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Research on How AI and Deep Learning are Changing the Healthcare Industry

Sonal[1], Harshal Jangid[2], Ashima Mehta[3]
UG Student, Department of Computer Science Engineering[1]
UG Student, Department of Information and Technology[2]
Head of Department, Computer Science Engineering[3]
Dronacharya College of Engineering, Haryana, India

Abstract: Deep learning (DL) and artificial intelligence (AI) are two of the most ground-breaking technologies of our day. When a machine can think, learn, perceive, and make decisions—tasks that typically require human intelligence—this is referred to as artificial intelligence (AI). A technique for teaching neural networks to learn from data and gain accuracy over time is known as deep learning, a subset of artificial intelligence. In fields including image identification, natural language processing, and autonomous cars, deep learning has achieved outstanding results. In a number of tasks, such as speech recognition, language translation, and image classification, deep learning models can currently outperform humans in terms of accuracy.

Keywords: Artificial Intelligence, Deep Learning, clinical decision support, health industries

I. INTRODUCTION

AI and similar technologies are becoming more and more common in business and society, and they are starting to be used in healthcare. Many facets of patient care could be changed by these technologies, as well as internal administrative procedures at payer, provider, and pharmaceutical companies. Numerous studies have already shown that AI is capable of doing important healthcare jobs including disease diagnosis as well as or better than humans. Today, algorithms already surpass radiologists in identifying cancerous tumours and advising researchers on how to create cohorts for expensive clinical trials. However, we think it will be a long time before AI completely replaces humans in large medical process domains for a variety of reasons. In the following piece, we outline both the potential that AI offers to automate aspects of care and some of the barriers to rapid implementation of AI in healthcare.

II. MACHINE LEARNING – NEURAL NETWORKS AND DEEP LEARNING

Machine learning is a statistical method for 'learning' through 'teaching' models with data and fitting models to data. One of the most prevalent types of AI is machine learning; in a 2018 Deloitte poll of 1,100 US managers whose organisations were already exploring AI, 63% of the businesses surveyed were using machine learning.1 There are numerous variations of this broad strategy, which forms the basis of many AI methodologies.

Precision medicine, which determines which treatment procedures are likely to be effective on a patient based on a variety of patient traits and the context of the therapy, is the most popular application of traditional machine learning in the healthcare industry.2 A training dataset is necessary for most of the machine learning and precision medicine applications.

The neural network is a more advanced type of machine learning. This technology, which has been around since the 1960s and has been widely used in medical research for several decades3, is used for categorization tasks like predicting whether a patient will contract a specific disease. It approaches issues in terms of variables' weights, or "features," that link inputs and outputs. It has been compared to how neurons interpret signals, however the comparison to how the brain works is not very strong.

Deep learning, or neural network models with many levels of features or variables that predict outcomes, is one of the most difficult types of machine learning. These models could contain thousands of hidden characteristics that are discovered by the faster processing of today's graphics processing units and cloud architectures. A common application

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of deep learning in healthcare is recognition of potentially cancerous lesions in radiology images.4 Deep learning is increasingly being applied to radiomics, or the detection of clinically relevant features in imaging data beyond what can be perceived by the human eye.5 Both radiomics and deep learning are most found in oncology-oriented image analysis. Their combination appears to promise greater accuracy in diagnosis than the previous generation of automated tools for image analysis, known as computer-aided detection or CAD.

Deep learning is a type of natural language processing (NLP), which is covered in more detail below, and is increasingly utilised for speech recognition. Each feature in a deep learning model often has minimal significance to a human observer, in contrast to earlier types of statistical analysis. As a result, it could be exceedingly challenging or perhaps impossible to interpret the explanation of the model's results.

III. DEEP LEARNING MODELS USED IN HEALTHCARE INDUSTRIES

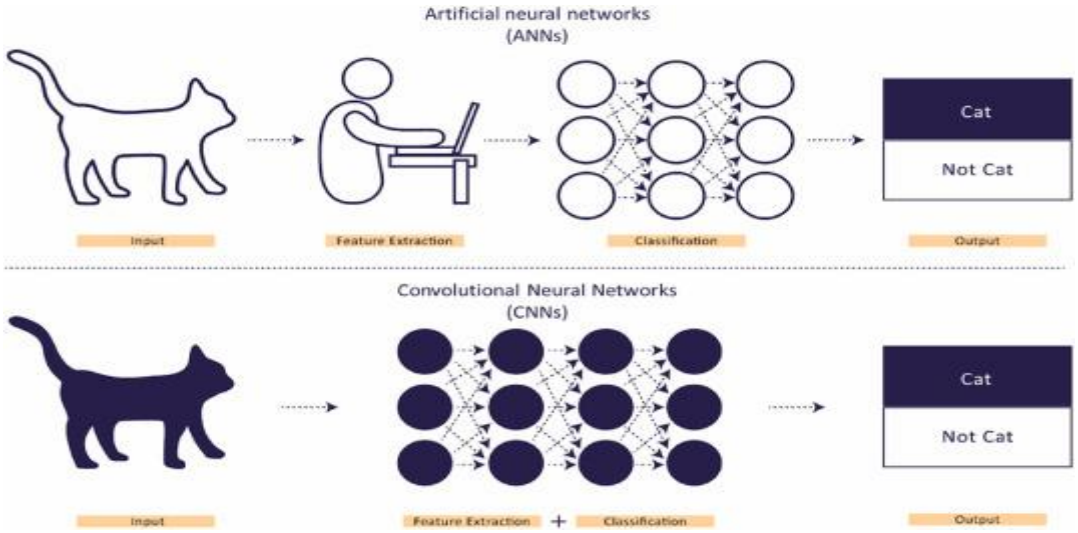
There are numerous deep learning models that are currently being used in the field of healthcare. Some of the most common applications include:

Image recognition

In the healthcare sector, image recognition enabled by deep learning models like convolutional neural networks (CNNs) is becoming more and more crucial. Here are some applications for picture recognition:

Diagnostics

A wide variety of disorders require the use of medical imaging techniques like X-rays, CT scans, and MRIs. However, these images might be challenging to correctly interpret, particularly for practitioners with less training. The accuracy of diagnosis can be increased by using image recognition algorithms to examine these photos and spot patterns and anomalies that would be hard for people to see.



