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A COMPARATIVE ANALYSIS OF AI AND MACHINE LEARNING ALGORITHMS FOR CLOUD-BASED BIOMEDICAL HEALTHCARE APPLICATIONS

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ABSTRACT
The biomedical field is one that has benefited greatly from today's advances in artificial intelligence (AI) and machine learning (ML). Artificial intelligence (AI) is the study of how computers can imitate human intellect in a variety of contexts. As an additional point, ML may be thought of as a branch of AI. Automatic pattern recognition is utilized. The goal of this publication is to provide researchers with a foundational knowledge of machine learning and its uses in medical care. Before discussing specific applications of machine learning in healthcare, we first provide a taxonomy of relevant schemes. Data pre-processing (data cleaning, data reduction), learning (unsupervised, supervised, semi-supervised, and reinforcement learning), evaluation (simulation-based evaluation, practical implementation-based evaluation in real environment), and applications (diagnosis, treatment) are the pillars of our proposed taxonomy for machine learning-based schemes in healthcare. Our suggested categorization allows us to examine several papers published on healthcare applications of machine learning. We hope that by reading this article, researchers can have a better understanding of the current state of research on ML's medical applications, better understand the obstacles they face, and better plan for the future of this field.
KEYWORDS: Artificial Intelligence (AI); Machine Learning (ML); Diagnosis; Treatment; Medicine.

INTRODUCTION
The term "Machine Learning" (ML) encompasses a broad category of statistical methods that enable machines to acquire knowledge from experience rather than predetermined rules. Algorithm modifications are a common manifestation of this type of learning. ML software can learn to identify persons in photos by analyzing thousands of images. There are two main categories of machine learning, supervised and unsupervised learning. One of the greatest sectors that stands to gain from this innovation is healthcare. As a result of scientific and medical breakthroughs during the past century, people are living longer than ever before. Even though technology has come a long way, new developments in areas like artificial intelligence (AI) and machine learning (ML) hold the possibility of a medical revolution. Of course, the tiniest and most insignificant details of any process may be reduced to a minimum with the help of computing. Machine learning (ML) is already used in healthcare, and it has promising future applications.

Figure 1. Schematic Representation of IOT Devices and Cloud Data Transfer

Big data, machine learning apps, and robotics are just some of the recent AI technologies being used to monitor, detect, and quantify risks and benefits in the healthcare business. Medical data and analytics are extremely important in the healthcare industry as they help improve processes and streamline the delivery of healthcare services. The volume and complexity of medical data collected in recent years have grown at an astounding rate. Electronic health records (EHRs), medical imaging data, and data from other monitoring devices, such as health tracking devices and apps, are just a few examples of the massive amounts of data generated by medical professionals, researchers, and patients. Artificial intelligence (AI) technology can now successfully take data, process it, perform dynamic analyses, and generate conclusions that may be used for medical intervention in this setting. Machine learning techniques, backed by data storage and processing capability, are frequently used to carry out this task. The daily monitoring of medical data, for instance, may allow for the establishment of solid forecasts based on patient behavior patterns. Therefore, AI may provide recommendations for diagnosis, medical intervention, therapeutic insights, and strategies for mitigating health deterioration and supporting proactive strategies to prevent patient conditions from worsening, thereby improving patient outcomes across the spectrum of diagnosis, illness, and medication use. Most cutting-edge medical facilities are currently investigating artificial intelligence (AI) solutions to enhance clinical accuracy and reduce operational costs. AI helps doctors and patients choose the best course of therapy by providing comprehensive information on all available alternatives.

The Role of AI in Establishing a Smart Sensor Network

Artificial intelligence (AI), often known as machine intelligence, is a subfield of computer science in which robots are given the capacity to mimic human intellect. Artificial intelligence (AI) allows computers and robots to comprehend, analyze, and learn from data using predefined algorithms. Cameras now have the ability to detect faces automatically, computers can translate across languages, searching for and locating things online is a breeze, computers can help physicians make choices, and the list goes on. Artificial intelligence (AI) technology may be traced back to the 1930s, when Alan Turing created the first Turing machines for performing clever mathematical computations automatically. Since its inception as a field of study in the 1950s, artificial intelligence has seen much investigation into its potential applications in fields including natural language processing, learning, reasoning, and knowledge representation. Recent advances in AI have been made possible in part by leaning on fields as diverse as psychology, linguistics, and philosophy in addition to computer science. As a result, AI has found uses in fields as diverse as teaching, e-commerce, robotics, navigation, healthcare, agriculture, the armed forces, marketing, and gaming. Search engines like Google, recommender systems like Netflix, self-driving cars like Tesla, and speech recognition systems like Siri and Alexa are all examples of popular AI applications. The main categories under which AI techniques fall are as follows: Inferencing Machines robotics Processing of natural language Big Data and Computer Vision.

