**Artificial intelligence in medicine: advantages and disadvantages for today and the future**

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**ABSTRACT**

The term “artificial intelligence” (AI) is used to describe the application of computers and technology to mimic human problem solving and creativity. The possibility of artificial intelligence in medicine is rapidly evolving and its utility in clinical practice may soon become commonplace. The application of AI in medicine has been considered an opportunity to advance medicine as it helps to store, analyze, and interpret large amounts of data and lead to increased diagnostic accuracy, speed, and optimize treatment strategies. On the other hand, many physicians are concerned that AI will replace medical professionals and lead to the “dehumanization” of medicine.

In medicine, the evolution of artificial intelligence promises better outcomes through more efficient diagnosis and accuracy of individualized treatments. As such, appropriate regulatory policies must be explored to ensure the safe implementation of AI in medicine to avoid losing the humanistic art of medical practice.

**Keywords: Artificial Intelligence, Medical Technology, Medical Technology, Advantages, Disadvantages.**

**INTRODUCTION**

Since the 19th century, artificial intelligence has been a topic of interest for many researchers. John McCarthy is the first person to use the term artificial intelligence (AI) and defined the term as the science and engineering of creating intelligent machines [1]. In more recent years, AI has been defined in several ways but has been summarized in popular thought as creating computer programs that think, learn and work like human beings [2]. The ultimate goal for developers of AI is to render computer software that is capable of superhuman-like learning, thinking, reacting, adapting, reasoning, and, ultimately, problem solving. Alan Turing (1912-1954), an English mathematician, cryptanalyst, and computer scientist is considered the “father of AI” for his significant contribution to developing concepts of algorithm and computation with the Turing machine. The “Turing test” was based on the idea that a computer’s intelligence can reach the level of human thinking and performance in related tasks [1].

Since the 1960s, increasing efforts have been placed into the development of AI and its application in medicine. Many institutions, including Stanford, Massachusetts Institute of Technology (MIT), Rutgers, and others, have devoted significant research into the application of AI to be applied to the field of medicine [3]. During this time, AI has developed and evolved at a rapid pace.

Despite its apparent utility, the application of artificial intelligence in medicine has been the point of contention among many scientists. Some justify using AI to perform efficient and accurate diagnoses to guide appropriate treatment. Proponents endorse the use of AI based on its ability to store vast amounts of data that are then analyzed to suggest proper diagnosis and treatment. Other scientists and physicians do not support the way AI is being applied in medicine. Opponents fear that AI may replace medical professionals in the future and reduce the ability of medical practitioners to implement medicine with a distinctly humanistic touch. Instead of adopting AI to establish diagnosis and treatment, opponents suggest that AI should only complement medical decision making, leaving the ultimate decisions to the human practitioners. For some, AI poses a serious threat to the way in which we currently practice medicine and treat patients. This review aims to explore the advantages and disadvantages of the application of AI in medicine; the opportunities and threats AI may pose to the current and the future practice of medicine.

**ADVANTAGES OF APPLICATION OF ARTIFICIAL INTELLIGENCE IN MEDICINE**

The use of AI in medicine is often nicknamed “Medical Technology” as it helps medical professionals to provide accurate and early diagnoses, reducing errors and complications while minimizing hospitalization times for patients [4]. AI utility has been demonstrated in many branches of medicine including cardiology, nephrology, neurology, gastroenterology, endocrinology, pulmonology, oncology, surgery, et al.

**Artificial intelligence in cardiology**

Modern technologic advances in data science are marked by the ability to collect, analyze, and utilize large sets of data efficiently [5]. One area of medicine that do this successfully is cardiology [6].

In cardiology, the electrocardiogram (ECG) is one of the key diagnostic tools for identifying atrial fibrillation. The advent of the smartphone has revolutionized the ability for practitioners to identify atrial fibrillation through ECG that reports directly to a patient’s smartphone. The application Kardia by AliveCor assists in the diagnosis of atrial fibrillation by allowing patients to measure their own ECGs that can then be compared to a vast collection of data quickly and efficiently [4]. AI has also been used to predict some cardiovascular diseases such as heart failure and acute coronary syndrome.

**Artificial intelligence nephrology**

Kidney disease is one of the leading health problems globally. Although the use of AI technology has been scarcely reported in nephrology [7], there has been demonstrated utility in the diagnosis and treatment of acute kidney injury (AKI) and chronic kidney diseases (CKD). In nephrology, AI has also to the accuracy of kidney transplantation [8].

In clinical nephrology, AI has been applied to predict the prognosis of patients affected by polycystic kidney disease through analysis of glomerular filtrate.

Considering the relative scarcity of AI use in nephrology, further research and development are warranted [9].

**Artificial intelligence in neurology**

Currently, there are many applications that are helping clinicians with a differential diagnosis. Some notable examples include DxPlain and Isabel.

