

Artificial Intelligence Application in Medical Diagnosis, Treatment Recommendations and Patient Care

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Abstract: The use of AI in healthcare continues to gain momentum with studies confirming its effectiveness in diagnosing some chronic illnesses, increasing staff efficiency, and improving the quality of care while optimizing resources. The article discusses current trends and achievements in the automated analysis field of medical images, laboratory diagnostics, as well as in the personalized medicine field. Special attention is paid to the artificial intelligence application for the treatment plans development and real-time monitoring of patients' condition.

Keywords: Artificial intelligence, healthcare, medical diagnosis, treatment, personalized medicine, ethics, patient data.

1. INTRODUCTION

In today's world, the artificial intelligence (AI) role is becoming increasingly important in various fields and one of the most promising is healthcare. Artificial intelligence (AI) holds great promise for delivery improving of medical and healthcare services around the world but only if ethical principles and human rights are at the forefront of its development, implementation and use.

The use of artificial intelligence technologies in the medical field opens up new horizons for diagnosis, treatment and patient care. This study relevance is due not only to the rapid technology development but also to the constant increase in medical data volume faced by doctors and healthcare systems.

The research purpose is to study the artificial intelligence application in healthcare with a focus on medical diagnosis, treatment recommendations and patient care.

2. ANALYSIS AND DISCUSSION

There is a shift towards the artificial intelligence (AI) use in healthcare across the world. This is partly because the healthcare industry is moving data management to the cloud and thanks to the cloud, data is now available in real time for further analysis. And instead of instructing employees to sort data manually it could be used the artificial intelligence power which will complete the task much more efficiently and in many cases more accurately[1].

Artificial Intelligence (AI) is a computer system or program capable to perform tasks that would normally require human intelligence. The main characteristics of AI include the ability to learn, adapt, analyze data, process information and make decisions and solve problems based on acquired knowledge[2].

Artificial intelligence is becoming an indispensable part of modern progress bringing its technological innovations to various areas and activity fields. This is leading to new technological revolutions and significant improvements in efficiency across the industries variety. At first glance, its impact is felt across various sectors providing many new perspectives and opportunities. Let's take a closer look at the main areas where artificial intelligence shows its influential characteristics:

- a. Technological innovation. Artificial intelligence is actively used in the development and technologies optimization leading to the completely new products creation and services. For example, autonomous cars are becoming an increasingly viable prospect where AI is used to recognize the environment and make decisions based on the collected data. Drones are being introduced into logistics, agriculture and filmmaking. AI-based medical diagnostic systems help identify diseases at early stages and make more accurate disease predictions;[3]
- b. Medicine and healthcare. Artificial intelligence is penetrating medical practice improving the diagnosis quality and treatment. Analyzing medical data using AI can reveal hidden patterns and dependencies facilitating early diseases detection and increasing the diagnoses accuracy [1,2, 4]. The personalized treatment regimens creation and medications that take into account the individual patients characteristics is becoming possible thanks to AI technologies.

Epidemic forecasting and infection modeling help to improve the public efforts effectiveness to control contagious diseases;

- a. Finance and banking. Banks and financial institutions are using artificial intelligence to analyze data and detect fraud. AI helps banks make informed decisions based on customer and market data, optimizes investment strategies and reduces risks. By personalizing ads and offers based on analytics data and customer behavior marketing and advertising companies increase the effectiveness of their campaigns and attract more potential customers [5,6];
- b. Industry. Manufacturing enterprises are actively implementing AI to automate and optimize production processes. Robotics and automation help improve productivity, reduce costs and reduce errors in production. Product quality control using AI ensures the final product higher quality which increases consumer confidence and improves the company's reputation [7,8];
- c. Marketing and advertising. Artificial intelligence allows companies to personalize their advertising campaigns and offers based on data about user interests and behavior. Data analysis allows you to predict the preferences and the audience needs, as well as determine the optimal time and channels for interacting with customers [9, 10].

Artificial intelligence is a promising direction. Every year it covers more and more areas optimizing production processes and increasing their efficiency. However, so far machines perform a very narrow tasks range and cannot completely replace human labor.

Artificial intelligence (AI) in medicine uses algorithms and software to approximate human knowledge when analyzing complex medical data. The main human health purpose applications is to analyze the relationship between prevention or treatment methods and patient outcomes. Artificial intelligence programs have been developed and put into practice to diagnose processes, develop treatment protocols, develop medicines and monitor the patient's condition. Healthcare remains one of the top areas for AI investment[11].

