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AN EFFECTIVE SCREENING ALGORITHM FOR THE DIAGNOSIS OF ALZHEIMER'S DISEASE

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Abstract **- Alzheimer's disease is a progressive neurologic disorder that causes the brain to shrink (atrophy) and brain cells to die. Alzheimer's disease is the most common cause of dementia, a continuous decline in thinking, behavioral and social skills thataffects a person's ability to function independently. The early signs of the disease include forgetting recent events or conversations. As the disease progresses, a person with Alzheimer's disease will develop severe memory impairment and lose the ability to carry out everyday tasks. It enhances at a languid pace and tears down the memory cells, thereby destroying an individual's thinking ability. It's a degenerative nerve disorder that leads to loss of function or even death of neurons. The average life expectancy. In that way MRI (magnetic resonance imaging) has become a useful medical diagnostic tool for the diagnosis of brain & other medical images. In this project, we are presenting a neural network method implemented for Alzheimer's detection via CNN.**

Keywords – CNN, Deep learning, Neural network, Feature Extraction.

I. INTRODUCTION

The brain is considered one of the most crucial organs in our body. All the activities and responses that allow us to think and believe are controlled and facilitated by the brain. It also empowers our sentiments and recollections. Alzheimer's disease is brain dysfunction which is unrepairable and progressive in nature. Someone in the world is diagnosed with Alzheimer's disease every four seconds. It enhances at a languid pace and tears down the memory cells, thereby destroying an individual's thinking ability. It's a degenerative nerve disorder that leads to loss of function or even death of neurons. The average life expectancy after an Alzheimer's diagnosis is only about four to eight years. On an average, 1 out of 10 people over the age of 65 is affected by this condition, but sometimes it can strike at a younger age and has been diagnosed in several people in their 20s. This disease is the primary cause of dementia in older people. Dementia causes a decline in cognitive skills that are used to perform daily activities, 60-80% of dementia cases are Alzheimer's.

One of the most common and preliminary Alzheimer's disease detection tests, along with psychological examinations, is the brain MRI scanning and analysis. The medical professionals examine the MRI scans and assess possible factors that have the potential to reveal the presence of Alzheimer's disease, such as, brain matter degeneration tumor. Although manual examinations of MRI data prove to be effective in detecting the presence of Alzheimer's disease, this process tends to reduce the efficiency of expeditious arrival of conclusions. This paper proposes an automatic detection of Alzheimer's disease.

Machine learning is split into mainly two types, which are:

1. Supervised Machine Learning
2. Unsupervised Machine Learning

Unsupervised learning is different from the Supervised learning technique; as its name suggests, there's no need for supervision. It means, in unsupervised machine learning, the machine is trained using the unlabeled dataset, and therefore the machine predicts the output with none supervision.

Deep learning is one altogether the techniques utilized in machine learning. Deep learning works on the principle of extracting features from the knowledge by using multiple layers for identifying different aspects relevant to file. Deep learning techniques comprises of convolutional network, recurrent neural network, and deep neural network. within the past, machine learning use was limited because of its inability to process the raw file. Deep learning has helped in overcoming this limitation, because it is the flexibleness to manage on large volumes of knowledge and thus has been an efficient and useful technique of machine learning. Deep learning has also picked up the pace because of the hardware advancements of computers. A deep experience in feature extraction was necessary to convert the knowledge into an appropriate form therefore the subsystem of the machine can recognize and classify the knowledge.

Machine learning performance greatly depends on data representation. because of this, much of the time is consumed in preprocessing design, which makes the algorithms labor intensive. Representation learning is utilized to extract only useful information during data classification by learning data representation. Feature learning has replaced manual involvement for data representation and allows the machine to hunt out the representations automatically to create it useful for classification. Representation learning has found its application in both academic furthermore as industrial fields. Representation learning has been used for speech recognition, language processing, and beholding. Deep learning is additionally employed in Deep architectures that give the advantage of reusing features and may additionally capture higher number of input configurations. Deep learning uses representation learning by creating multiple layers of representations. This creates a path connecting the input and output node, and also the depth of the trail influences the representation learning. It indicates the number of the way within which the assorted paths are often used. as an example, in image recognition, different layers represent different aspects like edges, surface, letters, or faces. Here, each neuron or node within the input layer works on a subtask and passes the results of the subtask to the hidden layers that the hidden layers pass the results of the following subtasks to the output layer to detect the face, which represents the last word output. Thus, deep learning methods have reduced human dependence by generating different methods for extracting features.This work is motivated to enhance the diagnostic capability of physicians and reduce the time required for accurate diagnosis. Image segmentation is performed on the input images. This enables easier analysis of the image thereby leading to better disease detection efficiency.

