JOURNAL OF ALGEBRAIC STATISTICS
Volume 13, No. 3, 2022, p. 4674 - 4681
https://publishoa.com
ISSN: 1309-3452

Uses of Artifical intelligence in Healthcare System:A Review

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ABSTRACT

Artificial intelligence (AI) has come a long way in the last several years, both in hardware implementation and software algorithms and applications. This paper examines recent advances in artificial intelligence applications in biomedicine, such as living aid, illness diagnosis, biomedical research, and biomedical information processing. It also reviews deep learning as a technique in Artificial intelligence in healthcare and compares it to traditional methods. This review will better comprehend technology availability, keep the pace of new scientific developments, appreciate the enormous potential of artificial intelligence in biomedicine, and inspire researchers working in related domains. It is fair to say that the use of AI in biomedicine is in its early stages, like artificial intelligence itself. Artificial intelligence will continue to push the boundaries and broaden the scope of its applications as new improvements and discoveries are made, and substantial advancements are projected shortly.

Keywords: Artifical intelligence,Deep learning,Natural language processing,Pattern recognition,Image recognition.

Introduction

In contrast to human or other living species' intelligence, robots' intelligence is known as artificial intelligence (AI). AI is also theresearch of "intelligent agents," specifically, any system or agent that can see and comprehend its environment and take the necessary measures to attain its goals. Machine learning is another term for this kind of intelligence (ML). Machine learning and analysis are examples of how artificial intelligence (AI) may be used in issue solving.

Software and hardware are often required for an AI system (Dias & Torkamani 2019). Algorithms are at the heart of AI from a software standpoint. Conceptually, an artificial neural network (ANN) may be used to run AI algorithms. There are weighted communication pathways between neurons in the network, which mimic the structure of the human brain. Multiple stimuli from nearby neurons may affect a single neuron, and the whole network can alter its state. The NN can produce outputs in response to environmental inputs, precisely as the human brain does when it adapts to various environmental shifts.

Applying foran NN algorithmic program on a physical computing platform is the most important aspect of AI from a hardware standpoint (Rong et al.,2020). The most straightforward technique is to use a universal-purpose central processing unit (CPU) with several threads or cores to perform the NN algorithm. GPUs, which excel in convolutional calculations, have also been preferable to CPUs for large-scale neural networks (NNs). For spiking NNs, co-processing between the CPU and the GPU proved more efficient than using the CPU alone. Even more efficient implementation of NNs may be achieved using programmable hardware, such as Application-Given Integrated Circuits (ASIC) and field-programmable gates (FPGAs), which can be tailored to a specific application. As a result, they have better power efficiency. They are smaller than CPU and GPU platforms since they can be tailored to a given application.

Form factor improvements and power efficiency are required to deploy AI in edge devices. Spintronics and memristor technology have been used to construct AI algorithms in analog integrated circuits. According to Fujiki et al. (2021), it is possible to blend computation and memory in some of these novel platforms, to overcome the "memory wall" of classic von Neumann designs. In order to make necessary changes, this access is required.

