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Memory Dysfunction Detection: An MRI Image-Based Approach

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Abstract- Using magnetic resonance, anatomical structures of the brain have been studied. imaging (MRI), which has helped to analyze various neurological diseases and define pathological areas. In order to implement preventive measures, early detection of memory dysfunction is essential. Memory Dysfunction is the most common chronic disease in the people belonging to old age, with a high rate of affection. Deep learning has proved to be a big success in the analysis of healthcare imagery over recent years. Using segmented MRI scans, diseases related to brain can be classified more precisely due to detailed tissue architecture studies. Many, intricate segmentation paradigms have been introduced for diagnosing Memory Dysfunction. Since deep Learning algorithms are capable of delivering efficient results when collecting a lot of data, and have attracted interest. Use to segment the brain's structure and classify memory disorders. Therefore, the techniques of deep learning are currently favored over machine learning techniques. We're going to talk about the concepts of convolutional neural network. In order to detect memory dysfunction, it may be used to study brain anatomy.

Their results on open datasets, and their latest techniques Consideration is given to the benefits of brain MRI segmentation for the categorization of memory disorders.

Keywords: Memory Dysfunction, Alzheimer's disease detection , Dementia Prediction.

I.INTRODUCTION

Memory Dysfunction clinical condition is characterized by progressive declines in cognitive and memory abilities. According to estimates, in the range of 60 to 80 percent of dementia cases are caused by this disease, which makes it a serious issue for the elderly. The development of Memory Dysfunction symptoms into a conclusive diagnosis is a lengthy process. Memory Dysfunction patients' brains exhibit early lateral ventricle enlargement and apparent hippocampal and amygdala atrophy, two symptoms of the disease that appear long before cognitive decline begins. Certain areas of the brain have begun to deteriorate, according to research on biomarkers for Memory Dysfunction.Early detection and correct treatment of memory deficiency is important. MRI is useful for studying brain structures due to its ability to offer clear images with high resolution and contrast. While CT scans are sometimes viewed as superior to MRI, MRI has become a standard method for examining brain structure and diagnosing brain injuries over the past few decades. Among the numerous brain disorders that MRI can identify are Memory Dysfunction and multiple sclerosis (MS). Researchers can measure changes in brain anatomy over time by segmenting brain MRI scans obtained at different intervals. Accurate diagnosis of diseases such as Alzheimer's depends on accurately identifying and classifying diseased tissue and the surrounding healthy tissue. However, accurate diagnosis requires a large amount of data. Physicians may find it difficult to manually analyze large and Complex MRI dataset to extract relevant information. Evaluation of brain MRI requires significant time and operator variability, so it is important to develop a segmentation process that produces good results. MRI brain segmentation aims to divide the image into groups of pixels with similar properties. Researchers have developed and studied various DL techniques for MRI brain segmentation. We also explore some general guidelines for early diagnosis of Alzheimer's. Alzheimer's disease is a type of dementia that affects behavior, memory and cognition. This study was designed to provide a comprehensive examination of state-of-the-art deep learning to identify healthy and diseased tissue in MRI images.

II.LITERATURE REVIEW

AD is a global disease which affects millions of people. This is a confusing energy that can cause abnormal behavior, memory loss, and cognitive impairment. Biomarker-based

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testing is one of the easiest ways to refute a report. With this new diagnostic tool, researchers can now identify patients with brain disease and track their progress through various stages of the disease.

Researchers frequently utilize magnetic resonance imaging (MRI) to detect brain and tumor cells early and accurately. They measure different parts of the brain using various methods like Free Surfer, SPM, AFNI, FSL, DIPY, NIPYPE, AAL, fMRIPrep, and Ants.Use machine learning and deep learning to ask patients to make diagnoses, predict treatment outcome, and uncover risks. Researchers used scientific and machine learning methods to identify disease-related neurodegenerative diseases and their severity by geographic region.Through critical learning, one can eliminate important points by getting ahead of the biomarker itself, and explain it to know the Notification and its level. A specific decision-making pipeline is almost always used to classify patients with severe cognitive impairment (HC) or cognitive impairment (MCI). Qualitative data sets, computer programs and classification techniques were used in these studies. Most people agree that the accuracy of the equation is high, but progress is needed on the distribution of different species. Some people want to use bad ideas or important computers that need to be repeated. These choices mainly show how computer connections can help classify and express biomarkers, but they also point out the difficulties and constraints of using this method. [1].