II. LITERATURESURVEY

1. Detection of Alzheimer's Disease with Shape Analysis of MRI Images

In the current study, we tested the effectiveness of a method using brain shape information for classification of healthy subjects and Alzheimer's disease patients. A P-type Fourier descriptor was used as shape information, and the lateral ventricle excluding the septum lucidum was analyzed. Using a combination of several descriptors as features, we performed classification using a support vector machine. The results revealed classification accuracy of 87.5%, which was superior to the accuracy achieved using volume ratio to intracranial volume (81.5%), which is widely used for conventional evaluation of morphological changes. The current findings suggest that shape information may be more useful in diagnosis, compared with conventional volume ratio.

2. Alzheimer disease detection and tracking of Alzheimer patient

Alzheimer disease is one of the forms of dementia. AD is tremendously increasing disease in the world. There are so many biomarkers detect the Alzheimer disease. From that Electro encephalograph signal is give correct result and performance. In Alzheimer disease, death of brain cells are occurs so there is many causes happened such as memory loss, poor in calculation and recent event 4 happened etc. Early detection of Alzheimer disease is very useful for him and his family. Early detection of Alzheimer patients is very useful for him and his family. In detection, firstly EEG database is filter then noise and artifacts is removed from EEG database using independent component analysis. By wavelet transform four features are extracted and classification is done by support vector machine. In monitoring system, Alzheimer patient is track by using GPS and GSM. With the help of this monitoring system Alzheimer patient is travel anywhere without caregiver.

3. Moving from detection to pre-detection of Alzheimer's Disease from MRIdata:

Alzheimer's Disease (AD) is the most common form of dementia, affecting approximately 10% of individuals under 65 years of age, with the prevalence doubling every 5 years up to age 80, above which the prevalence exceeds 40%. Currently diagnosis of AD is largely based on the examination of clinical history and tests such as MMSE

(Mini-mental state examination) and PAL (Paired Associates Learning). However many present studies have highlighted the inaccuracies and limitations of such tests. Thus medical officers are now moving to the more accurate neuro imaging data (Magnetic Resonance Imaging- MRI) based diagnosis for these types of diseases where brain atrophy transpires. However it is a considerable challenge to analyze large numbers of images manually to get the most accurate diagnosis at present. This multimodal data is fed into two well-studied variations of the RNNs; Long Short-Term Memory (LSTM) and Gated Recurrent Unit(GRU). As of this paper writing, detecting Alzheimer's is a difficult and time consuming task, but requires brain imaging report and human expertise.

4. Alzheimer's Disease and Dementia Detection from 3D Brain MRI Data Using Deep Convolutional Neural Networks:

As reported by the Alzheimer's Association, there are more than 5 million Americans living with Alzheimer's today, with an anticipated 16 million by 2050. The neurodegenerative disease is currently the 6th leading source of death in the US. In 2017 this disease would cost the nation $1.1 trillion. 1 in 3 seniors die in Alzheimer's disease or another dementia. It kills more than breast cancer and prostate cancer combined. As of this paper writing, detecting Alzheimer's is a difficult and time consuming task, but requires brain imaging report and human expertise. Needless to say, this conventional approach to detect Alzheimer's is costly and often error prone. In this paper an alternative approach has been discussed, that is fast, costs less and more reliable. Deep Learning represents the true bleeding edge of Machine Intelligence. Convolutional Neural Networks are biologically inspired Multilayer perceptronspecially capable of image processing. In this paper we present a stateof the art Deep Convolutional Neural Network to detect Alzheimer's Disease and Dementia from 3D MRI image.

III. Problem Definition & Methodologies

A. *Existing System*

Existing made use of a 5 stage ML pipeline process for the detection in which each stage had sub stage. Multiple classifiers were applied to this pipeline. He concluded that the random forest Classifier had better performance metrics made use of the Random-Forest classifier to compare the performance in imputation and non- imputation methods. They observed that the imputation method gives 87%accuracy, and the non-imputation method gives 83% accuracy. It further classified the subjects as demented or non-demented, respectively.

