Lifestyle & Culture

The applications of AI in the medical field

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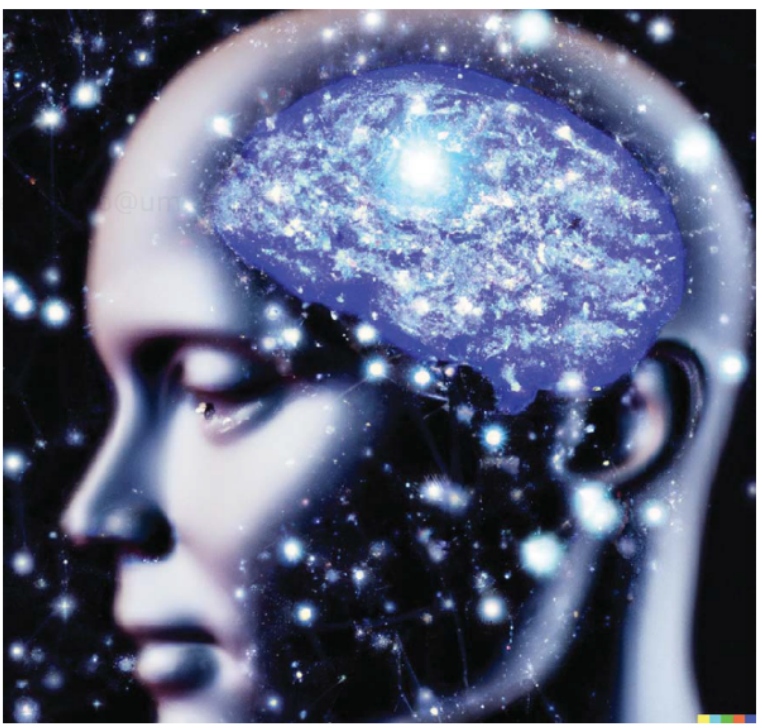

AI-generated images created by Prof. Blundell

AI stands for artificial intelligence, which refers to the ability of machines to perform tasks that would normally require human intelligence. This can include tasks such as visual perception, speech recognition, decision-making and language translation.

Deep learning is a subset of machine learning that involves training artificial neural networks to recognise patterns in data. These neural networks are inspired by the structure of the human brain, with layers of interconnected nodes that can process information and make decisions based on that information.

In recent years, AI has transformed medicine and its impact is only set to grow as technology advances. As previously explained, AI relies on complex algorithms that can analyse vast amounts of data and identify patterns that humans may miss. As such, AI can revolutionise how one diagnoses, treats and even prevents diseases when applied to the medical field.

In the medical industry, AI is being used to analyse vast amounts of medical data, including patient records, medical imaging and genetic information. Using algorithms that can identify patterns and correlations in this data, AI can help doctors make more accurate diagnoses, develop personalised treatment plans and even predict which patients may be at risk for certain diseases. In saying this, one of the major benefits of this technology is its ability to analyse compound data efficiently and effectively. This is particularly advantageous in medicine where abundant data is available.

One of the key applications of AI in medicine is drug development. Pharmaceutical companies can use AI to analyse chemical compounds and identify potential drug targets much more efficiently than traditional methods. By using algorithms that can predict the way drugs will interact with biological systems, scientists can develop new treatments quicker and with greater accuracy. Therefore, applying deep learning to the field of drug discovery is especially important when it comes to developing treatments for diseases that are difficult to treat, such as cancer. Thus, in saying this, AI opens new doors for potential pharmaceutical treatments that one would have only dreamt of a few years back.

Furthermore, since AI can analyse exorbitant amounts of data, which can be either structured or unstructured, it can be applied to analysing medical images, clinical records and so much more. Structured data refers to data that is organised in a specific format, such as medical records while unstructured data, includes data such as medical images, clinical notes and social media data.

In medical imaging, AI is being used to analyse medical imaging data, like X-rays, CT scans and MRIs. By training algorithms to recognise patterns in medical images, doctors can get more accurate diagnosis and treatment recommendations. This technology can also help doctors identify early signs of disease, such as cancerous tumours before they become too advanced to treat effectively. Therefore, through training deep-learning algorithms to identify patterns in medical images, that may be too subtle for the human eye to detect, diseases can be detected at a very early stage, preventing further progression to stages that may be difficult to treat or possibly untreatable.