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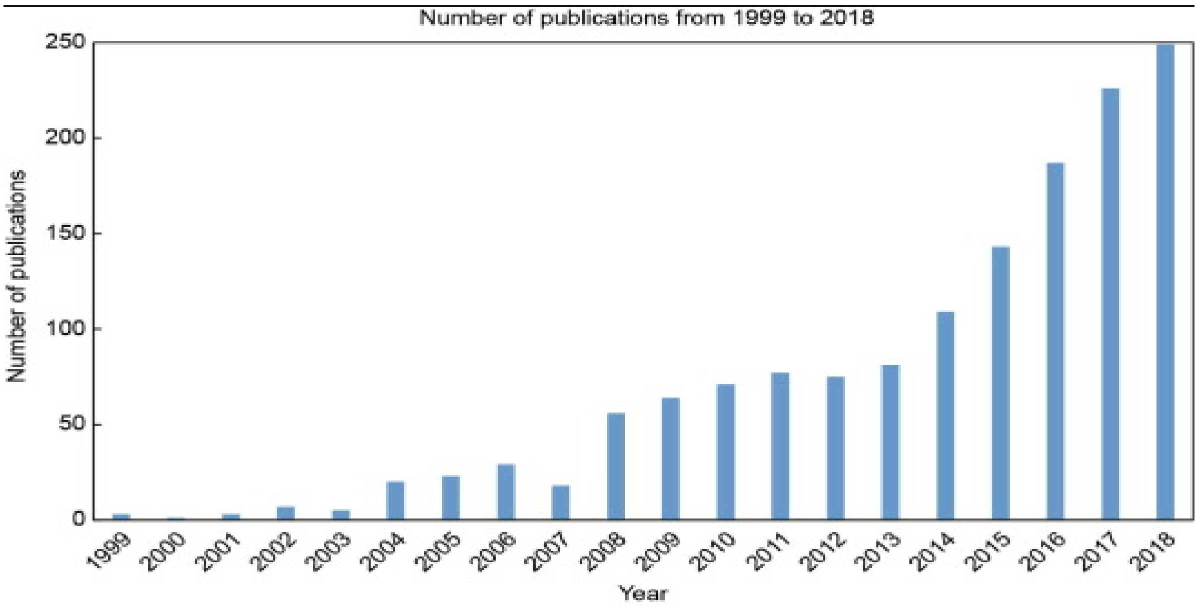
Reducing the number of bits needed to represent data in AI implementations has been a recent goal of academics looking to increase AI implementation efficiency. If one moves from 32 or 16 to 8 bits, the calculation accuracy will be maintained. The advantages include quicker calculation, lower power consumption, and a smaller footprint. The "memory wall" limitations, on the other hand, persist. It is critical to use balanced datasets and employ proper training techniques,enough volumes of data, and the continued availability of datasets to acquire optimal performance from ANNs.
Because of the fast growth of AI software and technology, AI is now being used in many technological domains, including the Internet of Things, autonomous driving,machine vision, robotics, and natural language processing. From 1999 to 2018, scholars in the biomedical sciences have been actively using artificial intelligence (AI) to enhance the treatment and analysis results and, as a result, to improve overall health care (Secinaro et al., 2021).



There has been a noticeable increase in interest over the previous five years, and further development is expected in the future (Secinaro et al., 2021). The advantages that artificial intelligence (AI) may provide to biomedicine have been anticipated for many decades. In reality, several studies have examined the potential of artificial intelligence in biomedical engineering. AI and biomedical applications have made significant development recently. Therefore, this paper aims to review the usage of AI in the health care sector.

Deep learning in Health care

Deep learning refers to a new expansion of conventional neural network technology. Deep learning may be thought of as a neural network with many layers, which is what it is. Deep learning is enabled by the rapid growth of modern computers, which allows it to construct neural networks with many layers, which is not possible with traditional neural networks. As a result, deep learning may investigate more complicated non-linear patterns in data. Another factor contributing to the recent rise in popularity of deep learning is the growth in the number and complexity of data available. The graph below indicates that deep learning is employed in imaging analysis in large numbers. It makes sense, given that images are naturally complex and high volume.

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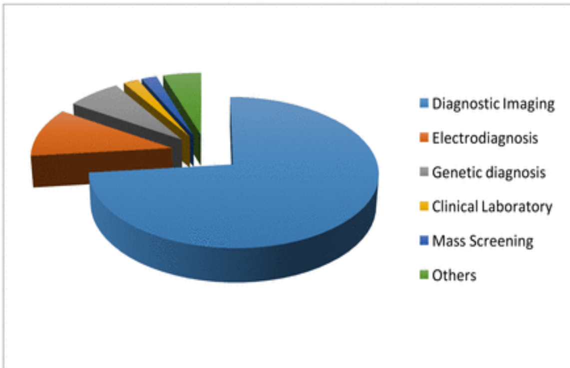

Uses of Deep Learning in Healthcare

Deep learning headlines are now focused on small-scale pilots or research initiatives that are still in the pre-commercialization phase of their development. On the other hand, deep learningslowly makes its way into cutting-edge clinical tools with high-value applications. Several creative patient-facing apps and a few unexpected ways to improve the health IT user experience are among the most promising.