Artificial intelligence (AI) is playing a significant role in transforming the healthcare industry providing unique opportunities to improve the efficiency and healthcare services accuracy. One of the key AI application direction in this area is medical diagnostics. Automated medical image analysis systems based on deep learning algorithms allow detect pathologies on X-rays, CT and MRI with high accuracy. This not only reduces diagnostic time but also increases the detecting diseases likelihood in the early stages which significantly affects prognosis and the effectiveness of treatment.

Advanced AI algorithms are also used in laboratory diagnostics. They are capable to analyzing large data volumes from various analyses identifying hidden patterns and relationships between different parameters. This makes it possible to create more accurate and personalized disease forecasts, as well as optimize treatment strategies.

One of the important AI aspect in healthcare is personalized medicine. Algorithms for analyzing patients' genetic data make it possible to identify genetic predispositions to various diseases which makes it possible to develop individualized approaches to treatment. This includes selecting the optimal medications and therapies taking into account each patient's body unique characteristics.

The artificial intelligence (AI) development as a scientific direction became possible only after the electronic computers (computers) creation in the 40s of the 20th century. During this period, Norbert

Wiener put forward the cybernetics basic principles, thereby creating the foundation for future research in the artificial intelligence field.

In 1954, at Moscow State University, under the leadership of Professor A. A. Lyapunov, the seminar “Automation and Thinking” began its work. This seminar with the physiologists, linguists, psychologists and mathematicians participation is considered the historical moment when artificial intelligence was “born” in Russia.

In the 1960s and 1970s research led to the first expert system creation, DENDRAL, dedicated to organic chemistry. This system served as the basis for MYCIN, one of the first artificial intelligence systems in medicine. However, despite their importance, systems such as Internist-1 and CASNET have not been widely adopted.

The 1980s and 1990s saw the microcomputers proliferation and the global networks creation. The researchers concluded that AI systems in healthcare should be designed to draw on the physicians expertise and be designed to work in the perfect data absence. During this period, new approaches such as fuzzy set theory, Bayes networks and artificial neural networks were developed to reflect the evolving healthcare need for intelligent computing systems.

Since 2002, technology has made a big leap forward and IT giants and entire states have joined the artificial intelligence implementation in medicine. Today scientists hope that artificial intelligence will in the near future make it possible to move towards precision medicine taking into account the unique genetic and other each patient characteristics. New applications and systems associated with AI have a number of advantages such as increased computing power, expanding the available data amount and genomic sequencing databases use, the electronic health systems introduction and precision medicine pilot projects launched in the United States[5].

Artificial intelligence has been successfully applied in mental health field. Machine learning algorithms can analyze psychological and emotional data from patients to identify early developing mental disorders signs or episodes. It helps to identify and prevent possible problems early and provide timely treatment and support to patients.

Another application area of artificial intelligence in treatment is new drugs development. Artificial intelligence can help predict the interactions of different substances and their potential effectiveness in combating specific diseases. This speeds up the process of developing new drugs and can lead to more effective discovery and innovative treatments.

One of the significant AI application areas in medical diagnostics is medical images analysis. Automated systems based on deep learning algorithms are capable of identifying pathologies on X-rays, CT and MRI with high accuracy. This approach not only speeds up the diagnostic process but also improves the diseases detection in the early stages increasing the successful treatment chances.

In the laboratory diagnostics field, AI is also demonstrating its effectiveness. Machine learning algorithms are capable of analyzing a parameters variety from medical tests identifying relationships and patterns that are invisible to the human eye. This allows for more accurate predictions and personalized recommendations for patients based on their unique characteristics.

Another important AI use aspect in medical diagnostics is the approach personalization to each patient. Algorithms for analyzing genetic and health data can identify individual risk factors and susceptibility to diseases. This opens up new opportunities for creating individualized treatment strategies and preventing the diseases development.

The use of artificial intelligence in diseases treatment opens up new opportunities to achieve more effective results. Machine learning algorithms can analyze patient medical data and identify patterns that may not be obvious to humans. This helps healthcare professionals determine optimal treatment regimens and predict the effectiveness of certain medications treatments. As a result, it is possible to develop more personalized treatment approaches taking into account each patient individual characteristics. This personalized approach can improve treatment effectiveness and improve patient outcomes.