- Classification: Decision tree, Naïve Bayes classifier, Bayesian network, Random Forest, Neural network, Deep learning, Support vector machines,
- Clustering: K-means, Mean shift, Expectation-Maximization, Gaussian mixture model,

- Prediction: Linear regression, Learning vector quantization, Logistic regression, K-nearest neighbors

To some academics, "strong AI" indicates robots can match or exceed human intelligence. Conversely, "weak AI" has fewer features. In weak AI, engineers of the AI system educate the computers to solve issues using AI algorithms. Weak AI applications include recommendation systems for online retailers, medical assistance software, and voice-based personal assistants like Siri. In the realm of strong AI, robots may act autonomously, without any input from a human being. Strong AI is useful in many areas, including cyber defense, the entertainment industry, and pattern identification and prediction of human behavior. In addition, many people turn to deep learning to help them with difficult issues. Using an artificial neural network with several layers, "deep learning" is a specific type of machine learning. Self-driving vehicles, fraud detection, healthcare, entertainment, machine translation, and virtual assistants are just some of the many possible applications for deep learning algorithms. The influence of artificial intelligence (and related fields like robots, the IoT, and machine learning) on human cultures might be profound. Human life may be made better with the help of AI technology, which can make it easier, safer, and more productive. Face recognition for security, automation in industry, natural language processing for translation, home robots, machine learning, and vision for healthcare are just a few of the many domains where AI has improved our daily lives. Thanks to advancements in AI, the internet of things, cloud computing, robotics, cyber physical systems, and machine to machine communication may now be realized, ushering in the Industry 4.0 revolutions. Smart automation and interconnection, when implemented properly, may help individuals manage their time, workload, flexibility, and cooperation. Some people who are skeptical of new technologies wonder if we actually need AI. Unwanted societal shifts, job loss, income disparity, and cybercrime are just some of the bad outcomes that AI has the potential to bring to civilizations. As a result, there is a lot of interest in studying the impact of AI in many fields. In this regard, the findings of this study provide light on the application of AI in the medical field.

LITERATURE REVIEW

Khwaja Mutahir Ahmad et al (2016), Recently, AI has demonstrated its usefulness in practically every industry. Researchers are showing a lot of interest in Machine Learning, a subfield of artificial intelligence. While traditional methods of prediction still have their place, Machine Learning has surpassed them in nearly every field of study. Training data is essential for many current Machine Learning techniques. Researchers may be hesitant to apply Machine Learning methods that call for massive amounts of training data because of the limited size of available datasets. This overview provides examples and evidence from relevant studies to show how Grey Machine Learning (GML) might be used to solve this problem. Which can make accurate time series predictions using both small and large data sets? The current state of grey models and machine learning forecasting methods is mapped out in detail in this survey. A quick explanation of Machine Learning and many types of traditional grey forecasting models are explored to give readers a solid foundation for further study. In addition, the value of the GML framework is briefly discussed.

Ahmed Abdelaziz et al (2018), The capacity of cloud computing to enhance the performance of healthcare services (HCS) has led to its recent proliferation in this sector. The best selection of VMs to execute a medical request, however, provides a significant difficulty. Medical requests (tasks) from stakeholders (patients, physicians, etc.) may be executed more quickly and with more efficiency if the right virtual machines (VMs) are chosen. This work provides a novel paradigm for HCS in the cloud, one that makes use of Parallel Particle Swarm Optimization (PPSO) to find the best possible configuration for virtual machines (VMs). To further evaluate our VMs model, we present a novel model for the diagnosis and prediction of chronic kidney disease (CKD). The CKD prediction model is constructed using linear regression (LR) and a neural network (NN) in rapid succession. In order to identify the most important contributors of CKD, LR is employed. NN is utilized to make CKD prognoses. According to the findings, the suggested model has a 50% lower overall execution time than the state-of-the-art models. Additionally, the system's real-time data retrieval efficiency has been increased by 5.2%. In addition, the hybrid intelligent model has a 97.8%

success rate in predicting CKD. When compared to the majority of the models used in the linked publications, the suggested model is 64% more effective.