B. Proposed System

Our proposed system will provide solution for the CNN model has shown decent accuracy in classification of images. The model has displayed certain promising graphs. It used a batch size of 64. The model has runned for 10 epochs. The model provided an accuracy of about 95% in the train data and about 80% in the test data. The proposed model can help doctors diagnose Alzheimer's Disease more effectively and can be modified. A Convolutional Neural Network (ConvNet/CNN) is a Deep Learning algorithm which can take in an input image, assign importance (learnable weight sand biases) to various aspects/objects in the image and be able to differentiate one from the other. The pre-processing required in a ConvNet is much lower as compared to other classification algorithms. A ConvNet is able to successfully capture the Spatial and Temporal dependencies in an image through the application of relevant filters. The architecture performs a better fitting to the image dataset due to the reduction in the number of parameters involved and reusability of weights. The objective of the Convolution Operation is to extract the high-level features such as edges, from the input image. Conventionally, the first ConvLayer is responsible for capturing the Low-Level features such as edges and color, and the gradient orientation, are taken etc.

Spatial and sequential feature extractors capture information required to discriminate among different classes, but to calculatethe probability distribution over the output.The data is divided into three sets of train, test, and validation that are disjoint in time. A classification module is merged intothe pipeline where a dense layer with softmax activation is a common option. According to the level of output, to complete therecognition task, a post-processing method (e.g. a language model) can be considered at this stage as well. Each instance doesnot completely represents a single isolated word and there may be co-articulation of the lips from preceding and subsequent words. It may appear counter intuitive at first that this weakly annotated word boundaries can help to increase the accuracy andro bustness of the model.

C. Algorithm

The CNN algorithm will be best suited for image processing because of its high accuracy rate. It is a complex feed forward neural network. The CNN algorithm consist of 3 component – input layer, hidden layer and output layer. The hidden layer is comprised of convolution layers, pooling layers, normalization layers, and fully connected layers. The CNN can be customized by adding more hidden layer. Which will also increase the accuracy rate

IV. DESIGN PROCESS

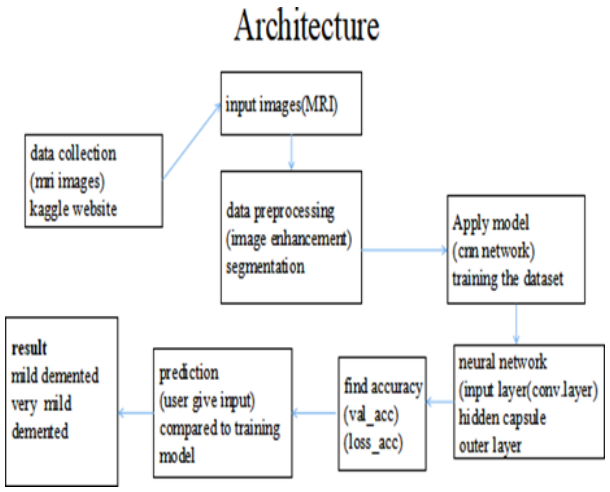

Fig 1. Architecture diagram

IV. SYSTEM REQUIRMENTS

1. Hardware Requirements

- Hard disk: 200GB&above
- RAM:4 GB
- Processor : Pentium IV & above

2. Software Requirements

- Python3.7oraboveversions
- Anaconda software
- OpenCV
- Csv

V. MODULES

Module 1 :Data Collection

The data is taken from an open online dataset library known as Kaggle, and the dataset hasn't been used by various other research projects and studies yet. It is an open-source dataset. This dataset contains almost 6,000 images distributed over four classes labelled Mildly, Moderately, Very Mildly and Non-Demented.

Module 2 : Image Preprocessing

Pre-processing is a common name for operations with images at the lowest level of abstraction. The aim of pre-processing is an improvement of the image data that suppresses unwilling distortions or enhances some image features important for furtherprocessing. Preprocessing is a technique that is used to convert the raw data into a clean data set. In other words, whenever the data is gathered from different sources it iscollected in raw format which is not feasible for the analysis.

Module 3 : Model Creation

This dataset contains almost 6,000 images distributed over four classes labelled Mildly, Moderately, Very Mildly and Non-Demented. The features are then distributed into 80% train dataset and 20% test dataset. 80% of the data is used in training means that each deep learning model has two phases that are training and testing, where it predicts the data that is provided to it. Both the models use the same dataset separated from the original Kaggle dataset and are divided in 8:2 ratio, which has 80% training and 20% validation dataset. The datasets have to have the same kind of distribution so that there is no such kind of discrepancy in the comparison of the prediction that both the models had a different type of input.

Module 4 : Model Prediction

Python predict() function enables us to predict the labels of the data values on the basis of the trained model. It returns the labels of the data passed as argument based upon the learned or trained data obtained from the model. predict() : given a trained model, predict the label of a new set of data. This method accepts one argument, the new data X_new (e.g. model. predict(X_new)), and returns the learned label for each object in the array. We create a web application in flask. front end- bootstrap, coding python. User give input it will compared to model and shows the output.

