Machine Learning in Healthcare Communication

Subjects: Computer Science, Artificial Intelligence
Contributor: James Chow

Machine learning (ML) is a study of computer algorithms for automation through experience. ML is a subset of artificial intelligence (AI) that develops computer systems, which are able to perform tasks generally having need of human intelligence. While healthcare communication is important in order to tactfully translate and disseminate information to support and educate patients and public, ML is proven applicable in healthcare with the ability for complex dialogue management and conversational flexibility. In this topical review, we will highlight how the application of ML/AI in healthcare communication is able to benefit humans. This includes chatbots for the COVID-19 health education, cancer therapy, and medical imaging.

Keywords: artificial intelligence ; machine learning ; healthcare communication ; chatbot

---

Artificial intelligence (AI) is a computer program's capability to perform a specific task or reasoning processes that we generally associate with intelligence in human beings. Primarily, it has to do with making the right decision with vagueness, uncertainty, or large data. A large quantity of data in the healthcare field, from clinical symptoms to imaging features, requires machine learning algorithms for classification [1]. Machine learning is a technique that utilizes pattern recognition. AI has been implemented in several applications in the clinical field, such as diagnostics, therapeutic and population health management. AI has a considerable impact on cell immunotherapy, cell biology and biomarker discovery, regenerative medicine and tissue engineering, and radiology. Machine learning in healthcare applications are drug detection and analysis; disease diagnosis; smart health records; remote health monitoring; assistive technologies; medical imaging diagnosis; crowdsourced data collection and outbreak prediction; and clinical trial and research [2]. A large quantity of data, also known as big data, is now available to train algorithms [3]. Several algorithms consisting of Convolution Neural Network (CNN) of more than a 100 layers have been used to diagnose pneumonia conditions. Several studies show that several algorithms can perform at the same level as a clinician and in some cases outperform clinicians. Specialists are still needed, however, as they can ensure safety and monitor AI output. AI does not hope to replace clinicians but to assist them and make their job more efficient. Facial analysis technologies have the capability to perform at the same level as clinicians with the help of deep learning. The Food and Drug Administration (FDA) has granted approval for a significant number of proprietary algorithms intended to be used for image analysis and interpretation; a prominent example would be Aidoc used in radiology to detect intracranial hemorrhage [4]. AI is used heavily in medical imaging to help in rendering medical diagnoses. Machine learning in medical imaging typically starts with algorithms looking for image features it believes to be important and will yield better predictions. A decision tree is an algorithm system, it identifies the best combination of features to classify the image or compute specific metrics for the image region. Several methods are also used for this purpose where each has its own weaknesses or strengths [5]. AI needs to be evaluated for stability and safety before it can be implemented in clinical settings. There have been many research papers on evaluating AI's decision-making and clinical decision support. The recent advances in AI and the introduction of PyTorch, DeepLearning4J, TensorFlow, and Keras have led to the development of numerous algorithms that is available to clinicians to implement in many applications [6]. Machine learning allows us to make informed clinical decisions through insights from past data and is the core of evidence-based medicine. AI provides techniques to analyze and reveal complex associations that are difficult to convert into an equation [7]. A neural network is a model aspiring to mimic how the human brain works. It is composed of large numbers of interconnected neurons. Machine learning can utilize this to solve complex problems by analyzing evidence to provide an appropriate conclusion. Machine learning can simultaneously observe and process at a very fast pace with almost limitless inputs. It carries a transformation pattern to healthcare supported by clinical data's extensive availability and recent advancement in analytics systems. Machine learning technique mimics medical practitioners in complicated problem solving through cautiously considering proof to make valid decisions [8]. AI and deep learning have been enabled by labelled big data and improvements in cloud storage modalities, and enhancement in computing power. In medicine, it has a significant impact at three levels: for the health system by improving workflow and the potential for reducing medical errors; for clinicians primarily through rapid, accurate image interpretation; and for patients by having the ability to process data, which ultimately promotes health [9]. Chatbots have high potential in a clinical setting, but for them to be used safely in clinical settings, they first need to be evaluated like a novel medical device or like a new drug [10]. Two very important factors in terms of patient care for physicians are

knowledge and experience; however, in terms of gaining knowledge by cumulating data, humans are limited, but machine learning can excel in that area [11]. Machine learning can generally be classified into two categories: supervised learning and unsupervised learning [12].

References

1. Peyrou, B.; Vignaux, J.-J.; André, A. Artificial Intelligence and Health Care. In Digital Medicine; André, A., Ed.; Springer International Publishing: Cham, Switzerland, 2019; pp. 29–40.
2. Sathya, D.; Sudha, V.; Jagadeesan, D. Application of Machine Learning Techniques in Healthcare. In Handbook of Research on Applications and Implementations of Machine Learning Techniques; IGI Global: Hershey, PA, USA, 2019; pp. 289–304.
3. Hosny, A.; Parmar, C.; Quackenbush, J.; Schwartz, L.H.; Aerts, H.J.W.L. Artificial intelligence in radiology. Nat. Rev. Cancer 2018, 18, 500–510.
4. Dzobo, K.; Adotey, S.; Thomford, N.E.; Dzobo, W. Integrating Artificial and Human Intelligence: A Partnership for Responsible Innovation in Biomedical Engineering and Medicine. Omics J. Integr. Biol. 2020, 24, 247–263.
5. Erickson, B.J.; Korfiatis, P.; Akkus, Z.; Kline, T.L. Machine learning for medical imaging. Radiographics 2017, 37, 505–515.
6. Magrabi, F.; Ammenwerth, E.; Mcnair, J.B.; De Keizer, N.F.; Georgiou, A. Artificial Intelligence in Clinical Decision Support: Challenges for Evaluating AI and Practical Implications A Position Paper from the IMIA Technology Assessment & Quality Development in Health Informatics Working Group and the EFMI Working Group for Assessment of Health Information Systems. Yearb. Med. Inform. 2019, 28, 128–134.
7. Buch, V.H.; Ahmed, I.; Maruthappuls, M. Artificial intelligence in medicine: Current trends and future possibilities. Br. J. Gen. Pract. 2018, 68, 143–144.
8. Rayan, R. Artificial Intelligence Perspective on Healthcare. InICEAT 2019.
9. Topol, E.J. High-performance medicine: The convergence of human and artificial intelligence. Nat. Med. 2019, 25, 44–56.
10. Bibault, J.E.; Chaix, B.; Guillemassé, A.; Cousin, S.; Escande, A.; Perrin, M.; Pienkowski, A.; Delamon, G.; Nectoux, P.; Brouard, B. A chatbot versus physicians to provide information for patients with breast cancer: Blind, randomized controlled noninferiority trial. J. Med. Internet Res. 2019, 21, e15787.
11. Mintz, Y.; Brodie, R. Introduction to artificial intelligence in medicine. Minim. Invasive Ther. Allied Technol. 2019, 28, 73–81.
12. Bzdok, D.; Krzywinski, M.; Altman, N. Points of significance: Machine learning: Supervised methods. Nat. Methods 2018, 15, 5–6.