RESEARCH METHODOLOGY

Healthcare services and the capacity to treat complicated diseases are continually advancing and improving in quality. However, there are still numerous obstacles to overcome, especially when it comes to customizing dose and treatment duration depending on patient characteristics. In order to determine the most effective and customized therapies for children, ML has been effectively implemented in pediatric care in recent years. Due of the recent COVID-19 epidemic, ML has been thrown into the limelight. To streamline operations and drive R&D in an often unpredictable and uncertain work environment, businesses have resorted to ML. Hospitals and health systems have benefited from ML's ability to tackle one-off problems. Many businesses are making an effort to take advantage of ML technology since it is one of the most promising areas of artificial intelligence. The use of ML is rising in popularity. Its use of algorithms for data-driven learning makes it applicable in fields as diverse as business and medicine. As new research, methods, and tools become available, healthcare is always evolving. In some of these novel contexts, ML might help medical practitioners. Unstructured text was historically difficult to develop and distribute at scale, but modern technology has made this possible. Millions of lives can be improved by the decisions that doctors and executives can make with the help of this new trove of ML-derived information.

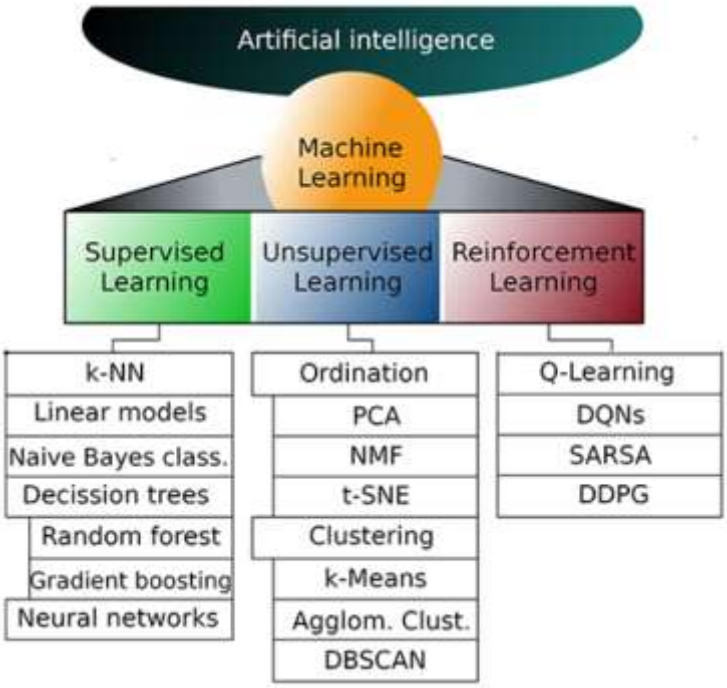

Figure 2. Representative Machine learning algorithms

High-performance computing that is quick, reliable, and able to manage huge and complicated data silos is being generated as cutting-edge technology gains popularity in the healthcare industry. Medical practitioners are aided in their work by automated ML to improve patient care and healthcare infrastructure. This technology enables healthcare practitioners to make the most of real-time data by providing unique methodologies and efficient programming interfaces for doing so. In turn, this improves the quality of care provided to patients by healthcare professionals and other employees. Currently, the most common use of ML in healthcare is to evaluate massive volumes of data for the benefit of medical experts. This technology can help doctors see outliers, trends, and patterns, all while reducing the likelihood of mistakes being made. Accurate healthcare operations and lightning-fast computing capabilities are two outcomes of the data science revolution, which incorporates ML models.Due to its capacity to handle massive quantities of data, create accurate findings, and regulate processes to generate the best optimum output, artificial intelligence (AI) has been a topic of interest among researchers and biomedical enterprises. Machines have been used for some time now to make decisions and forecast the long-term repercussions of diseases and other

