

Artificial Intelligence Can Improve the Health Care System

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ABSTRACT

Artificial intelligence (AI) is a computer system used to model human cognitive functions, intelligence, and behaviour. Components include both, a virtual and a physical aspect. Virtual aspects of AI include algorithms and neural networks instilled within the system to execute its assignments. Physical components include the entity in conjunction with a code. ¹ AI is currently being developed by Nvidia Corporation, Alphabet, Twilio, Amazon, Micron Technology, Microsoft Corp., Baidu, Intel Corp., Facebook, and Tencent. ² Expanding AI into the health care system can be beneficial for preventative care, patient safety, and reducing treatment costs for families. AI has proven to be useful in machine learning, thus, it can be programmed to complete specific tasks. By performing tasks such as data interpretation, the amount of time that it takes for a physician to consult patients regarding their results will be reduced. In addition, AI is capable of analyzing medical images to identify tumours and it has previously been used in various other branches of medicine such as neurology and cardiology. Overall, AI has great potential to improve the health care industry in North America and worldwide. However, potential violations while utilizing personal patient data must be addressed whilst modifying this technology.

Keywords: Artificial Intelligence, health care, disease evaluation, machine learning

The term “artificial intelligence” (AI) was first used in 1956 by a computer scientist, John McCarthy.³ It was thought of as a proposed solution to solving problems using formal log-based models of reasoning.⁴ AI involves a classifier, which identifies the set of categories or sub-populations that a new observation belongs to. These classifiers are built on data that has been inputted from previously systematized documents,⁵ and is capable of natural language processing of data. The first Artificial Intelligence system was designed by Allen Newell at Carnegie Mellon University. It was called “Logic Theorist” and applied by J. Clifford Shaw.⁴ Prior to its development, these individuals sought to understand how machines are capable of learning human functions such as visual perception and decision-making.

The physical aspect of AI refers to the software that is installed on a computer, whereas, the virtual aspect refers to machine learning, which is fulfilled through mathematical algorithms. Presently, artificial intelligence has experienced breakthroughs in deep learn-

ing, which refers to non-linear patterns in the data that have multiple layers. The technology is becoming increasingly popular since the volume and complexity of data is expanding.⁶

Using artificial intelligence represents a more efficient method of approaching issues such as diagnostic and organizational problems in the health care system, as machine models are applied in order to accurately make predictions and analyze data. Machine learning methods can be implemented to increase its technological performance since more information is systematically inputted into the machine’s database. The application of these models offers many advantages, such as increased flexibility with changing conditions, lower costs, and compatibility with electrical sensing techniques, that are all rapidly advancing.⁷ The use of AI will primarily be beneficial to health care practitioners since it is able to use the information from previously inputted health care data in order to enhance clinical practices.⁶

AI is capable of processing data more efficiently than humans due to robotic automation, which demonstrates a high degree of accuracy. Accordingly, it can be used to answer general questions regarding patient care, since it cultivates medical information that derives from resources such as journals and textbooks,⁶ as well as previous archives. Furthermore, AI can be used to monitor large datasets in order to detect mistakes and potential threats to patient health. Lastly, AI can be trained to categorize physical examination notes that are taken by health care professionals, as well as clinical laboratory results and diagnostic images. Although in the prospect human assistance will not be required to complete such tasks, it is required to establish system automation.

Specific Uses for AI

The first successful application of AI was the clinical decision support systems (CDSS) established in the 1970s, in which a software named Pathfinder was used to help scientists identify lymph-node diseases.⁸ The algorithms instilled in these systems allowed for the identification of abnormalities in medical images, including tumours and polyps associated with these diseases. AI has also helped clinical fellows in making decisions for treatment plans, as it is able to consider a plethora of treatment options and is also capable of “thinking like a doctor” in order to assess various health care problems.⁹

Previous exposure in the field of AI includes applications like MYCIN, AI/RHEUM, INTERNIST, SPE, and the TIA system.¹⁰ MYCIN was developed in the early 1970s by Stanford University in order to perform diagnoses and provide treatment options for infectious diseases. This application was especially effective within the domain of meningitis, in which ten cases were selected and corresponding treatment recommendations were acquired using MYCIN. From the ten cases, in eight evaluations, 70% of MYCIN’s were verified,¹⁰ thus displaying moderate accuracy of the system.

