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Machine Learning in ADHD and Depression Mental Health Diagnosis

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Abstract: *According to the World Health Organization (WHO) "depression" is considered a mental disorder. In this decade mental ailment like depression and stress has become common as well as a crucial public health concern and has a relevant impact on society. It influences the people of all age groups, male or female, urban or rural, educated or uneducated and even employed or unemployed. In this proposed work, a wearable is designed such that it captures the biological parameters experienced by the clinically depressed person while they undergo stress. IOT plays an important role in sensing, analysing and processing the data. This explores the current machine learning based methods used to identify Attention Deficit Hyperactivity Disorder (ADHD) and depression in humans. Prevalence of mental ADHD and depression is increasing worldwide, partly due to the devastating impact of the COVID-19 pandemic for the latter but also because of the increasing demand placed on the mental health services. It is known that depression is the most common mental health condition, affecting an estimated 19.7% of people aged over 16. ADHD is also a very prevalent mental health condition, affecting approximately 7.2% of all age groups, with this being conceived as a conservative estimate. We explore the use of machine learning to identify ADHD and depression using different wearable and non-wearable sensors/modalities for training and testing. With mental health awareness on the rise, it is necessary to survey the existing literature on ADHD and depression for a machine learning based reliable Artificial Intelligence (AI). With access to in-person clinics limited and a paradigm shift to remote consultations, there is a need for AI-based technology to support the healthcare bodies, particularly in developed countries*

Keywords: World Health Organization

I. INTRODUCTION

Depression is believed to be treatable but unfortunately, much depression and anxiety disorder victims keep suffering as they don't get the care and attention as well as support. Depression is the unbalanced feeling of sadness, exhaustion, and anxiety along with some different physical complaints. Depression is also a disease that is non-communicable and can be cured with the correct dosage of medicines and sometimes lifestyle changes.

The term Internet of Medical Things (IOMT) is becoming a common paradigm with so many advancements in the medical industry. This has increased the life expectancy of human beings, especially in developed countries. The Internet of Health Things or Internet of Medical Things or Smart Healthcare as it being called is combining the reliability and safety of conventional medical devices used for the treatment of chronic illnesses with the dynamicity and generality of Internet of Things. IOMT is providing solutions for addressing the requirements of both the aging population as well as patients with chronic diseases and providing patients mobility in contrast to the telemedicine systems. There are a multitude of mental health conditions that can affect individuals, with various explanations accounting for their occurrence. There is no single definitive answer that has been identified. Conditions like depression and schizophrenia have been associated with hereditary factors and chemical imbalances in the human body .

There are a multitude of mental health conditions that can affect individuals, with various explanations accounting for their occurrence. There is no single definitive answer that has been identified. Conditions like depression and schizophrenia have been associated with hereditary factors and chemical imbalances in the human body[20]. However,

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this research mainly focuses on ADHD and depression, the two most prevalent mental disorders in humans. Both conditions often co-occur, with people diagnosed with one being more likely to be diagnosed with the other. In fact, adults with ADHD are three times more likely to have depression, and individuals with depression have a 30-40% prevalence of ADHD. There are also links between ADHD and increased suicidal ideation. Distinguishing between the two can be challenging.

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II. PROBLEM STATEMENT

Attention-Deficit/Hyperactivity Disorder (ADHD) diagnosis currently relies on subjective assessments, leading to delays in identification and intervention. Existing methods lack precision in predicting ADHD, hindering the ability to implement timely and targeted therapeutic interventions for affected individuals. The challenge lies in developing a reliable machine learning model that can analyse diverse datasets to accurately predict ADHD, offering a transformative solution for early detection and personalized treatment strategies. Research indicates that depression can be associated with both cognitive impairment and dementia, and that depression increases the risk of developing dementia (Steffens et al, 2006). It is not always easy to diagnose depression in a person with Alzheimer's disease, as Alzheimer's itself may mimic the signs of depression. Although depression may be a risk factor for dementia, its presence is also an early presenting symptom, rather than its cause (WHO Library Cataloguing, 2006). There is a greater prevalence of depression with people who have vascular and mixed types of dementia as opposed to the Alzheimer's type.The escalating prevalence of ADHD and depression globally presents a substantial challenge to traditional mental health diagnostic and treatment frameworks, which are often constrained by subjectivity, accessibility issues, and resource limitations.

2.1 OBJECTIVES

Some objectives of this project could include:

- Develop a robust machine learning model capable of accurately predicting ADHD by integrating and analysing diverse datasets, including behavioural patterns and neuroimaging data.
- Enhance early detection capabilities to reduce the time between symptom onset and diagnosis, facilitating timely intervention and support for individuals at risk of or affected by ADHD.
- Evaluate the model's performance against standard clinical assessments and contribute to the validation of machine learning based diagnostic tools for ADHD within the medical community.
- To develop a Convolutional Neural Network (CNN) model for the accurate detection of ADHD using MRI scans.
- To utilize CNN for the identification of depression through analysis of facial expressions in the FER2013 dataset.
- To employ IoT technology for collecting and analysing environmental data to predict depression indicators.
- To enhance the accessibility and efficiency of mental health diagnostics through the integration of AI and IoT in remote monitoring.