Imaging diagnostics and analytics

MR and CT procedures employ picture segmentation, disease identification, and prediction via image recognition and object detection. A mixture of imaging data features, such as tissue volume, shape, and size, may be used to produce successful interpretations by deep learning models. It is possible to use these models to identify critical regions in photos. Deep learning algorithms diagnose diabetic retinopathy, Alzheimer's disease, and breast nodules (Shaheen, 2021). Thanks to new advancements in deep learning, most pathology and radiology photos will be studied in the future. Algorithms for deep understanding make it easier to identify and prioritize anomalies in large datasets. Doctors benefit from the insights provided by convolutional neural networks (CNNs) by catching health problems in their patients earlier and with more precision.

Convolutional neural networks (CNNs) are a sort of deep learning especially well-suited to image analysis, such as MRI or x-ray findings (Blaivas & Blaivas 2021). As a result, computer scientists at Stanford University say, CNNs are built with the idea that they would be processing pictures, enabling the networks to run more effectively and handle bigger images more efficiently. When it comes to recognizing essential characteristics in diagnostic imaging investigations, certain CNNs have surpassed the accuracy of human diagnosticians.

Healthcare data analytics

Electronic health records (EHRs) offer a wealth of organized and unstructured data that deep learning models can analyze quickly and accurately. These records may include clinician notes, laboratory test results, diagnoses, and drug prescriptions. Lifestyle data may be gleaned from cellphones and other wearable devices and deep learning models; they can convert data by monitoring medical risk factors using mobile applications. In 2019, the FDA authorized Current Health's AI wearable gadget for home use as one of the first AI medical monitoring wearables(Briganti & Le Moine 2020). Using this gadget, healthcare personnel can track vital signs such as heart rate, breathing, temperature, and movement.

Mental health chatbots

AI-based mental health applications like Happify, Moodkit, Woebot, and Wysa are becoming more popular. Some of these chatbots can have more lifelike interactions with patients using deep learning algorithms. According to Fulmer et al. (2018), students' sadness and anxiety symptoms may be significantly reduced with an intelligent conversational agent.

Comparison between Deep learning and traditional Machine Learning algorithms

Data generated by clinical activities such as screening, diagnosis, treatment assignment, and other activities like these must be "trained" with AI systems before they can be used in healthcare. "Training data" is the term for this information (Esmaeilzadeh, 2020). Medical records fall under clinical data, such as demographics, medical notes, electronic recordings from medical equipment, and results from clinical laboratories and imaging studies.

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Image analysis, genetic testing, and electrodiagnosis are used extensively in the AI literature throughout the diagnostic stage, as shown in Figure 1. AI can help radiologists analyze diagnostic images that have many data. Long non-coding RNAs, such as those seen in stomach cancer, have been the subject of research by Li et al. Using an electrodiagnosis aid system developed by Shin et al., neurological impairment might be detected (Li et al., 2017).

