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DETECTION AND CLASSIFICATION OF ALZHEIMER'S DISEASE USING DEEP LEARNING

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ABSTRACT— *In recent years, the diagnosis of Alzheimer's disease (AD) has become one of the most challenging problems in medical fields. This paper proposes a new segmentation method which is used region masking for selecting the useful properties of affected parts in the human brain for improving the accuracy of diagnosis for AD. In the proposed method, the accuracy of classification is improved by using deep learning Network classifier, are selected by using region masking. Furthermore, the Convolutional Neural Network classifier is used for the diagnosis of AD. The data set will be discussed in this paper contains normal and AD subjects. The empirical results show that the proposed method significantly improves the accuracy of the diagnosis of AD in comparison with previous methods. Here, we briefly review some of the important literature on AD and explore how Deep Learning can help researchers diagnose the disease at its early stages.*

Keywords— Alzheimer disease, Region Masking, Segmentation, Convolutional Neural Network, Deep Learning.

1, INTRODUCTION

The problems associated with the aging population are becoming increasingly serious as people live longer and fertility rates decline in most countries. Furthermore, because a greater proportion of individuals are elderly, more people are at high risk of developing dementia. Currently, approximately 47 million people worldwide live with dementia, and this number is predicted to increase to more than 131 million by 2050. Alzheimer's disease (AD) is the most common form of dementia diagnosed in elderly people and significantly reduces their quality of

life. An accurate and early diagnosis is essential for timely treatment and risk reduction. Over the past decade, several imaging modalities have been used in AD diagnosis, including diffusion tensor imaging (DTI)structural magnetic resonance imaging (MRI) and positron emission tomography (PET). Among these modalities, functional MRI (fMRI) plays an important role in monitoring brain activity and exploring the functional connectivity among different brain regions; therefore, fMRI is a promising methodology for the investigation and detection of brain disease.

2, EXISTING SYSTEM

In this paper the accurate diagnosis of Alzheimer's disease (AD) plays an important role in patient treatment, especially at the disease's early stages, because risk awareness allows the patients to undergo preventive measures even before the occurrence of irreversible brain damage. Although many recent studies have used computers to diagnose AD, most machine detection methods are limited by congenital observations. AD can be diagnosed-but not predicted-at its early stages, as prediction is only applicable before the disease manifests itself. Deep Learning (DL) has become a common technique for the early diagnosis of AD. Here, we briey review some of the important literature on AD and explore how DL can help researchers diagnose the disease at its early stages.

2.1 DISADVANTAGES OF EXISTING SYSTEM

- Here the detection process is only done.
- There is a lack of disease area segmentation.
- Because the actual stage of the disease plays important role in doctor references

3, PROPOSED SYSTEM

In this paper the accurate diagnosis of Alzheimer's disease (AD) plays an important role in patient treatment, especially at the disease's early stages, because risk awareness allows the patients to undergo preventive measures even before the occurrence of irreversible brain damage. Although many recent studies have used computers to diagnose AD, most machine detection methods are limited by congenital observations. AD can be diagnosed-but not predicted-at its early stages, as prediction is only applicable before the disease manifests itself. Deep Learning (DL) has become a common technique for the early diagnosis of AD. Here, we briey review some of the important literature on AD and explore how DL can help researchers diagnose the disease at its early stages.

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3.1 BLOCK DIAGRAM:

