innovation and technological transformation [13, 14,,15]. AI uses a variety of techniques and methods, such as those from biology, logic, and mathematics. The ability of modern AI technologies to comprehend a wider variety of recent years is machine learning, which serves as the foundation for many of the applications that are currently in use [16]. The aging of the world's population and the rise in chronic sickness have long put pressure on healthcare systems. This has become more evident since the COVID-19 pandemic, which drove many healthcare facilities to their limits. During major outbreaks, a large number of patients with COVID-19 and other unrelated illnesses were treated in temporary facilities and through telehealth technologies [17, 18]. Governments, payers, regulators, and providers are facing pressure to innovate and change healthcare delivery models due to the world's aging populations, increasing burden of chronic diseases, and rising healthcare costs. Furthermore, healthcare systems are facing challenges in both "performing" (providing efficient, high-quality treatment) and "transforming" care at scale by incorporating real-world data-driven insights directly into patient care, given the current worldwide pandemic. The pandemic has also brought attention to disparities and shortages in the healthcare workforce. Regarding care access, as previously stated by the World Health Organization and The King's Fund [19, 20].

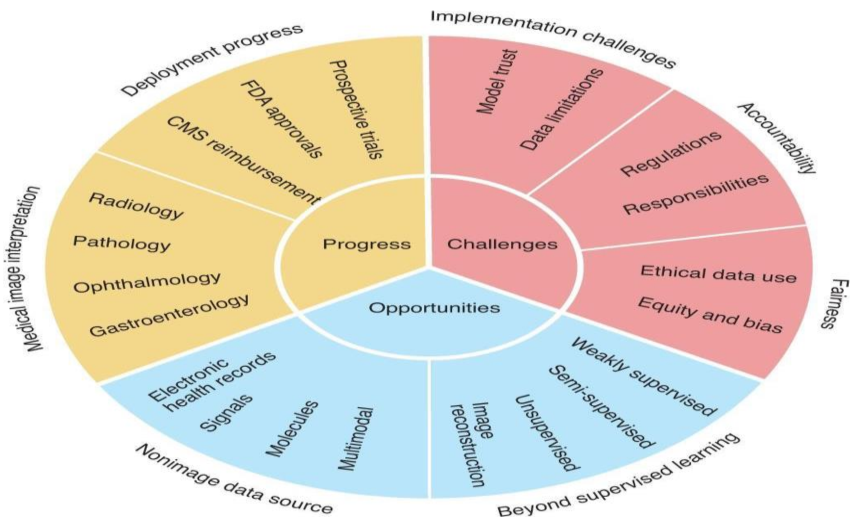


Fig. 1. Healthcare AI

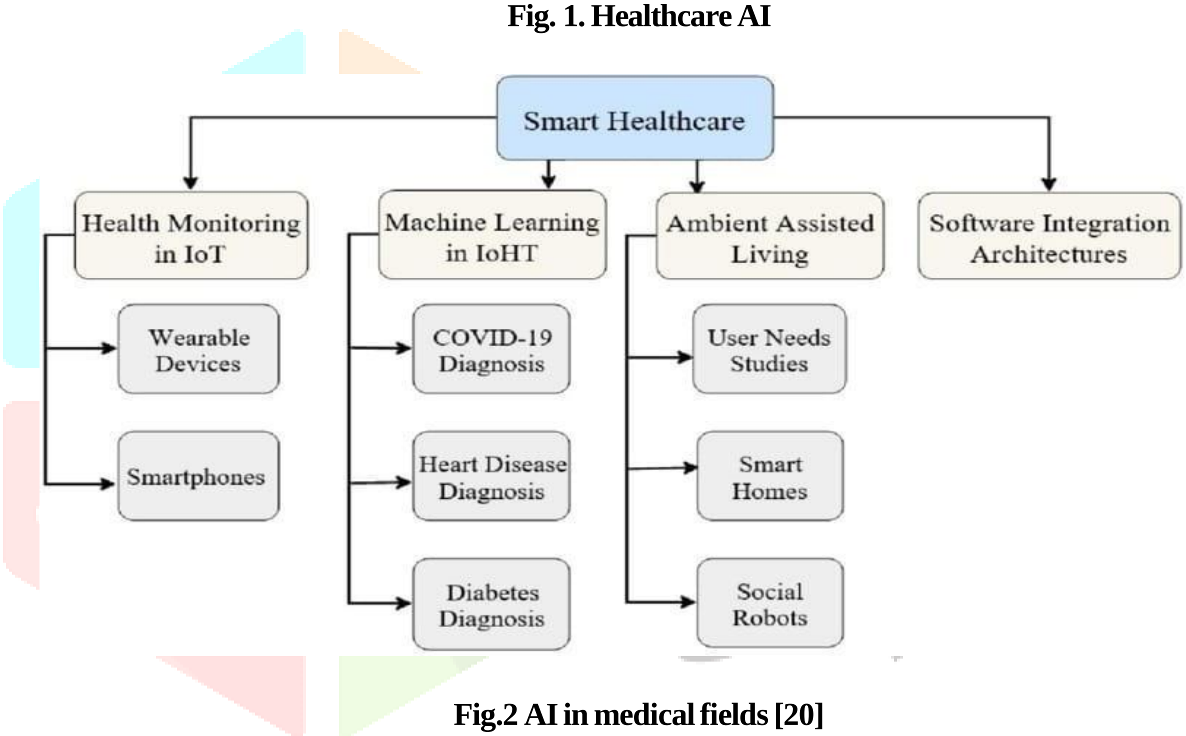


Fig.2 AI in medical fields [20]

Advantages-

- Improved diagnosis through data analysis.
- Administrative and regular duties.
- Digital consultations and health monitoring.
- Quicker drug development and research.
- Boost the precision of surgery [21, 22]

DISADVANTAGES-

- Cost and difficulty of implementation.
- Potential loss of employment.
- Difficulties with training.
- Difficulty with change. [21, 22]

ROLES IN AI HEALTHCARE

Diagnostic and Imaging Services for medicine – In order to address the strict requirement of promptly and effectively managing COVID-19 cases, earlier research described the use of transformers in distinguishing COVID-19 from pneumonia using X-ray and CT images. The primary purpose of medical imaging technologies is diagnosis. The process of determining a patient's illness and symptoms is known as medical diagnosis. The medical diagnosis, which is gathered from the patient's medical history, provides the information about the disease or condition that is required for therapy. [23, 24, 25].