Neurologic disorders including epilepsy, Parkinson’s disease, Huntington’s disease, multiple sclerosis, and many others have been managed with the use of AI [4].

**Artificial intelligence in gastroenterology**

The application of AI in gastroenterology has shown promising potential. Processing and analysis of ultrasound, esophagogastroduodenoscopy (EGD), Capsule endoscopy (CE), and colonoscopy images have been augmented and improved through AI technology. AI has also been used to diagnose diseases such as gastroesophageal reflux disease (GERD), esophageal cancer, and inflammatory bowel disease [10].

**Artificial intelligence in endocrinology**

In endocrinology, AI has also been used in the diagnosis and management of endocrine disorders. A notable example can be appreciated in the development of AI technology to detect acromegaly by analysis of facial expression profiles [11].

**Artificial intelligence in pulmonary medicine**

In pulmonary medicine, the integration of AI has enabled the development of Tele-ICU respiratory therapy (remote care of pulmonary patients who are in the intensive care unit); a component of critical care medicine that will allow clinicians to monitor patients closely and provide care for growing numbers of patients [12].

**Artificial intelligence in oncology**

The early diagnosis of cancer is essential for favorable outcomes. Regarding early diagnosis, AI technology has shown promising potential. For example, AI has been used to diagnose colon cancer using AI-based colonoscopy. In addition to timeliness, this technology has been shown to be an efficient and cost-effective way to diagnose benign polyps without resection and differentiate cancer [13]. Other common treatment methods of various cancers include immunotherapy, chemotherapy, radiotherapy, and surgery. Particularly in surgery, AI has been used approach to ensure precision and accuracy of resection margins [14].

**Artificial intelligence in surgery**

“The future of technology and medicine is not in the blood and bowels at all, but in bits and bytes” Prof. Richard Satava once said [15]. In surgery, robotic technology can lead to less invasive procedures and high levels of surgical precision. Approximately one million urological and gynecological surgeries are performed annually. Interestingly, only 5,000 surgical robots contribute to this figure [15]. It is clear that robotics in surgery can produce favorable outcomes in less-invasive procedures while achieving considerable productivity.

**DISADVANTAGES OF APPLICATION OF ARTIFICIAL INTELLIGENCE IN MEDICINE**

Although AI has shown to be effective in both diagnosis and treatment, there are some observed disadvantages of this medical technology. Some physicians contest that the use of AI is gradually replacing medical professionals and fear that AI will ruin the medical profession instead of developing it. The notion that AI-based medical practice may not be able to perform some intricate tasks underlie this fear. Further, opponents suggest that AI is fundamentally unable to practice medical empathy, a key consideration for those who disagree with its implementation.

Antagonism to the application of AI in medicine is bolstered by a growing ideal that medicine requires wisdom rather than intelligence. For example, the classical doctor-patient relationship has shown that the expression of empathy can help a patient to feel cared for and understood. Unfortunately, this empathy cannot be expressed by computers and therefore holistic medical care is unable to be achieved.

In addition to lacking human empathy, AI tools are very expensive [17] and their usage requires advanced training. AI tools are also limited in some areas by a lack of robust data which are required for the AI to continue “learning” [2]. It is reasonable to assume that hospital systems looking to implement AI would require massive spending and continuing education for staff training. Therefore, access to AI based medical applications would be limited only to those health systems with large budgets and would create an inherent inequity of resource allocation. For these reasons, some physicians and researchers demonstrate a clear preference for human-based, rather than AI-enhanced, medical practice.

Taken as a whole, the greatest fear surrounding the adoption of AI in medicine is the dehumanization of medical practice and that physicians will be ultimately replaced by computers [16].

**CONCLUSION**

Application of the artificial intelligence is one of the promising developments in medicine that may help to transform the efficacy and accuracy of clinical practice. AI, when applied appropriately, has been clearly shown to play an essential role in the diagnosis and treatment of multiple diseases and disorders.

Although there are many advantages to the adoption of AI in medicine, AI must not replace physicians. Medical technology should support physicians to efficiently offer appropriate health services, though caution should be taken to not replace the role of the physician in its entirety. In favorable circumstances, AI will allow physicians to focus on the humanistic side of medicine while augmenting their ability to accurately treat and diagnose.

For AI to be implemented in medicine, further research should focus on the financial aspects of AI development and training of practitioners that are AI-knowledgeable. Regulatory policies should also be established as guidelines for the eventual adoption of AI in medical practice which will, amongst other concerns, prevent the ultimate replacement of physicians.

Moving forward, research must be done to better define the role of artificial intelligence in medicine and explore its eventual evolution. Researchers should focus on threats that medical technology may pose to the future of medicine and appropriate methods in which to mediate these concerns.

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