VI. IMPLEMENTATION

The image depicts the brain detection using random forest classifier. An image can be converted the brain to grey scale which is done using random forest classifier. The video input is converted into a sequence of frames. In each MRI the disease level can be calculated based on the training sets.

VII. RESULT AND DISCUSSION

In the early stage of Alzheimer's, a person may function independently. He or she may still drive, work and be part of social activities. Despite this, the person may feel as if he or she is having memory lapses, such as forgetting familiar words or the location of everyday objects. Symptoms may not be widely apparent at this stage, but family and close friends may take notice and a doctor would be able to identify symptoms using certain diagnostic tools.

Middle-stage Alzheimer's is typically can last for many years and disease a progresses, the person with Alzheimer's disease will require greater level of care. During the middle stage of Alzheimer's, the dementia symptoms are more pronounced. The person may confuse words, get frustrated or angry, and act in unexpected ways, such as refusing to bathe. Damage to nerve cells in the brain can also make it difficult for the person to express thoughts and perform routine tasks without assistance.

In the final stage of the disease, dementia symptoms are severe. In the final stage of the disease, dementia symptoms are severe. Individuals lose the ability to respond to their environment, to carry on a conversation and, eventually, to control movement. They may still say words or phrases, but communicating pain becomes difficult. Symptoms may not be widely apparent at the stages.

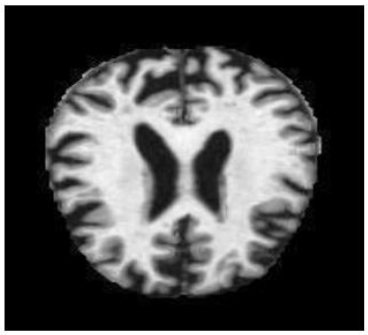

Fig 2. Output screenshot

The image depicts the brain detection using random forest classifier. An image can be converted the brain to grey scale which is done using random forest classifier. The video input is converted into a sequence of frames. In each MRI the disease level can be calculated based on the training sets.

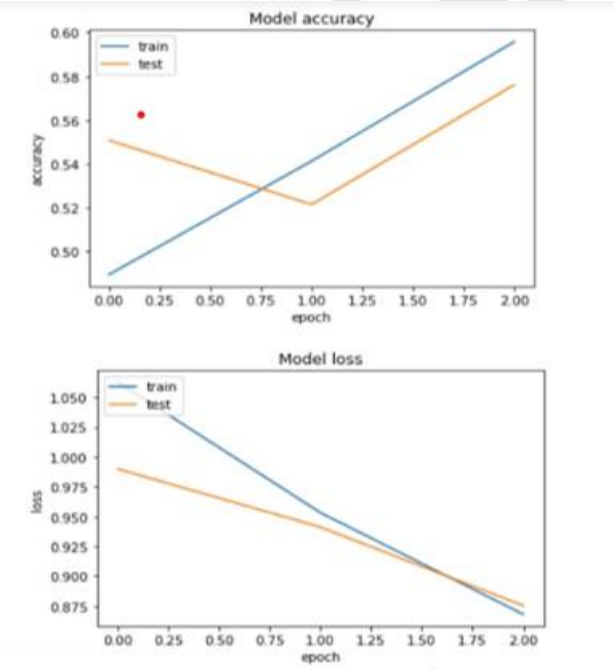

Fig 3. Trained and tested graph

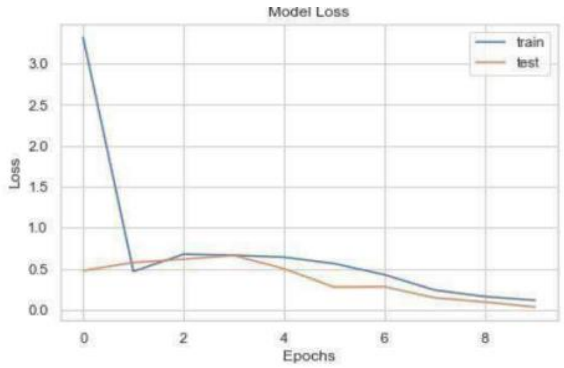

Fig 4. Model summary

VII. CONCLUSION

This paper determines a prospective solution for detecting the disease at an early stage. The models used in this paper have successfully classified the images into the appropriate four classes and indeed provided us with promising results. The cnn model has shown decent accuracy in classification of images. The model has displayed certainpromising graphs. It used a batch size of 64. The model has runned for 10 epochs. The model provided an accuracy of about 95% in the train data and about 80% in the test data. The proposed model can help doctors diagnose Alzheimer's Disease more effectively and can be modified

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