Recently, various machine learning-based robots have been developed for early detection of certain diseases. Researchers developed a machine learning-based demonstration robot to identify dementia and its variants, including AD, VaD, LBD, FTD, and MD, and analyzed it in the Voice Transcription Questionnaire (SLR). We utilized the PRISMA criteria for this systematic literature review (SLR). A thorough examination was conducted to create a survey that employs machine learning methods to forecast the onset of dementia and its subtypes by employing three types of data transformations: audio, clinical, and photographs.

The purpose of the SLR is to summarize existing data, point out gaps in the literature, and provide a basis for further consideration. They propose that the systematic literature spredиction using machine learning (ML) technology, which had previously concentrated on individual types of data. These SLR evaluations fail to acknowledge the restrictions of existing inclusion criteria for dementia prediction.This study combines existing models using both deep learning (DL) and machine learning (ML) to forecast dementia and its subtypes (like AD, VaD, FTD, and MD). The aim of this literature review is to examine and assess the efficiency of automatic symptom structures in predicting dementia using different data variables[2].

When comparing various advertising levels, researchers found that Monfared and colleagues incorporated several composite scores for Alzheimer's disease. These scores are used to evaluate the cognitive impairment of patients.We made various classifications and found that there was a significant difference between early and late MCI patients, but the difference in mild cognitive impairment was not significant. We estimate that when comparing physical judgments to clinical studies, we see a 10-15% rate of negative outcomes. Additionally, about 30 percent of those diagnosed were able to recognize their age but had Alzheimer's disease-related brain abnormalities in the plaques and bulbar regions.

Preprocessing complexity. Preprocessing of medical data, especially neuroimaging data, often requires pipelines. Although there are many different plans and priorities, there is no single standard. Moreover, the only thing that determines the quality of pre-treatment is the evaluation of doctors[3].

Not all the data we have is easy to access. Even though there's a lot of data on Alzheimer's disease and related disorders compared to many other illnesses, the amount of specific information is relatively small compared to extensive datasets like Image-Net. And the growth hasn't been as impressive as expected.

Many systems and models are not available for free. When code isn't open-source, important details like the specific data used, how it's prepared, the methods and parameters used, how it's evaluated, and the measurements taken are often not provided.All of these factors can come together to affect the results. Furthermore, only a small number of systems have been described to compare different models using the same pre/treatment and measurement methods.

The research conducted by Gargi Pant Shukla et al. delves into the realm of Alzheimer’s Disease (AD) detection via lens of ML and DL algorithms applied to Magnetic Resonance Imaging (MRI) data. Through meticulous pre-processing techniques like selective clipping and histogram equalization, the study enhances the quality of MRI images, paving the way for more accurate classification. Leveraging algorithms including Random Forest, XGBoost, and Convolutional Neural Networks (CNNs), the research achieves remarkable success in distinguishing AD patients from healthy individuals, boasting an impressive accuracy rate of 70.57% and sensitivity of 71.60%. This innovative approach not only demonstrates the efficacy of computational methodologies in AD diagnosis but also holds significant promise for advancing

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patient care and outcomes within neurology and dementia research, offering a potential avenue for early intervention and improved management strategies [4].

The study of P. Khan et al. Provides a comprehensive review of current advances in diagnosing Alzheimer's disease (AD) and related diseases using ML and DL methods. ML techniques utilize various data sources like genetics, neuroimaging, EEG signals, and biomarkers to classify patients. DL techniques, particularly CNNs and RNNs, excel in extracting features from neuroimaging data and show high accuracy in classifying AD patients. Integration of multiple modalities and novel DL architectures further enhances diagnostic accuracy and early detection of AD. However, further validation and standardization are needed for clinical implementation [5].

