Review of Application of Machine Learning in Healthcare

Ashok Sharma[1], Parveen Singh*[2]
[1]*Lovely Professional University,Phagwara*
[2]*Govt SPMR College of Commerce, Jammu*
(E-mail: ashoksharmamca@gmail.com
(E-mail:imparveen@yahoo.com)
**Corresponding author*

Abstract - Machine Learning has emerged as a contemporary and advanced technology that has gained significant popularity across various industries. Its pervasive presence and widespread adoption make it a key component in numerous applications. Machine Learning plays a crucial role in diverse fields such as finance, medical science, and security. Particularly in the medical domain, it utilizes data from healthcare sources to uncover patterns and deliver exceptional predictive capabilities for disease prognosis.

This paper provides a recent review of the latest methods and algorithms utilized for the analysis of data captured by wearable sensors in healthcare services for monitoring vital signs. The focus is on common data mining tasks such as anomaly detection, prediction, and decision-making, with a particular emphasis on continuous time series measurements. The suitability of different data mining and machine learning techniques for processing physiological data is explored, along with an overview of the characteristics of the data sets used for experimental validation

Keywords: Machile Learning,Healthcare,ANN,Support Vector Machine, CNN, Ambient Intelligence

I. INTRODUCTION

This paper conducts a comprehensive examination of different machine learning algorithms employed to create effective decision support systems in healthcare applications. The authors of this article contribute to narrowing the research gap in developing efficient decision support systems for medical purposes [1].

Over the recent years, notable advancements have taken place in the application of machine learning across industries and research endeavours. This paper explores the possibilities of harnessing machine learning technologies in the field of healthcare and sheds light on several industry-driven initiatives that employ machine learning in the healthcare sector [2].

Contemporary electronic health records (EHRs) offer a wealth of data that can be utilized to address clinically relevant inquiries. The increasing volume of data within EHRs makes the healthcare domain particularly suitable for leveraging machine learning techniques. Nevertheless, learning from clinical settings introduces distinctive obstacles that complicate the application of conventional machine learning methodologies. Notably, EHRs often lack accurate disease labeling, conditions can involve multiple underlying endotypes, and the representation of healthy individuals is inadequate. This article serves as an introductory guide to elucidate these challenges and emphasize the potential for collaboration between the Machne machine learning community and healthcare practitioners to make meaningful contributions [3].

II. ARTIFICIAL IN HUMAN COGNITION

Artificial intelligence (AI) strives to replicate human cognitive abilities and is revolutionizing the healthcare sector, driven by the expanding availability of healthcare data and the rapid advancements in analytics techniques. In this paper, the authors have conducted an assessment of the present state of AI applications in healthcare and explored its future prospects. Widely adopted AI techniques encompass machine learning algorithms for structured data, including traditional methods like support vector machines and neural networks, as well as advanced deep learning approaches. Additionally, natural language processing techniques are employed for analyzing unstructured data. Prominent disease domains that leverage AI tools include cancer, neurology, and cardiology [4].

The concept of the artificial neural network (ANN), which draws inspiration from the synapse system of human neurons, was first introduced in the 1950s. However, the ANN faced limitations in effectively solving real-world problems due to challenges such as the vanishing gradient and overfitting during training of deep architectures, insufficient computing power, and a lack of substantial data to train the computer system. Nevertheless, recent resurgence of interest in this concept can be attributed to the availability of large-scale datasets, improved computing power facilitated by modern graphics processing units, and novel algorithms designed for training deep neural networks. Recent studies have indicated the potential of this technology to outperform humans in certain visual and auditory recognition tasks, indicating its promising applications in medicine and healthcare, particularly in the field of medical imaging. This review article offers valuable

insights into the historical development and applications of deep learning technology, with a specific focus on its relevance and potential applications in the realm of medical imaging.[5]

III. BIG DATA AND MACHINE LEARNING

The exponential growth of big data in the healthcare sectors has brought about very drastic outcomes in term of disease diagnosis and healthcare services through accurate data analysis. However, accurate results are based on the volume and authenticity of data. In this research we have paid stress on using machine learning algorithms for predicting the outbreak of chronic diseases. The research specifically focuses on a regional chronic disease, cerebral infarction, and proposes a novel algorithm for disease risk prediction based on a convolutional neural network (CNN) that incorporates structured and unstructured data from hospitals. Notably, this work stands out as it addresses both types of data in the context of medical big data analytics[6].