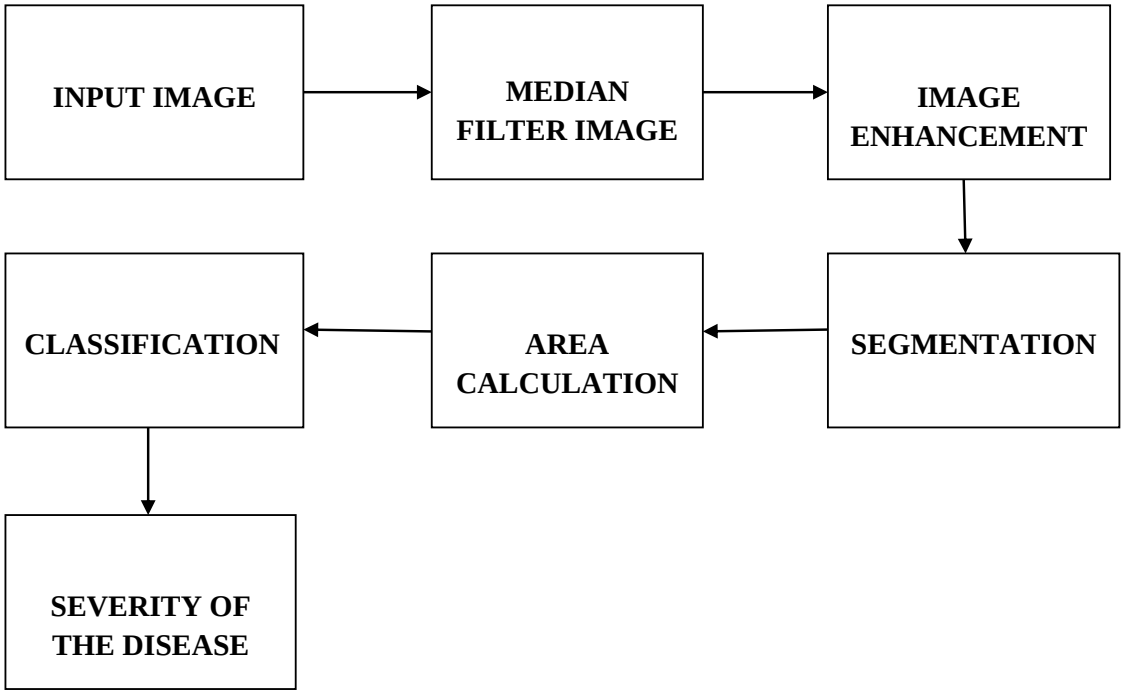

FIG 3.1 Block Diagram of Image Processing

The figure 3.1 shows the flow diagram description of the image processing. Firstly, input MRI scanned input image will be loaded in MATLAB. Read and Display an input Image. Read an image into the workspace, using the imread command. In image processing, it is defined as the action of retrieving an image from some source, usually a hardware-based source for processing. It is the first step in the workflow sequence because, without an image, no processing is possible. The image that is acquired is completely unprocessed. The aim of pre-processing is an improvement of the image data that suppresses unwanted distortions or enhances some image

features important for further processing. Image pre-processing methods use the considerable redundancy in images. Neighboring pixels corresponding to one object in real images have essentially the same or similar brightness value. Thus distorted pixel can often be restored as an average value of neighboring pixels. The main purpose of the RGB color model is for the sensing, representation, and display of images in electronic systems, such as televisions and computers, though it has also been used in conventional photography. Grayscale images are distinct from one-bit bi-tonal black-and-white images, which in the context of computer imaging are images with only the two colors, black, and white (also called bi level or binary images). Grayscale images have many shades of gray in between. Grayscale images are also monochromatic, denoting the presence of only one (mono) color (chrome). Noise present in the image can be removed by using median filter. The median filter processes each signal one by one for each entry and it replaces the median of the neighboring entries one by one. The pattern of neighbors is described as the "window", which slides, entry by entry, over the whole signal. Image Enhancement is the technique to improvise the understandability or perception of information in images for human viewers. The quality of an image can be improved by enhancing the image, which produces an image with better quality than the original image. Image segmentation is a commonly used technique in digital image processing and analysis to partition an image into multiple parts or regions, often based on the characteristics of the pixels in the image. Then area of the spread will be determined with the help of the Convolutional Neural Network algorithm. The Convolutional Neural Networks (CNN) is one of the most famous deep learning algorithms and the most commonly used in image classification applications. In general, the CNN architecture contains three types of layers, which are convolutional layers, pooling layers, and fully connected layers. The CNN algorithm receives an input image that passes through the layers to identify features and recognize the image, and then it produces the classification result. The architecture of the CNN contains alternating convolutional layers and pooling layers, followed by a set of fully connected layers. The output of each layer in the CNN is the input of the following layer and then the disease is classified from normal to severe based on the spread.