1. Virtual patient care -A smart device, like a tablet, has been proposed to serve as an interface between the patient and the sensors, and the collected data is sent to the cloud for storage and data analysis for elderly care. Virtual patient care: A study suggested a smart sensor system based on a combined sensor network to observe a person's home and environment and obtain data on a person's health status and behavior. The recommended platform includes wearable, biomedical, and non-intrusive sensors that monitor physiological variables like blood pressure, respiratory rate, pulse rate, breathing waveform, and ECG[26].
2. Medical research and drug discovery - ML helps with the pretrial stage of clinical trials by selecting the cohort, arranging participants, and gathering and evaluating data. It can improve clinical studies' efficacy, generalizability, patient-centered perspective, and success rate. However, in clinical trials, ML has to focus more on its philosophical and functional challenges. Natural language processing (NLP), in addition to machine learning (ML), has shown promise in a number of ways to improve participant management in clinical trials; nevertheless, it is unclear how these technologies will affect the caliber of clinical trials and participant satisfaction. To enhance participant management, further study comparing various approaches might be carried out. The goal of early-phase drug discovery is to identify highly promising synthetic compounds, semi-synthetic derivatives, or naturally occurring chemicals that exhibit a discernible influence on different stages of a disease by advantageously regulating a specific biological signalling cascade or cascades. From the perspective of medicinal chemistry, this procedure is somewhat intricate, frequently takes a long time, and entails numerous theoretical and experimental studies as well as numerous optimization processes within certain areas of this scientific subject [27,28,29].
3. Engagement and compliance of patients-The "last stretch" problem in healthcare is patient engagement and compliance, which is the final barrier separating better and worse health results. When a patient does not follow a prescribed treatment plan or take their prescribed drugs, this is known as non-compliance. Health outcomes, such as healthcare use, cost, and patient experience, are likely to be better for patients who are actively involved in their care [30]. The enhancement and personalization of patient- provider interactions is referred to as "patient engagement." Through personalized communication, AI improves patient education, treatment compliance, and healing care experiences [31].