Artificial intelligence (AI) has revolutionized surgery by introducing AI-enabled robotic systems. These systems provide high precision and enable less invasive procedures, fundamentally changing

the approach to surgical procedures. The use of robotic systems covers various surgery areas including neurosurgery, cardiology and thoracic surgery. Artificial intelligence enables precise robotic control which is critical for complex surgical procedures, reducing surgical time, improving outcomes and speeding recovery [12].

Robotic systems process and analyze large medical data volumes in real time providing surgeons with relevant information and support during operations. This increases the safety level and procedures accuracy. However, the implementation of these technologies also raises ethical and practical issues, requiring protocols development and medical personnel training for effective use while maintaining high safety standards and quality in healthcare.

In summary, AI use in medicine and the robotic systems use in surgery represent significant progress. These technologies improve diagnostic accuracy, personalize treatment and improve surgical outcomes. However, it is necessary to take into account ethical and practical aspects, ensuring adequate medical personnel training to effectively use new tools in practice (Table 1).

Table1. *Examples of artificial intelligence use in the diagnosis and diseases treatment[12]*

Application	Description
Image Analysis	Automated X-rays analysis or screening images with high accuracy and speed.
Personalized treatment	Individual approaches development to treatment, taking into account each patient characteristics.
Robotic surgery	Precision and less invasive surgical procedures using robotic systems.

The artificial intelligence (AI) implementation in healthcare raises a number of ethical issues that require serious discussion and resolution [13].

One key aspect is the issue of transparency and explains AI algorithms ability, especially in making important medical decisions context. Lack of algorithms work understanding can make it difficult to explain decisions to both patients and healthcare professionals, making informed consent difficult.

Confidentiality issues and personal data protection also remain relevant.

Collecting and processing large medical data volumes to train algorithms can compromise patient privacy. Guaranteeing the security and confidentiality of this data becomes a prerequisite for trust from both patients and the medical community.

The artificial intelligence introduction into medicine also poses some ethical questions. For example, questions arise about who owns patient medical data and how to ensure its privacy when used to train artificial intelligence algorithms. One possible solution may be to use anonymized data or develop strict security protocols to protect patient privacy.

Another ethical issue is the artificial intelligence emerging possibility as a replacement for medical personnel. The question arises about how to find a balance between automation and maintaining human interaction in the medical process. It is necessary to develop strict ethical and legal standards for the use of artificial intelligence in medicine (Table 2).

Table2. *Ethical issues in artificial intelligence use in medicine*

Ethical issue	Significance
Data privacy	Protecting the confidentiality of patient medical data.
Regulation and Standards	Standards development and legislation for the AI use in medicine.
Collaboration between healthcare professionals and AI	Determining the artificial intelligence role in the medical process.
Protection against errors and misinterpretations	Eliminate the AI errors possibility and incorrect conclusions.

Questions related to the artificial intelligence (AI) use in healthcare and personalized medicine inevitably arise in the professional community raising doubts about AI skill level and the risks associated with it[14].

3. RESULTS OF THE RESEARCH

Artificial intelligence is a promising direction. Every year it covers more and more areas optimizing production processes and increasing their efficiency. However, so far machines perform a very narrow tasks range and cannot completely replace human labor.

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4. RESULTS OF THE RESEARCH

Artificial intelligence errors are becoming a pressing issue, especially in cases where proprietary algorithms, such as the Epic Sepsis model, are found to be unreliable. Despite developers' claims of up to 83% accuracy, the lack of independent testing raises questions about reliability. Research has revealed significant errors in the algorithm's performance, highlighting the need for more transparent research.

Data privacy poses another challenge as advances in technology may compromise the personal information protection. The problem becomes more complex when systems can predict patient information even without hacking, highlighting the privacy importance.

Discrimination issues also come into focus as bias in algorithms can result from data limitations and poor programming.

The responsibility issue for AI misdiagnosis raises ethical dilemmas in healthcare requiring further discussion and the clear norms establishment and standards.

The healthcare industry is quite conservative and both the ethical and social use aspects of AI-based technologies are subject to regulatory regulation. Without a deep understanding of the full AI implications, new technologies could harm the people they are intended to help.