III.PROPOSED METHODOLOGY

The first step for developing a model that takes the MRI images as input and then predicts the output is selecting a proper module for building the model. In this project, we have used InceptionV3. On the ImageNet dataset, the accuracy of the image recognition model InceptionV3 is higher than 78.1%. The model is the result of many ideas developed by different researchers.

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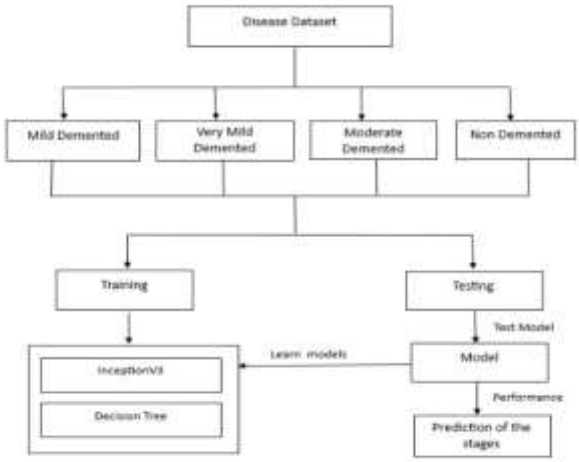

Fig .1

GoogLeNet

GoogLeNet, also known as InceptionV1, was one of the pioneering deep convolutional neural network (CNN) architectures developed by researchers at Google. It was introduced in the paper titled "Going Deeper with Convolutions" by Szegedy et al. in 2014. GoogLeNet introduced the concept of the "Inception module," which aimed to capture features at multiple scales efficiently.
GoogLeNet's hallmark is the Inception module, which consists of multiple parallel convolutional branches with various kernel sizes (1x1, 3x3, and 5x5) and a max-pooling branch.

This method helps the system to capturefeatures at various scales while maintaining computational efficiency. In InceptionV3, this concept is further refined with factorized convolutions and additional optimizations to improve efficiency and performance.

Inception V3

InceptionV3 is a type of convolutional neural network (CNN) design created by researchers at Google as a member of the Inception network series.It was designed for image classification and recognition tasks, particularly for large-scale image datasets. InceptionV3 is an evolution of its predecessors, Inception and InceptionV2.

Similar to ImageNet, a database for the distribution of visual objects, Inception facilitates the distribution of objects in the computer domain. Many applications use the InceptionV3 architecture, which is often "pre-trained" using ImageNet.

IV.RESULT

Fig.2

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Moderate_Demented

Fig.3

Mild_Demented

Fig.4

Non_Demented

Fig.5

Very_Mild_Demented

Fig.6

In our research project focused on Alzheimer's disease detection, we employed InceptionV3 and GoogLeNet to predict the progression of the disease across its four stages: mild, moderate, very mild, and non-demented. Leveraging these advanced computational methods, we aimed to provide a robust framework for early detection and monitoring of Alzheimer's disease, emphasizing the critical role of artificial intelligence in healthcare. Additionally, recognizing the importance of user interface design, we developed an intuitive and user-friendly interface to facilitate the interpretation and utilization of our predictive models by healthcare practitioners and potentially even patients themselves. Our study's results, detailed in the research paper, demonstrate promising accuracy, precision for each disease stage, underscoring the advantage of DL approaches in advancing Alzheimer's disease diagnosis and management.

V.CONCLUSION

Most of the people think that Memory dysfunction is a degenerative illness that causes the brain's neurons to eventually die off. Recently, the medical field has seen remarkable success implementing a Deep Learning technique for the classification of Memory Dysfunction , which, unlike the traditional machine learning approach, does not require any manual feature extraction approaches. Even though deep learning techniques are widely used, there is currently a lack of a generic and trustworthy method for quantitatively analyzing brain MRI images. In this paper, we examine studies that use MRI to classify brain structure and diagnose Memory Dysfunction. Brain MRI scan facilitates disease classification and understanding.

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