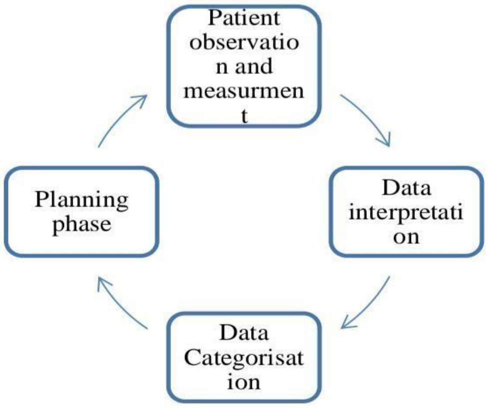


Fig.3. Patient involvement and the system for delivering healthcare [33]

4. Rehabilation -AI in rehabilitation can improve patient care by supporting physiotherapists in a number of ways, such as by offering a comprehensive evaluation and patient predicting. Performance, making a determination. AI can also be used for problem solving, x-ray diagnosis, and best practice guidelines in medical and rehabilitation settings [32]. Dexterous or soft robotic hands were used for simple mobilization in patients with musculoskeletal disorders. But the treatment's long-term effectiveness hasn't been proven yet [34]
5. Administrative application -Another technique, machine learning (ML), can be used to match data from many websites in relation to payment administration and claim[35].
6. Source of artificial intelligence in healthcare – Fig.5 Key elements of AI in Healthcare

CHALLENGES OF AI IN HEALTHCARE –

Ethical and social -Concerning accountability and transparency, questions are raised regarding the responsibility of AI-generated judgments and the restitution for those impacted by AI use. Particularly with ML technologies, there are problems with error or data bias recognition and AI output authentication that may be primarily opaque because of the way they continuously assess their own boundaries and standards [36].These cyber threats can be identified and avoided with the use of predictive algorithms. It is crucial to thoroughly examine cybersecurity and the cyber risk environment of

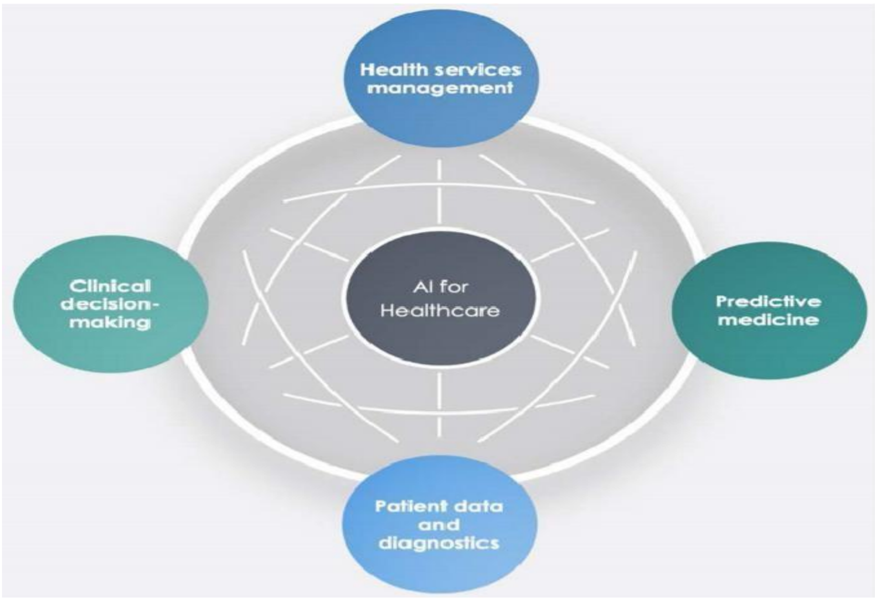


Fig.5 Key elements of AI in healthcare

Health care systems in order to protect data privacy and preserve system integrity [37,38]. People have always worried that their jobs may be lost due to artificial intelligence (AI) in healthcare. Because they fear being replaced, some people have doubts about and are even antagonistic to AI- based projects. However, this viewpoint is mostly predicated on a misunderstanding of artificial intelligence in all of its forms. Even if we disregard how long it will take for AI to get to the point where it can effectively replace medical professionals, the introduction of AI does not mean that jobs would become obsolete [39].

