

## Artificial Intelligence in Medical Science: Revolutionizing Healthcare

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### Introduction

The skill to learn, decisions making, and problems solving ability are considered to be part of human thinking capacity. When a machine can achieve these capacities autonomously, this can be defined as artificial Intelligence (AI). Artificial intelligence (AI) has emerged as a transformative technology in various fields, and the healthcare sector is no exception. The integration of AI in medical science holds immense potential to revolutionize healthcare delivery, improve patient outcomes, and enhance the efficiency of medical professionals. AI is paving the way for ground-breaking advancements from disease diagnosis and treatment to drug discovery and personalized medicine. This article explores the applications of AI in medical science and highlights its impact on healthcare.

### Disease diagnosis and medical imaging

One of the most significant applications of AI in medical science is disease diagnosis. AI algorithms can analyze extensive medical data, identifying patterns and anomalies that may be challenging for human doctors to detect. AI and machine learning have become invaluable in clinical practice by interpreting imaging modalities like ECGs, radiographs, CT and MRI scans, skin images, and retinal photographs. For instance, AI can analyze medical scans to identify tumors or lesions, aiding doctors in making informed decisions about treatment options. Studies have shown that AI systems can diagnose lung carcinomas in CT scans more accurately than human doctors [2]. AI is also used to diagnose polyps during colonoscopy [2] and detect skin cancer from photographs of skin lesions with equal efficiency to humans. Wearable devices integrated with

AI can diagnose cardiac arrhythmias and epilepsy in real-time, providing timely warnings [3]. Furthermore, AI has a significant role in personalized medicine, analyzing patients' genetic data and medical history to develop customized treatment plans that enhance outcomes and minimize adverse reactions.

### Predictive analytics and risk assessment

AI algorithms can analyze patient data, including electronic health records, genetic profiles, and lifestyle information, to predict the risk of developing certain diseases. By considering multiple factors, AI systems can identify patterns and generate personalized individual risk scores. This facilitates proactive, preventive, and targeted healthcare interventions to mitigate potential health risks. Additionally, AI-powered predictive analytics can forecast disease progression, allowing physicians to tailor treatment plans and optimize patient care.

### Drug discovery and development

AI is also revolutionizing drug development by leveraging large datasets of molecular structures to identify potential drug candidates. AI algorithms can predict the efficacy and safety of these candidates, significantly reducing the time and cost required for drug development. This holds the potential for faster treatments for various diseases. In addition to diagnosis and drug development, AI has the potential to simplify and expedite clinical trials. By leveraging AI and machine learning, clinical trials can be more efficiently recruited and matched with participants. AI can analyze trial data to predict adverse events and identify patient subpopulations, enhancing trial outcomes. Furthermore, AI can

generate synthetic control groups by matching historical data, effectively targeting trial enrollment criteria. AI and machine learning can also simulate diagnostic and therapeutic outcomes by generating “synthetic patients”.

### Personalized medicine and treatment optimization

AI plays a pivotal role in advancing personalized medicine, tailoring treatments to individual patients based on their unique characteristics and medical history. Machine learning algorithms can analyze complex datasets, including genomic profiles, clinical data, and treatment outcomes, to identify optimal treatment strategies for specific patient subgroups. AI-based decision support systems provide healthcare providers with valuable insights and recommendations, assisting them in making informed treatment decisions. By considering individual variations in genetics, lifestyle, and environmental factors, personalized medicine aims to enhance treatment efficacy, minimize adverse effects, and improve patient satisfaction.

### Chatbot/ChatGPT

The development of chatbot programs utilizing AI and natural-language processing has further advanced the use of AI in medical science. Chatbots can automate responses to questions, simulating human conversation. They assist with medical documentation, enabling clinicians to have more time with patients [4]. Programs like “Ambient Clinical Intelligence” can analyze doctor-patient conversations and prepare electronic health records. AI-powered chatbots, such as “Babylon,” assist in making appointments and arranging routine tests. They can also answer critical questions about differential diagnosis, although interpretation and caution are necessary to avoid mistakes.

AI and machine-learning programs have also entered various other areas of medicine. For example, they can identify infectious disease outbreaks, diagnose common and rare conditions by combining clinical and genetic data, and provide simulation-based surgical training for studying surgical techniques, facilitating objective feedback and enhancing student learning.

### Challenges

While the potential of AI in medical science is immense, challenges must be addressed. For example, bias in AI algorithms due to biased training data poses a concern, as it can lead to

incorrect diagnoses or treatment recommendations. Patient privacy and data security are also important considerations.

Contrary to concerns about AI reducing the need for doctors, many believe AI will expand healthcare professionals’ work scope. The demand for doctors with knowledge about AI is growing, prompting changes in medical school curricula to include relevant topics like physics, mathematics, computer science, coding, and algorithms [5].

### Conclusion

Ongoing research and data collection is underway to assess AI technologies’ effectiveness. As the standards for AI implementation in medicine continue to evolve, the potential for AI to bring significant benefits to clinicians, researchers, and patients is becoming increasingly evident. Despite challenges, the benefits of AI in medical science are evident. As technology continues to evolve, we can anticipate even more innovative applications of AI in the field, leading to better health outcomes for patients worldwide. AI will play a fundamental role in shaping and supporting modern healthcare systems as part of the broader digital health landscape.

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