AI/RHEUM is a system that computes rheumatic diagnoses, using the EXPERT system developed in the University of Missouri. In one study of 384 patients, the physician’s diagnosis was compared with the diagnosis made by an AI system. Using raw data collected and presented to three rheumatologists from 48 cases, it was found that AI exhibited an accuracy rate of 94%. All rheumatologists agreed on 28 of the cases, and 96% agreed on 46 cases.¹⁰

The INTERNIST system uses clinical pathologic conferences from the New England Journal of Medicine as its source of data, and standards of data presentation are established by the performance of clinicians and discussants.¹⁰ The Serum Protein Electrophoresis (SPE) system was created in order to analyze data that

is collected by a laboratory instrument. Using 256 cases, the study is unique to Artificial Intelligence in Medicine (AIM) since it was 100% acceptable, but warned scientists to expect differences of opinions, thus requiring further verifications.¹⁰

The Transient Ischemic Attacks (TIA) system is used in health care to help evaluate TIAs and suggest available therapeutic options. The system was held to the decision-making standards of stroke specialists at the University of Maryland. The participant group was made up of 103 patients and of these, the system was able to draw the same conclusions as an expert reviewer in all but 12 cases.

The Improvement of AI

New ways in which AI is being used to improve the health care industry is by building real-time inferences and models while accessing data from a large patient population. These developments can be used to provide alerts for patients who need immediate assistance, and to estimate the length of inpatients’ stay.

Medical datasets are becoming increasingly accessible to the public, so AI can pick up on patterns used to predict treatments for patients while minimizing the risk of incorrect diagnoses.⁹ In this way, AI techniques can also be combined with electronic health records (EHR), which are becoming increasingly popular in modern medicine to improve health outcomes for patients. By using EHR, AI will be able to classify any abnormalities in the health care records, thus aiding in the process of disease identification.

As previously described, the physical branch of AI refers to machines and robots, and the virtual aspect refers to the mathematical algorithms that are inputted into the systems and improved with experience. For instance, targeted nanorobots can be included as part of the physical branch of AI, in which a new drug delivery system is presented. The carriers are capable of performing a motor-based or pump-based drug delivery.¹¹ With this, it was discovered that medication can bypass neural networks which were previously known to be impossible for humans to accomplish.

In contrast to the successes of AI, there are various challenges associated with this technology. This includes any potential violations that overstep patients’ private information, as well as ethical issues related to access to personal data. Other difficulties with using AI in hospitals include the size and complexity of data, which can be resolved with new algorithms and pattern detection approaches. Another current concern associated with AI is the extent of its regulation since there is no “gold standard” against which researchers can compare the system’s performance.¹² There is a possibility that AI can alter the initial diagnosis or

treatment decision of the health care professional, which might deliver unforeseen consequences.¹² Lastly, it is important to consider the economic value of using AI systems, as health care costs in North America continue to rise. The initial cost of establishment would likely be high, however, upon its development and implementation, treatment costs for the affected individuals would drastically decrease.

CONCLUSION

AI can be used to cultivate the health care industry by advancing diagnostics and improving treatment positions for patients. This technology proves to be accurate since it uses algorithms to analyze datasets from health-related data. It can also be enhanced with self-correcting abilities in order to improve accuracy after receiving feedback, which ultimately improves patient outcomes. In the future, AI can be used to personalize treatments for patients by evaluating their genetic makeup, which must be first considered for ethics board approval due to implications of having access to sensitive genetic data. Overall, further investigation into AI represents a valuable and multi-faceted avenue of research for the health care field.

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