Another area where AI is being applied in medicine is clinical decision-making. By analysing patient data and medical records, AI algorithms can provide doctors with more personalised treatment options. For example, algorithms can take into account a patient's medical history, current symptoms, genetic makeup and lifestyle factors to recommend treatments that are tailored to their individual needs. This can improve patient outcomes and reduce the risk of complications. Furthermore, apart from helping medical professionals with tailoring patient-personalised treatments, this concept may also be applied in more compound situations such as in multiple disciplinary team meetings where more complex cases are discussed and solutions for patient management are considered. In saying this, AI can provide treatment recommendations for such situations, allowing doctors to make a more informed decision that is best for the patient.

Electronic health records (EHRs) are another sector where AI is having a significant impact. By analysing large datasets of patient information, AI algorithms can identify patterns that may be missed by human doctors. This can help doctors identify patients who are at risk of developing certain conditions and develop more effective treatment plans. For example, an AI algorithm could flag a patient's EHR as high-risk for cardiovascular disease and recommend lifestyle changes or medication to help prevent future heart attacks. Thus, through this tool, physicians can identify patients who are at risk for certain conditions and not only reach out to them but provide more personalised treatment options to prevent disease. Therefore, AI can indirectly help promote the overall health of a country's general population while reducing the economic health burden since through this method fewer people are at risk of developing certain diseases.

Unsurprisingly, AI can also be applied in the surgical field. This technology can be used to generate 3D models of a patient's anatomy based on medical imaging data, which can help surgeons better plan and prepare for surgical procedures, allowing them to identify any potentially problematic areas and plan the best possible approach. In robotic surgery (RS), a surgeon controls a robotic arm that is guided by AI algorithms to perform precise procedures. Thus, in RS, AI can aid the robot's movements and ensure precise and accurate incisions, preventing the risk of complications. Additionally, AI can provide real-time feedback to surgeons during procedures, which can help them make more informed decisions and adjust their approach as needed. For example, AI algorithms can analyse data from medical sensors and instruments to provide feedback on the patient's vital signs, blood flow and tissue damage. It can also assist surgeons during complex procedures by providing guidance and recommendations. For example, AI algorithms can analyse medical images and provide guidance on the best approach for removing a tumour or repairing a damaged organ. Following a surgical procedure, AI can also aid to monitor patients to ensure that they are recovering properly as well as detect any early complications that may arise. Therefore, by analysing data from medical sensors and other sources, AI algorithms can identify signs of infection, blood loss or other issues that may require immediate attention. Thus, as seen AI can help during the preoperative, surgical and postoperative phases of a patient's surgery.

In the emergency department, AI can also improve the efficiency and accuracy of diagnosis, triage patients and streamline the workflow to ensure optimal healthcare. By analysing the patient's medical history, current signs and symptoms and lab results, it can aid doctors identify patients who require immediate attention and ensure that they receive timely care. In this way, it is also helping healthcare providers optimise the use of resources like stuff, equipment and medications. Similarly, by analysing large datasets AI can aid with diagnosis helping reduce the risk of misdiagnosis or delayed diagnosis, which can lead to improved patient outcomes.

Likewise, AI can further aid in analysing diseases and diagnosing them by being applied in histopathology which is the study of the microscopic structure of tissues. Just like with medical imaging, AI can analyse digital images of tissue samples to identify and quantify various features like cell shape, size and density. This not only aids pathologists identify abnormalities and diagnose disease but it aids the process to be more effective and efficient ensuring that no abnormalities go missed due to human error or minuscule anomalies that may go undetected by the trained human eye. AI can also aid pathologists to classify tissue based on their microscopic classification, diagnose cancer, predict disease progression and plan treatment strategies more accurately and quickly.

As seen throughout this article, the applications of AI in the medical industry are boundless and the list will continue to endlessly grow as the technology advances and improves. Thus, it is our duty as humans, to keep up with the technology and familiarise ourselves with it to learn and apply it to the best of its potential in an ethical way that would benefit us and future generations.

In conclusion, as evidently depicted, AI has the potential to revolutionise and transform medicine in even more profound ways than we can imagine. Without a doubt, in the future AI algorithms will become more sophisticated and complex, being able to analyse even greater datasets quicker, providing more accurate predictions while providing more drug discovery options and better patient-personalised management options. Thus, we should not see this great technology as a threat but rather as a tool between the user and the execution of the outcome. However, it is very important to keep in mind that the overall result will ultimately depend on how the operator wields this tool and that is a mystery we are yet to discover.

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