Medical imaging can also be used for screening, such as finding lung nodules or breast cancer. Screening programmes can be made more effective and precise by using image recognition models, which can swiftly and accurately analyse enormous quantities of images.

SCREENING: Medical imaging can also be used for screening, such as finding lung nodules or breast cancer. Screening programmes can be made more effective and precise by using image recognition models, which can swiftly and accurately analyse enormous quantities of images.

SURGICAL PLANNING: By analysing medical photos to produce a thorough 3D visualisation of the patient's anatomy, image recognition models can assist in surgical planning. This can aid surgeons in making better plans and preparations for difficult procedures, which will benefit patients.

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MONITORING: Image recognition models can be used to monitor patients for changes in their condition, such as changes in tumour size. This can help clinicians adjust treatment plans in real-time and improve patient outcomes.
MEDICAL RESEARCH: Image recognition models can be used to analyze large volumes of medical images to identify new patterns and trends that can inform medical research. For example, researchers can use these models to identify new biomarkers for disease or to better understand how certain diseases progress.

Natural Language Processing (NLP)
Numerous medical records and clinical notes are analysed using NLP algorithms. This can aid in finding trends, forecasting illness development, and enhancing clinical judgement.

PERSONALIZED MEDICINE
Personalized medicine is an approach that involves tailoring medical treatment to the individual characteristics of each patient. Deep learning, a subfield of artificial intelligence, has the potential to revolutionize personalized medicine by analysing vast amounts of data to identify the most effective treatment options for individual patients. Here are some ways that deep learning can be used for personalized medicine:
GENOMIC ANALYSIS: Deep learning models can be used to analyse a patient's genomic data to identify the specific genetic mutations that may be driving their disease. This can help clinicians identify personalized treatment options that target these mutations.
PREDICTIVE ANALYTICS: Deep learning models can be used to analyse a patient's medical history, family history, and other clinical data to predict the likelihood of certain diseases or conditions. This can help clinicians identify patients who are at high risk for a particular disease and take proactive measures to prevent or treat the condition.
TREATMENT SELECTION: Deep learning models can be used to analyse large volumes of data from clinical trials and real-world patient data to identify the most effective treatment options for individual patients. This can help clinicians make more informed decisions about which treatments to use for their patients, based on factors such as the patient's age, medical history, and genetic profile.
Drug discovery:
Deep learning models can be used to analyse vast amounts of data to identify new drug targets and potential treatment options. This can help accelerate drug discovery and development, leading to new treatments for a wide range of diseases and conditions.

IV. FUTURE SCOPE OF AI

With potential applications in numerous industries, deep learning's promising and exciting future in AI is quite fascinating. Here are a few potential advancements in AI and deep learning for the future:
EXPLAINABLE AI: Interpreting the output of the models can be challenging, which is one of deep learning's drawbacks. An emerging field called explainable AI tries to create models that can explain their choices, making it simpler for people to comprehend and believe the outcomes.
FEDERATED LEARNING: Federated learning is a method that enables the training of deep learning models using data from several sources without the need for centralised data. This may make it possible for fields like to use AI more frequently.
REINFORCEMENT LEARNING: Reinforcement learning is a branch of machine learning in which models are trained to make judgements based on mistakes. This may make it possible for AI systems to learn and adapt in real-time, enhancing their precision and efficacy.
EDGE COMPUTING: As opposed to data processing in a centralised place, edge computing processes data closer to the source. This may make it possible for AI systems to function more effectively without consuming a lot of processing or storage space.
In the developing discipline of quantum computing, data is processed using the principles of quantum mechanics. The ability to process enormous volumes of data considerably more quickly than is now achievable with conventional computing could result from this.

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Overall, deep learning's potential for AI is very bright, with applications across a wide range of industries. We may anticipate new and inventive applications of AI and deep learning as technology progresses, which will revolutionise many aspects of our life.

V. CONCLUSION

AI and deep learning are revolutionizing the healthcare industry by enabling clinicians to make more accurate diagnoses, develop personalized treatment plans, and improve patient outcomes. From analysing medical images to identifying new drug targets, AI and deep learning have the potential to transform every aspect of healthcare. By analysing vast amounts of data and identifying patterns and anomalies that may be difficult for humans to see, these technologies can help clinicians make more informed decisions and provide better care for their patients. While there are still challenges to overcome, such as ensuring patient privacy and developing explainable AI models, the potential benefits of AI and deep learning in healthcare are enormous. As these technologies continue to evolve and become more accessible, we can expect to see even more innovative applications in the healthcare industry that will transform the way we diagnose, treat, and prevent disease. Ultimately, AI and deep learning have the potential to improve the quality of care for patients around the world, helping to save lives and improve the overall health and well-being of communities everywhere.

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