events, thus artificial intelligence is hardly a new concept. Machines and algorithms now play an increasingly important role in our daily lives. Using trustworthy machine-algorithm-coordinated results, we take into account a number of characteristics, including fairness, explainability, accountability, dependability, and acceptability. The term "artificial intelligence" (AI) refers to the use of computer programs and algorithms to simulate human intellect. Logical thinking, knowledge-based learning, drug development, guided surgery, and state-of-the-art imaging are just some of the cognitive tasks that AI can do. The notion of artificial intelligence (AI) was founded by a number of researchers in the late 1940s, and their concepts continue to be important as the basis for modern AI-based research and creation. In 1972, Japanese scientists created "WABOT-1," the world's first humanoid robot that can speak Japanese, calculate distances, and find its way around an environment. However, until the late 1990s, progress in AI research was stymied by a lack of both processing capacity and financial resources. Large technology corporations like IBM began developing AI-based models in the late 1990s. In the mid-2000s, businesses that process vast amounts of data profited from AI models and applications. This includes social media sites, email providers, search engines, and many more. The increased processing capability of CPUs and the practicality of GPUs in the realm of calculations are contributing factors to the recent growth of AI. Big data generated by consumer demand and the need for improved analytics is another driver toward the use of AI-based systems. Most artificial intelligence (AI) systems nowadays employ machine learning (ML) to analyze data and draw conclusions about the world. ML may be broken down even further into subcategories based on algorithm structure and learning technique. There are several distinct types of learning strategies, including supervised, unsupervised, and reinforcement. Supervised learning involves supplying an algorithm with training data. Applications that have access to and can make use of previous data for making predictions about future occurrences are good candidates for supervised learning. These more easy and precise procedures are made possible by these algorithms' utilization of previous data for training. It is possible to further categorize these programs into regression and classification programs. Applications of regression algorithms include weather forecasting and other situations in which there is a correlation between the input and output variables. Classification algorithms divide output variables based on their relationship to input variables into groups, such as yes/no or true/false. Because of these characteristics, supervised learning may be used to anticipate the outcome of a real-world situation by analyzing the data at hand. Even if the data in a dataset are incorrectly labeled or categorised, unsupervised learning techniques can nevertheless extract a pattern from the data.

RESEARCH DESIGN

Machine learning demonstrates crucial performance in health-care, and these are predominantly enforced to healthcare, including computer-aided diagnosis, image registration, image annotation, image-guided medical aid, and image database retrieval, multimodal image fusion, medical image segmentation, where deficiencies may be fatal. The societal effects of machine learning in healthcare are likely to be small. Machine learning is the key to lowering the rising cost of healthcare and facilitating better communication between patients and doctors. There are a plethora of health-related applications for ML solutions, such as assisting physicians in identifying many individualized prescriptions and therapies for patients and assisting individuals in determining when they need to record follow-up visits. The healthcare industry now has access to a plethora of previously unavailable data. It stores electronic medical records (EMRs) that may or may not include organized data. Data that is easily analyzed in a database is called "structured health information," and it will include things like patient weights and general symptoms like stomach discomfort, headache, etc. The vast majority of medical data consists of unstructured notes, photographs, audio/video recordings, reports, and discharge summaries. Conversations between a provider and a patient are difficult to quantify and evaluate due to their uniqueness and the variety of paths they might follow.

Different Techniques Used by ML

1. SVM, or Support Vector Machine The 1990s-created Support Vector Machine (SVM). A common and straightforward method for completing machine learning (ML) projects is the support vector machine (SVM). In this method, participants are presented with a set of training samples, and those

samples are then organized into several groups. Classification and regression issues are typical applications of the support vector machine (SVM).
2. A Naive Bayes classifier Bayesian classifiers may be seen in statistical classifiers. Class membership probabilities are calculated using Naive Bayes from a single class label. It just needs to scan the data once, making categorization a breeze.
3. A Tree of Choices The most common classification method is the decision tree (DT), which consists of an internal node and one leaf node labeled with the classes to which the data belongs. Root nodes are the highest level nodes in a decision tree (DT). The decision tree is widely used since its creation is straightforward and does not call for any input parameters.
4. k-nearest neighbor as the fourth K-nearest neighbor is a popular method for sample categorization. Using this method, we can determine the distance measure using N samples from the training set.
5. The development of Fuzzy Logic from Fuzzy Set Theory. The range of these numbers is between zero and one. This technique is widely employed in various technical contexts.
6. Regression and Classification Using CART One name for the Tree Method is the CART. The target variable can be represented as a categorical or continuous variable in classification and regression trees, respectively. The tree's values are predicted using these factors.