1. Governance – There is a chance to appropriately address these concerns in the application and use of AI through active governance at the hospital level [40]. Furthermore, a recent study discovered that patient safety and healthcare system responsibility depend on the regulation of AI technology at the system level. Significant health implications are made achievable by such governance, which also boosts clinician confidence and acceptance. When implementing AI-powered apps, the governance framework should be all-encompassing to handle the difficulties pertaining to the clinical, operational, and leadership domains [41]. Potential biases in AI models, patient privacy protection, and winning over doctors and the public to the use of AI in healthcare are the three main obstacles. [42].

2. Technical -To solve the problems with cost, technology infrastructure, and the use of AI systems by HCPs, health providers should create and carry out a strategy plan for integrating AI in healthcare. A major barrier to widespread adoption of AI-based clinical decision support systems is that healthcare professionals frequently mistrust or have a poor understanding of them due to unknown hazards. To improve end-user confidence and overcome the limited adoption of AI in such situations, XAI solutions are prioritized [43].

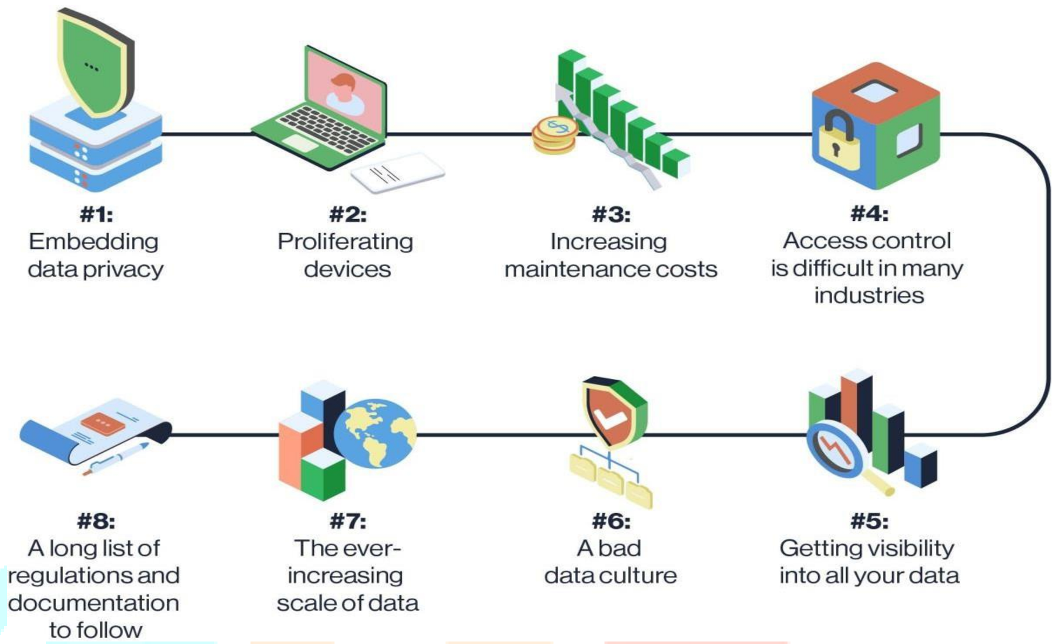
LIMATIONS OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE –

A single research database, like Scopus, might be restrictive. The PubMed, IEEE, and Web of Science databases might all be examined further, both separately and collectively, with a focus on the health sections. Ten, it can be overly generic to use search phrases like "Artifficial Intelligence" or "AI" along with "Healthcare." And Omit intriguing research. Furthermore, even though we examined 288 peer- reviewed scientific articles, the analysis of conference papers may yield intriguing findings for further research because the new issue is novel. Furthermore, because this is a relatively new field of study, the analysis will frequently become outdated as more studies are released. Lastly, even though bibliometric analysis has reduced the analysis's subjectivity [44]. The varied linguistic and cultural backgrounds of the whole patient population could not be well represented in the data sources utilized to train and evaluate the natural language processing models [45]. Important restrictions are presented by privacy and ethical issues. The study must fully handle patient privacy and data security even as it places a strong emphasis on improving patient engagement. Sensitive health data is processed by virtual health assistants, and any compromise or improper use of this data could have detrimental effects on patient involvement and trust [46].

