Can the application of machine learning in healthcare benefit society?

Ann-Kristin Balve

ANR: 649435   SNR: 2059591

Tilburg university

Introduction to Artificial Intelligence 2

Dr. Emmanuel Keuleers, Dr. Henry Brighton, Diana Schmalzried

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Introduction

An increasing life expectancy worldwide and a shortage of health professionals have caused a global human resource crisis in the health sector. The World Health Organization (WHO) prognosticated a scarcity of 9.9 million physicians and nurses worldwide for 2030 (World Health Organization, 2016) and by 2050, every fourth person in Europe and America will be over 65 years old (Spatharou et al., 2020). This highlights the urgent need to transform healthcare to meet the changing needs of patients. Machine learning (ML) together with the increased availability of data has the potential to reduce the pressure on the healthcare system, improve the quality of care, prevent disease outbreaks, and enhance precision in diagnosis and treatment.

Background information

The application of Artificial Intelligence (AI) in medicine goes back to expert systems in the 1980s. MYCIN was one of the earliest expert systems that could diagnose infectious diseases and propose treatments. These systems required human expertise encoded in knowledge bases and had limitations regarding ill-defined problems. With the rise of data, digitalization of patient records, and improved computing power, AI has finally revolutionized healthcare.

ML in medicine analyses and learns patterns in historical data to predict the risk of diseases, improve diagnosis, provide personalized treatments, and use smart health records to promote a healthy lifestyle. Especially deep learning (DL), a branch of ML using neural networks, contributed to this ongoing development by being able to identify complex patterns in data difficult to detect for the human eye.

Supporting Evidence

ML can predict the risk of disease outbreaks and is therefore essential for preventative

healthcare. BlueDot is a software company that developed a warning system for infectious diseases by using international news, data from global airlines, and animal and plant disease outbreaks. It predicts the location and spread of pandemic outbreaks in the future and achieved recognition when it forecasted the Covid19 outbreak in Wuhan nine days before the WHO (BlueDot: Outbreak Risk Software, 2021). Furthermore, it identified Brazil and India both as future hotspots before they became Covid19 epicenters. These examples suggest that ML can help to effectively slow down the spread of infectious diseases and therefore relieve the pressure on the healthcare system.

Regarding disease diagnosis, AI algorithms using DL have successfully detected abnormal patterns in images. DL algorithms assisted radiologists, for example, in breast cancer diagnosis by analyzing mammograms (Rodríguez-Ruiz et al., 2019). When using the AI system, the doctors' performance in detecting cancer was enhanced and they appeared to be more focused (Rodríguez-Ruiz et al., 2019). Consequently, by using ML algorithms as a second opinion for doctors, false diagnoses can be minimized, and an early detection of severe diseases might increase the survival rate of patients.

DL has likewise shown potential in the personalization of pharmaceuticals. Precision medicine is a term for tailored medication which is based on features such as genetics, patient records, and lifestyle. DL algorithms can find patterns among these features and accurately predict how an individual patient reacts to a disease (Zhang et al., 2018). This allows to study characteristics of diseases, identify risk factors, predict the effect of a treatment for a patient and hence develop effective drugs (Zhang et al., 2018). The resulting personalized treatment plans therefore lead to a better patient experience and more successful treatments, especially for complex diseases such as Alzheimer's disease or cancer (Craig, 2008).

Finally, smart health devices and personalized digital healthcare promote a sustaining healthy lifestyle. Glucose monitoring systems for diabetes patients, for instance, can predict whether glucose levels will rise or drop and how fast they will change (Lawton et al., 2019). Patients improved their self-management since they could continuously view their blood sugar levels and could therefore adjust their behavior by learning from the past (Lawton et al., 2019). Another example is Ada, a diagnosis assistance app that asks questions about symptoms and gives patients a first diagnosis (Health. Powered by Ada., n.d.). Smart health devices are a promising development since they reduce long ways to doctors, make healthcare accessible to everyone and allow patients to better understand their own health-related problems.

Counterargument

On the other hand, the increasing application of AI in medicine has led to concerns about the replacement of physicians. This is however unlikely since AI systems cannot replace interpersonal skills and emotional intelligence of doctors. Instead, they could be a complementary tool for physicians (Ahuja, 2019). The automation of time-consuming administrative tasks may rather increase the face-to-face time between doctors and their patients.

Furthermore, bias, safety and privacy issues in ML algorithms must be considered (Rigby, 2019). Since datasets are hardly ever perfect representations of the whole population there can be differences in the accuracy of results with respect to gender, race, or social status (Chen et al., 2019). Beyond that, the collection of large amounts of personal patient data stresses the importance of a legal and ethical framework for AI technology in healthcare. In conclusion, to limit negative consequences, governments should invest in data security and safe and responsible AI.

Conclusion

The predictive power and time efficiency of ML algorithms in healthcare allows for preventative measures and early disease detection. The workload of medical professionals decreases with the automation of tasks which may improve their working conditions and could result in a higher quality of care and more accurate diagnoses. Moreover, ML promotes personalized and accessible healthcare. Responsible and safe ML can therefore benefit society.

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