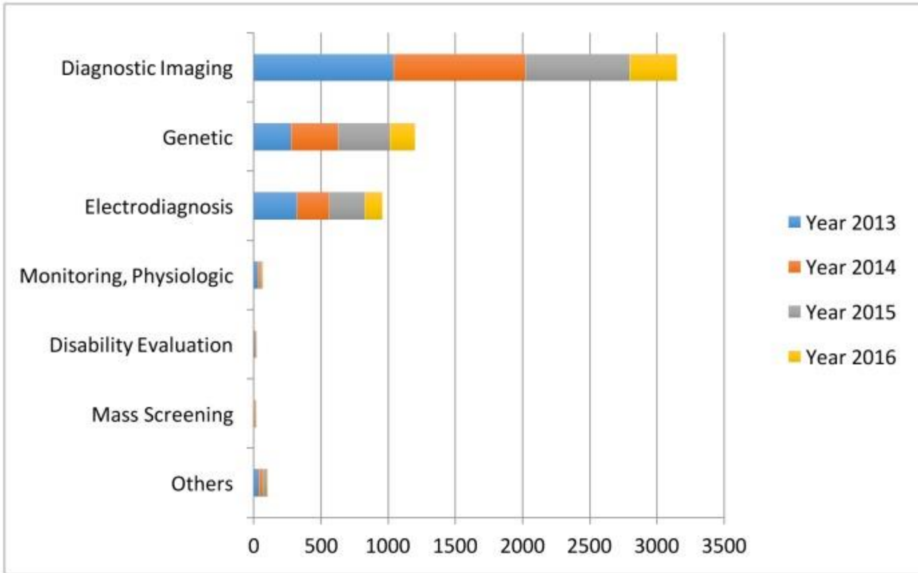

Figure 1

Machine learning (ML) approaches for analyzing structured data, such as imaging or genomic, are applied in this area. ML algorithms used in medical applications include clustering patients' traits and inferring disease probability. Unstructured medical data, such as medical journals and clinical notes, can supplement and enhance organized medical data using natural language processing (NLP) approaches. The goal of natural language processing (NLP) is to turn unstructured text into data that computers can analyze.

Although research on artificial intelligence in healthcare is growing, three major diseases are still the focus of AI research: cancer, nervous system disease, and cardiovascular disease. Because these three diseases have received much attention, it is not a surprise. Early detection of all three illnesses is critical to preventing further health problems for individuals. An additional advantage of the AI system is that it has the potential to improve diagnostic methods like imaging, genomics, EMR, and electrophysiology (EP). (Wang et al., 2020).

In preprocessing or quality control procedures, the ML algorithms can be used immediately to image, EP, and genomic data. Narrative text can be mined for useful information by NLP to aid clinical judgment.

Comparative Study of NLP and Image, Speech, and Pattern recognition Algorithms		
Algorithm	Description	Experienced Efficiency
Natural Language Processing	Computer-mediated interpretation of spoken or written language is known as natural language processing (NLP), where sentiment analysis occurs.	NLP aids computers in reading text, hearing Speech, and interpreting it while also analyzing sentiment and determining which components are essential enough to incorporate into machine learning algorithms (Jayaraman

		et al., 2020). NLP-related tasks include chatbots, virtual personal assistants, document descriptions, speech recognition, and language translation. Emotion AI or opinion mining is a sub-field of NLP that aims to extract public mood and perspectives from reviews, blogs, forums, news, social media, etcetera. Sentiment Analysis While sentiment analysis is considered a machine learning activity; it also includes more powerful emotions like sadness, extreme happiness, extreme happiness, anger, and a host of others (Messaoudi et al., 2022).
Image, Speech, and Pattern recognition	There are many examples of machine learning in the real world that can identify an object as a digital image, including image, Speech, and pattern recognition.	Image recognition can be used to label a cancerous or non-cancerous x-ray,identify characters or faces in an image, and tag images on social media, among many others(Hou, 2020). Using machine learning techniques is also common for sound and linguistic models, such as Cortana and Google Assistant and Alexa and Siri. When talking about pattern recognition, we mean the automated detection of patterns and regularities in data, such as images. Classification, feature clustering, sequence labeling methods, and selection are among the machine learning techniques employed in this field (Dargan et al., 2020).

Massive volumes of data are a significant benefit of deep learning, which helps explain why it is becoming so popular. There will be many new chances for deep learning advances in the "Big Data Era" of technology. According to Waxenegger-Wilfing (2021), the deep learning models are like the rocket engine. The data we can put into these algorithms is like rocket fuel.