AI's lifetime of risks to data privacy and security-

A taxonomy of machine learning-related security and privacy vulnerabilities was created. According to the taxonomy, those attacks fall into three groups: (1) attacks directed at classifiers; (2) attacks that compromise confidentiality by compromising integrity, availability, and privacy; and (3) as saults that may or may not be particular. They also provide an overview of the defense strategies used during the training, testing, and inferring stages of the machine learning life cycle. For instance, they highlight data sanitization strategies used during the training stage to prevent data poisoning attacks and privacy preserving strategies used during the testing or inferring stage to prevent privacy attacks[47].

Fig.5 Threat lifecycle for data privacy and security [47]



Phases –

1. Data collection and processing phase - For many forms of generative AI in healthcare, biases and errors also rely on the data sources. For instance, putting together chemical compound or protein structure databases and genomic databases for drug discovery is very difficult and may be prone to errors because many of these databases are inconsistent in format, lack the required annotations, and have low-quality data [48].

2. Model training and building phase – In the medical field, where integrity and responsibility depend on knowing the rationale behind a diagnosis or recommended course of treatment, the absence of interpretability and explainability can be a major problem. One technique to assess the responsibility and integrity of AI models is adversarial training. The technique checks for output robustness and integrity by attacking the training model with properly constructed adversarial instances [49,50].
3. Implementation phase – Large amounts of annotated medical data are necessary for training GANs and LLMs; yet, the challenge of obtaining such data (such as reluctance to contribute due to regulatory compliance requirements or data scarcity from uncommon medical illnesses) encourages the development of synthetic medical data. Research and practice on the connection between synthetic data utilization and AI hallucinations by GANs and LLMs are still in their infancy, which could result in unidentified weaknesses like adversarial attacks. At this point, privacy threats are a serious problem. Ghosheh et al. examine the privacy issues around the usage of GANs to create synthetic EHRs[51].

Artificial intelligence responsibility in healthcare-

This metric focuses on how AI, particularly generative AI, is unique in terms of "human centricity, social responsibility, and sustainability." To put it another way, AI responsibility is a complex concept that depends on a wide range of other metrics and elements, including the legal and ethical frameworks (such as accountability and traceability) and biases, fairness, and transparency. Additionally, this is a new idea that is being developed [52].

Prospect AI in healthcare in the future –

Governments should invest in and support the modernization of healthcare organizations if these technologies are crucial for managing health services and treating patients. As in the European situation with the Next Generation EU program or national investment programs, new investment monies could be made available in the healthcare sector [53]. In order to lessen the variation between studies, it is critical that future research establish reporting standards. Future problems will also arise from the commercialization of AI. It is probable that AI MLCs will be marketed alongside and used in conjunction with specific medical technologies. Anticipating conflicts of interest will be crucial, and this may resemble the safeguards in place when working with financially interested medical companies [54]. The caliber of the dataset used to train and validate AI software determines its limitations. Predicting how many training photos a dataset will require can be difficult; it is common to believe that the more images, the better. Excessive datasets, however, reduce training efficiency and may cause the MLC to over fit to the training dataset. For increased external validity, the collection should also include photos from a diverse range of demographics [55]. Because of the quick spread of sophisticated AI and ML applications into the fields of digital health, law, transportation, finance, and defense, exploitability is becoming more widely acknowledged as a critical concern. AI in optical research is challenging. AI software's capabilities are determined on the quality of the datasets used for training and validation. It can be challenging to predict how many training images would be required in a dataset, despite the apparent logic that the more shots, the better. An excessive number of data sets reduces the effectiveness of the training process, and the MLC may overfit the training dataset. The dataset should also include photos from a range of demographics for better external validity. Algorithms may not be applicable in every scenario; minor variations among machine brands may have an impact on the correctness of the evaluations. In order to reduce the size of the dataset and the algorithm's complexity, it may also be helpful to restrict the number of classifications in a program to those that have substantial prognostic importance [56, 57]