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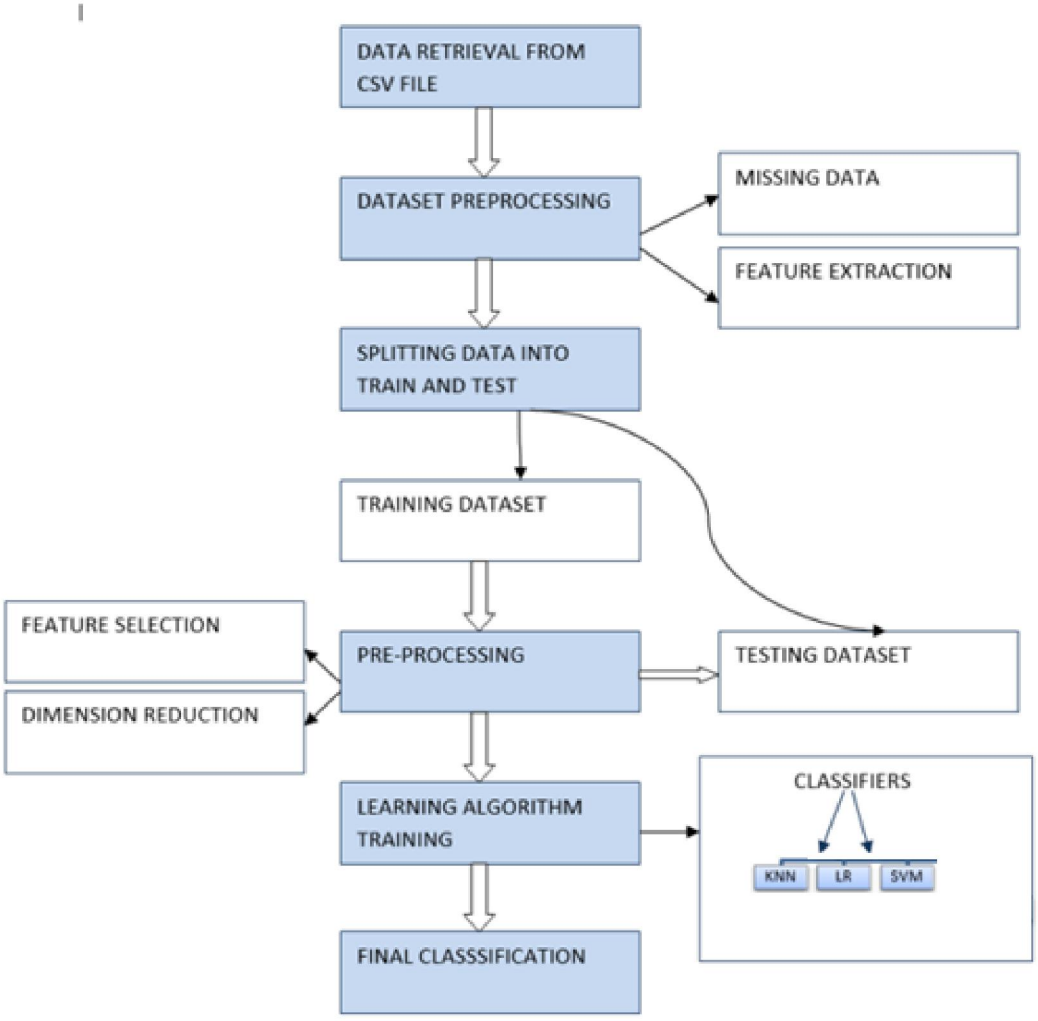
III. DESIGN AND METHODOLOGY

Diagnosis of ADHD Syndrome by Comparative Analysis of EEG Signals of Brain



IV. CONCLUSION

Machine learning offers substantial potential for improving ADHD and depression diagnostics. Despite challenges related to data quality, overfitting, and algorithm interpretability, machine learnings ability to identify patterns in complex datasets makes it a valuable tool in mental health research. Future efforts should focus on creating reliable models, protecting patient data, and ensuring models can be generalized to different populations. Effective collaboration between clinicians, data scientists, and patients will be key to maximizing machine learning's potential in mental health diagnosis and treatment. The project represents a significant advancement in the field of mental health care, leveraging artificial intelligence (AI) and the Internet of Things (IoT) to address the challenges posed by ADHD and depression. By developing machine learning (ML) models for early detection and monitoring, the project aims to improve the accuracy and efficiency of diagnosing these disorders, particularly in the context of limited access to in-person clinical services. Through the implementation of Convolutional Neural Networks (CNNs) for analysing MRI scans and facial expressions, the project offers a novel approach to identifying ADHD and depression. Additionally, the exploration of depression prediction using environmental data collected from IoT sensors demonstrates the project's innovative use of technology to enhance mental health care. The project's focus on remote diagnosis and treatment

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aligns with the current global shift towards telehealth and the increased demand for accessible mental health services. By providing a scalable and efficient solution for mental health disorders, the project aims to support healthcare professionals and improve patient outcomes in both developed and developing countries.

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