The 2022 for artificial intelligence (AI) in Russian medicine was marked by two significant events. Thus, the AI platform in healthcare began work. According to Dmitry Temnov, Deputy Director of Digital Development and Information Technologies Department of the Russian Health Ministry, it will become a tool that unites the medical community and experts in the AI field. The platform hosts priority clinical tasks and datasets for developers of artificial intelligence technologies.

In February 2022, Russia adopted a number of standards in the field of artificial intelligence in healthcare. Among the first standards[15]:

1. "Intelligent methods for processing medical data. Basic provisions";
2. "AI systems in clinical medicine – program, clinical trial methodology";
3. "Standard for change management in AI systems with continuous learning." More than 120 more standards are being developed.

Thanks to the platform approach, Moscow is ahead of Russian regions in AI use in healthcare. In 2019, an experiment was launched here to introduce artificial intelligence and digital vision into the capital's healthcare system[15].

The medtech market includes major players: Google, Apple, Microsoft. Their AI products improve the diagnoses accuracy, doctors availability and medical data organization. These large companies have the advantage of having funds and qualified employees. This allows them to create complex products that include previously unavailable features. For example, Google Health is a service that brings together a services variety for both patients and doctors. With AI help it helps prevent blindness, detect breast cancer at an early stage, support mental health, etc.

In addition, according to research, the market for AI in medicine will grow rapidly in the next few years (Figure 1).

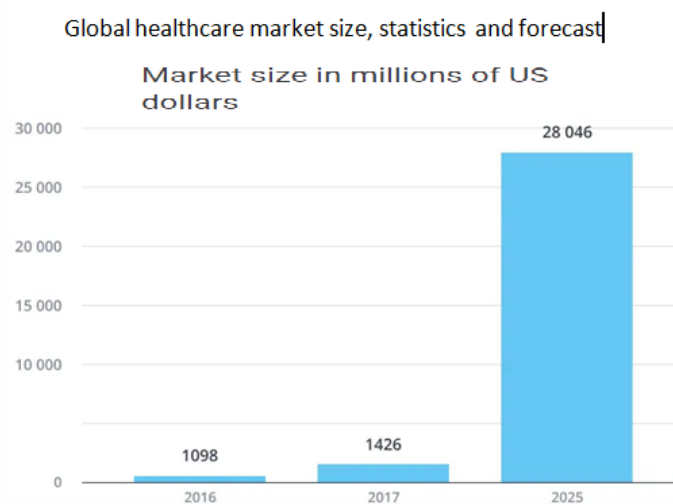


Figure1. Global market size for AI in healthcare [16]

However, the latest technologies are now opposed by their high cost and people's distrust of machines. In addition, many developing countries lack equipment and funds to implement artificial intelligence in medicine. Therefore, to satisfy the audience, it is necessary to create optimal products. For example, simpler and cheaper AI systems will make medicine more accessible and high-quality marketing and positive reviews will convince customers of artificial intelligence benefits. This is a great chance to find the right approach to the audience and occupy a profitable niche.

Thus, the prospects for AI use in healthcare cover a wide range of possibilities from improving diagnosis and personalizing treatment to accelerating medical research and optimizing management processes. However, these technologies implementation requires careful regulation to ensure that medical practice is ethical, safe and meets quality standards [16,17].

5. CONCLUSION

In conclusion, a consideration of artificial intelligence application in healthcare highlights the significant potential benefits and challenges facing this innovative medicine field.

AI use in medical diagnostics opens up new prospects for earlier diseases detection and increased diagnoses accuracy. Machine learning and big data analytics technologies make it possible to create highly effective tools for doctors reducing diagnostic time and improving the patient care quality.

However, there are inherent ethical questions involved in AI implementation in healthcare. The considered aspects, such as confidentiality, possible algorithms errors and even replacing the human factor question become the discussion subject and require detailed regulation.

The vast AI promise in healthcare provides opportunities for more accurate diagnosis, personalized treatment, faster research and improved management processes. However, these opportunities require careful research, innovative thinking and all parties commitment to ensure these technologies are implemented with maximum benefit to society and the highest ethics and safety standards.

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Citation: OBOULHAS TSAHAT Conrad Onesime et al. "Artificial Intelligence Application in Medical Diagnosis, Treatment Recommendations and Patient Care" *International Journal of Research Studies in Computer Science and Engineering (IJRSCSE)*, vol 10, no. 1, 2024, pp. 16-24. DOI: <https://doi.org/10.20431/2349-4859.1001003>.

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