Applications of Machine Learning in Biomedical Field

Machine learning algorithms may be trained using large databases of medical images such as X-rays, CT scans, and MRI images, allowing for faster and more accurate diagnosis of illnesses like cancer and heart disease. Second, in the realm of medicine, machine learning may help speed up drug development and save costs by predicting the efficacy and toxicity of potential pharmaceutical options. For example, machine learning may be used to forecast the activity of small compounds against targets and to identify novel therapeutic targets. Third, personalized medicine: using a patient's genetic and clinical data, machine learning may help determine which patients will have the best outcome from a given treatment. As a result, patients may benefit from more tailored and effective treatment plans that incorporate immunotherapies and targeted pharmaceuticals. Electronic Health Records: Machine learning can analyze patient data from electronic health records to identify patterns and trends, such as susceptibility to disease or response to treatment. As a result, doctors and nurses will be able to make more informed decisions for their patients. To uncover genetic differences associated with sickness risk and treatment efficacy, genomic data may be examined with machine learning. This might help scientists fine-tune treatments and develop superior disease preventive strategies. Machine learning may be used to develop diagnosis models for a variety of diseases based on patient data such as symptoms and test results. Machine learning may be used to diagnose skin cancer, for instance, by analyzing photographs of skin lesions. Machine learning can predict the risk of disease development and assess patient outcomes based on a number of factors such as age, gender, and comorbidities. This can help doctors and other healthcare providers make better decisions for their patients. Wearables, such as fitness trackers and smart watches, can gather data that can be evaluated by machine learning to monitor health and identify the early warning symptoms of disease. For instance, machine learning may be used to detect arrhythmias in a patient's heart using data from a wearable device and predict the patient's risk of developing cardiac illness.

RESULT AND DISCUSSION

Machine learning may also be used to enhance risk adjustment inside healthcare companies. Algorithms in these systems are able to extract data from medical records with more speed and precision than human reviewers, and they improve with experience. Plans and providers may use ML to find unrecognized risks and healthcare gaps, hence increasing the precision of risk scores. The healthcare industry may use the data gathered by ML to better manage risk and deliver higher-quality treatment to patients by pinpointing where care is lacking. Larger data sets may be integrated, explored, and used to make better decisions with the help of this technology. It operates on the principle of an algorithm, which is a collection of rules for accomplishing a certain job. This enables for the autonomous acquisition of useful knowledge within the medical community. The use of ML technologies for data analysis in healthcare has improved in terms of both reliability and effectiveness. As a result, people depend on healthcare providers to improve in order to meet their

demands for quicker diagnosis and treatment. In Table 1 we examine the most important uses of Machine Learning in Healthcare now. Algorithms powered by ML in healthcare feature self-learning neural networks that can enhance the quality of care by analyzing information about a patient's condition, X-rays, CT scans, and other diagnostic and screening data. Technology-enabled healthcare is gradually becoming a reality as the prevalence of smart medical devices increases. The healthcare industry is quite supportive of new ideas, which bodes well for the development of ML in the sector. This technology is responsible for processing large amounts of data, making reliable predictions about potential outcomes, and other tasks. Individuals with very specific requirements might benefit from this in the form of a tailored prescription. In the future, this ML technique might be used with nanotechnology to enhance drug delivery. Machine learning (ML) provides immediate assistance and foresees potential problems. ML has the ability to foresee pandemics everywhere in the planet. In today's environment, the expert must have a vast amount of data under control from sources like website data and real-time social media updates. This technology will help validate this information and make predictions about everything from illness outbreaks to life-threatening ones. More and more studies are incorporating ML into their findings. The processing of large amounts of data, the generation of reliable forecasts, and the facilitation of scientific inquiry by means of its use have all increased its relevance and importance. There is hope for the future of precision medicine in the adoption of ML as a novel approach for epidemiological investigations. The best outcomes occur when medical care is tailored to each patient's specific needs. This is why predictive analytics, a part of ML, may play such a pivotal role in tailoring care to each patient. Using a patient's clinical history and genetic information, doctors can make one of a small number of diagnoses or make a risk assessment. In the future, ML methods will generate a number of therapeutic options by drawing on the patient's medical record. Furthermore, medical institutions should consider adding ML-related curriculum to their curricula. Throughout their education, medical students, residents, and fellows should learn about machine learning and data science.

CONCLUSION

There are several areas of business where machine learning (ML) techniques are crucial. There are more issues in healthcare, and the costs continue to rise. They are fixed using a variety of machine learning methods. In this study, we provide many ML methods for illness prediction, including those applicable to cardiovascular disease, breast cancer, diabetes, and thyroid disorders. Based on the previous research, we know that naïve bayes can accurately diagnose cardiac conditions 86% of the time. When it comes to diagnosing breast cancer, SVM achieves a 96.40 percent success rate, whereas CART achieves a success rate of 79.00 percent. It has been stated that AI has benefits in several areas of healthcare, including cardiac arrhythmia monitoring, diabetes treatment, and aided operations. ML facilitates the efficient processing of large and complicated sensor data for the purpose of analysis and the enhancement of decision-making abilities. Analytical data may be extracted from low-resolution or noisy data sets with the aid of AI/ML as well. IoMT devices can use the AI/ML technology to learn the link between sample parameters and measured signals and then use SML techniques to extract the hidden information. In addition to enhancing signal strength, sensitivity, specificity, and measurement time, AI approaches can help reduce noise.

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