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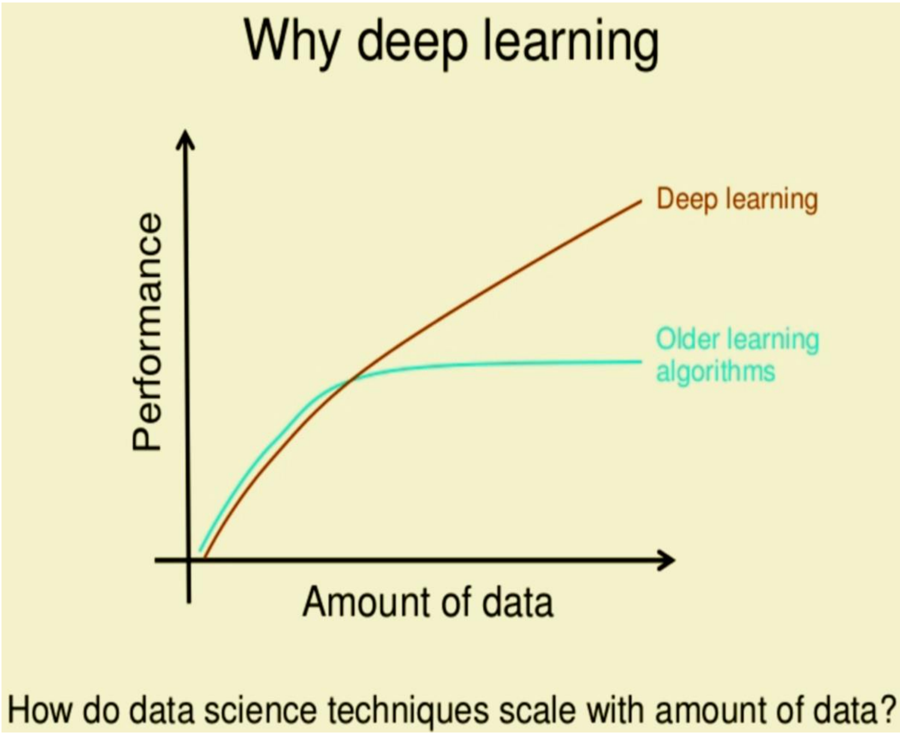

In contrast to typical Machine Learning techniques, Deep Learning necessitates high-end computing resources. The GPU is now an essential component to carry out any Deep Learning algorithm. Traditional machine learning approaches need a domain expert to identify the majority of the valuable features to simplify the data and make patterns more evident to learning algorithms (Kaur et al.,2020).The significant benefit of deep learning is that it tries to learn high-level characteristics incrementally from data when it comes to deep learning. There is no longer a requirement for domain knowledge and feature extraction.

How Deep Learning and Machine Learning approach problem resolution is another significant distinction. There is a distinct difference between Deep Learning and Machine Learning in approaching an issue. For example, deep learning algorithms like Yolo net take a picture as input and output the position and name of items. However, to use the HOG as an input to the learning method, the abounding box object identification technique is needed first in typical Machine Learning algorithms like SVM.

Accuracy of deep learning in health care

It is now possible for the healthcare sector to evaluate large amounts of data quickly without sacrificing accuracy because of deep learning (Nash et al., 2018). An elegant combination of both machine learning and artificial intelligence, it employs a layered algorithmic architecture to process enormous amounts of data in a short time. Deep learning in healthcare has several advantages, including speed, efficiency, and accuracy, but the advantages do not end there. The neural networks constructed by numerous layers of AI and ML and their learning capacity are much more beneficial. Yes, learning is the key to deep learning's success.
This kind of learning is based on mathematical models that mimic the human brain in many ways. Network and technology layers offer tremendous computer power and the capacity to sort through enormous amounts of previously lost, forgotten, or overlooked data. Healthcare professionals can solve complicated issues and extract valuable insights from the mountains of data that populate the industry using these deep learning networks. In the healthcare industry, it is a skill set noted.

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Conclusion

AI in biomedicine, encompassing illness diagnosis and prediction, living aid, biomedical information processing, and biomedical research, was covered in this work. Many additional fields of biomedicine might benefit from the use of artificial intelligence. Artificial intelligence is becoming essential in biomedicine because of the inherent complexity of biological issues and the applicability of AI to handle such challenges. The progress of biomedicine necessitates higher levels of AI capacity, while new AI capabilities enable unique biomedical solutions. Both areas will progress significantly shortlydue to this match of supply and demand and paired advances.

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