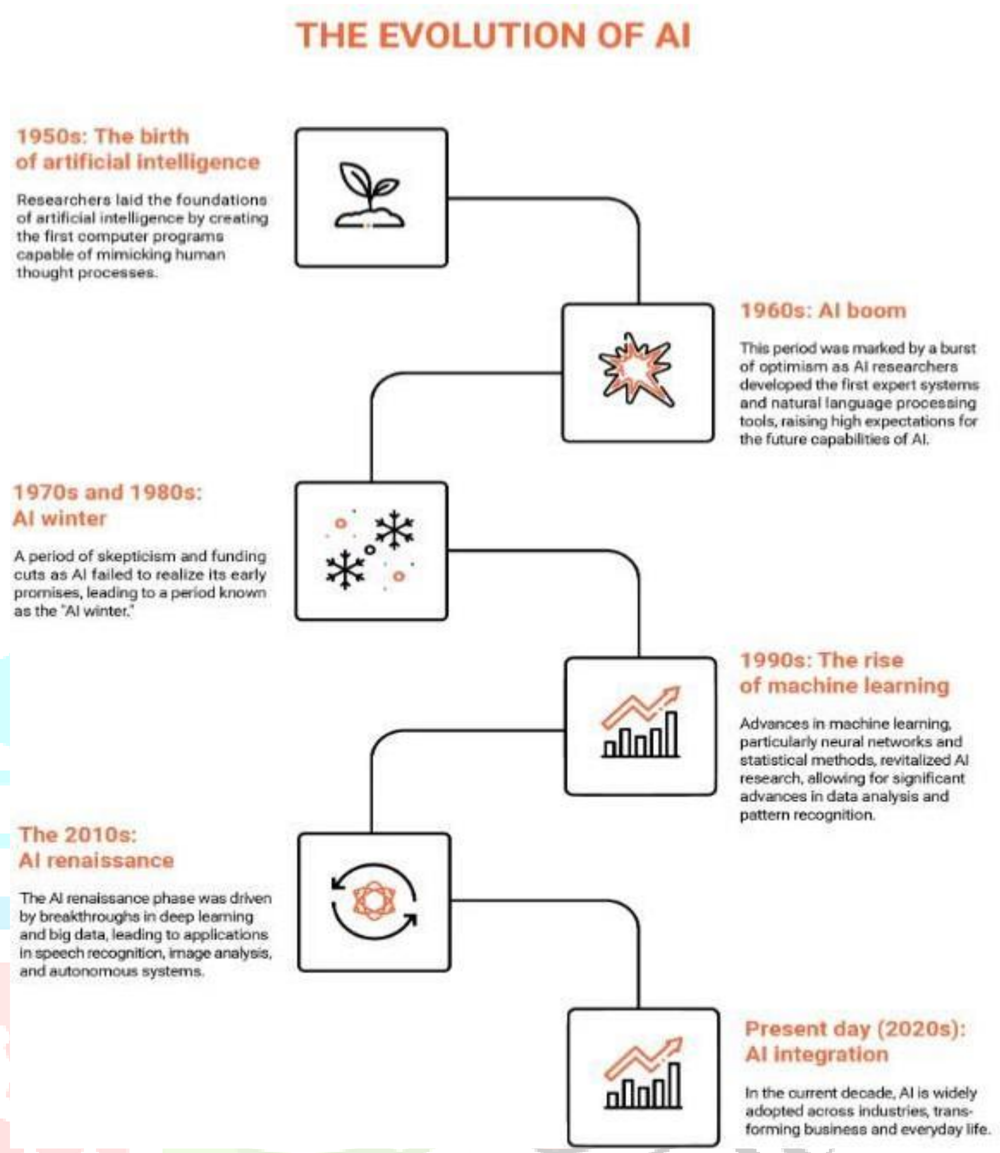


Fig. 6. Future prospects for artificial intelligence in healthcare

Conclusion - AI has the potential to greatly reduce healthcare inefficiencies, improve patient flow and experience, improve care provider experience and patient safety, improve lives, and address complex challenges in a variety of disciplines, from business and environmental sustainability to healthcare education. AI is being used to detect clinical conditions in medical imaging and diagnostic services, control the COVID-19 outbreak with early diagnosis, manage electronic health records, improve patient engagement and treatment plan compliance, reduce the administrative burden of healthcare professionals (HCPs), find new medications and vaccines, identify medical prescription errors, store and analyze large amounts of data, and provide technology

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