Machine Learning has found extensive applications in the healthcare industry, where prediction techniques have proven to be highly beneficial. These techniques encompass alerting systems aimed for healthcare quality to reduce costs and embrace personalized healthcare approaches, it encounters challenges in vital areas such as electronic record management, data integration, computer-aided diagnoses, and disease predictions. Machine Learning offers a diverse array of tools, techniques, and frameworks to tackle these challenges. This article sheds light on the wide-ranging applications of Machine Learning across different domains, emphasizing its pivotal role in the healthcare industry.[7]

EHRs have been increasingly utilized by researchers for various clinical informatics applications. Concurrently, the field of deep learning has witnessed significant advancements within the machine learning community. In this review, authors have conducted a comprehensive examination of current research endeavours that employ deep learning techniques in clinical tasks utilizing EHR data. This research summarizes the current state of the field and outline potential avenues for future research in deep learning with EHRs [8].

IV. AMBIENT INTELLIGENCE AND HUMAN ACTION

Ambient Intelligence (AmI) represents a novel approach in information technology that aims to enhance individuals' capabilities through digital environments that are perceptive, adaptable, and responsive to human needs, behaviors, gestures, and emotions. This futuristic vision of everyday surroundings fosters innovative interactions between humans and machines, characterized by seamless, pervasive, and proactive communications. The potential of AmI technology in developing practical solutions, particularly in the healthcare sector, is substantial. This survey aims to explore the integration of AmI techniques into the healthcare domain, providing the research community with essential foundational knowledge. We will examine the infrastructure and technology prerequisites for realizing the AmI vision, including smart environments and wearable medical devices. The review will encompass an overview of state-of-the-art artificial intelligence (AI) methodologies employed in developing AmI systems in healthcare. This includes diverse learning techniques for capturing user interactions, reasoning techniques for inferring user goals and intentions, and planning techniques for orchestrating activities and interactions. Furthermore, we will discuss how AmI technology can provide support to individuals impacted by physical or mental disabilities, as well as those living with chronic diseases.[9]

The objective of this study is to construct a classifier model using the WEKA tool to predict diabetes disease. The researchers utilized the Naive Bayes, Support Vector Machine, Random Forest, and Simple CART algorithms for this purpose. The aim was to identify the most effective algorithm based on performance results for accurately predicting diabetes disease. Each algorithm was evaluated using the dataset, and the experimental results were analyzed. It was observed that the Support Vector Machine algorithm demonstrated the highest accuracy in predicting the disease [10].

V. MACHINE LEARNING AND COMPUTATIONAL REQUIREMENTS

The insights gained from Machine Learning (ML) will play a crucial role in advancing research and enhancing our comprehension of diseases. However, the widespread application of ML typically necessitates substantial amounts of high-quality data, making progress both expensive and time-intensive. Nevertheless, recent advancements indicate that this technology has the potential to become an integral component of our healthcare system, relieving the workload of physicians and facilitating faster and more comprehensive patient care [12][13].

The emergence of Graphic Processing Units (GPUs) that are widely accessible revolutionized parallel processing, offering enhanced speed, affordability, and computational power. Concurrently, the era of 'Big Data' gained momentum, encompassing diverse forms of data such as images, text, bioinformatics, medical records, and financial transactions. Simultaneously, there was an exponential increase in data storage capabilities. These factors sparked a remarkable resurgence of interest in Artificial Intelligence (AI) not only within academic circles but also in industries beyond traditional computer science. AI has once again captured the zeitgeist and holds the potential to revolutionize medicine across various domains, including

basic science, clinical practice, healthcare management, and finance [14].

In order to fully harness the immense potential of extensive routine healthcare data and effectively collaborate with information technology experts and data analysts, healthcare epidemiologists should possess a certain level of proficiency in large-scale analysis techniques, with a specific emphasis on machine learning. This comprehensive review delves into the expansive domain of machine learning and its initial applications within the emerging field of digital healthcare epidemiology.[15]

VI. CONCLUSION

The application of Machine Learning (ML) in healthcare has garnered significant attention and has the potential to revolutionize the industry. ML techniques offer advanced capabilities for analyzing large volumes of healthcare data, extracting insights, and making accurate predictions. This review explores the various applications of ML in healthcare and highlights its transformative impact.

One major area of application is disease prediction and diagnosis. ML algorithms can analyze patient data, including medical records, genetic information, and imaging scans, to identify patterns and indicators of diseases. This enables early detection, personalized treatment plans, and improved patient outcomes. ML also plays a vital role in medical imaging, assisting in the detection of abnormalities, tumor classification, and image enhancement.

Furthermore, ML facilitates precision medicine by tailoring treatment plans to individual patients. By considering patient-specific data, such as genetic profiles, medical history, and lifestyle factors, ML algorithms can generate personalized treatment recommendations. This approach maximizes treatment effectiveness and minimizes adverse effects.

ML algorithms are also instrumental in improving patient care and healthcare operations. Predictive analytics can anticipate patient deterioration, enabling timely interventions and reducing hospital readmissions. ML can optimize resource allocation, predict patient flow, and enhance operational efficiency. Additionally, ML-based decision support systems aid healthcare professionals in making informed decisions by providing evidence-based recommendations.

VII. REFERENCES

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