3.3 BLOCK DIAGRAM OF HARDWARE SETUP :

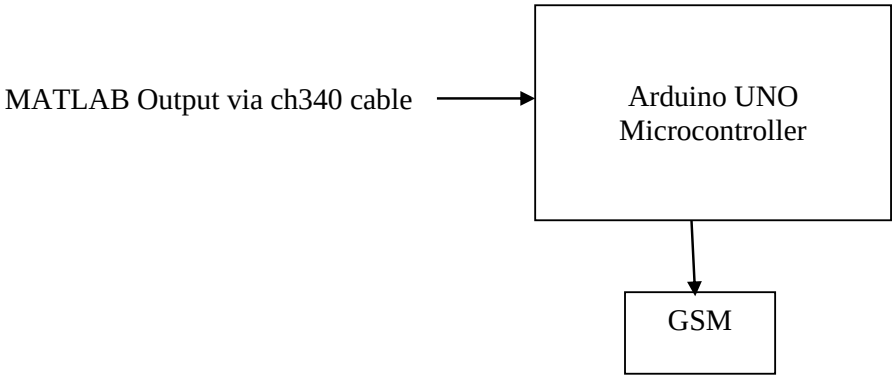

FIG 3.2 Block Diagram of Hardware Setup

3.4.1 BLOCK DIAGRAM DESCRIPTION OF HARDWARESETUP

The figure 3.2 shows the black diagram of the hardware setup. The processed image output from the MATLAB software is given to the ARDUINO UNO microcontroller. . The ARDUINO UNO microcontroller has to receive a data from the software. For the parallel communication the CH340 cable and boards are used. There are two TTL circuits interfaced between the ARDUINO UNO microcontroller and the GSM module. The GSM module receives the data transmitted by the ARDUINO UNO microcontroller. The mobile phone receives a message with the help of GSM and displays the severity of the disease.

3.4.2 PROPOSED SYSTEM ADVANTAGES

- Here the detection and segmentation both are done.
- This region masking technique is applicable for segmenting the affected part for further actions.

- Here the actual stage of the disease can be implemented is added another one advantage for better diagnosis. Because the stage of disease is more important factor for better identification and diagnosis.

4, RESULTS AND DISCUSSION

The initial step is to acquire an image. The input image is the MRI image. The figure 4.1 is the MRI image which is the taken as the input for further processing to identity the Alzheimer disease.

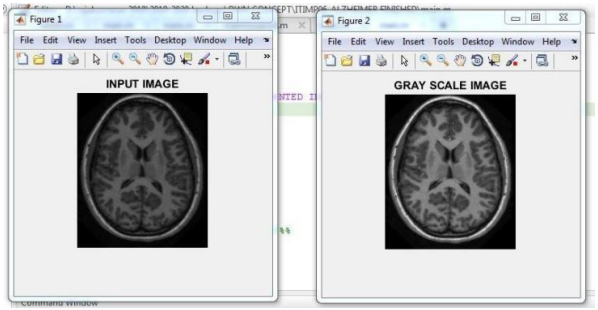

FIG 4.1 Input image

Next step in the image processing is to filter the image. The median filter is used here. The median filter replaces the current pixel intensity value with the median of the neighbouring pixel intensity values. The salt and pepper noise is removed using the median filter. The figure 4.2 is the filtered image.

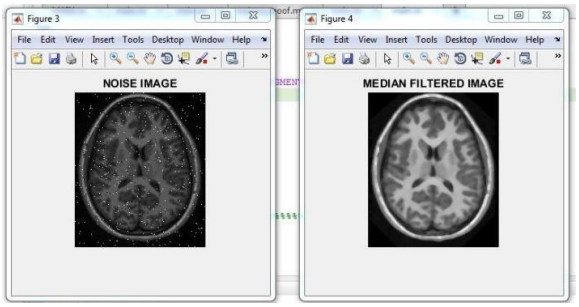

FIG 4.2 Median Filtered Image

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The enhanced image is given as the input to the segmentation process. Thesegmentation is carried out using the Masking Algorithm. The algorithm creates an empty mask. The pixel intensity value is different for disease region and the normal region. The affected regions are replaced as white colour in the mask and normal regions are replaced as black colour and figure 4.3 is the masked image.

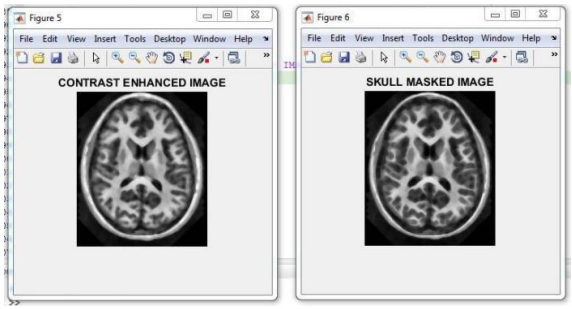

FIG 4.3 Enhanced image &Masked image

Now the black and white conversion is processed and a compliment of black and white image is done, where the pixels of certain width are highlighted which is shown in figure 4.4

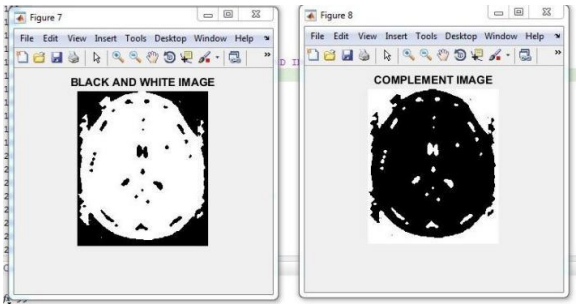

FIG 4.4 Black & White and Complement image

Now all the highlighted white pixels are obtained. Now to fetch the exact Alzheimer spread which is in the middle all the other small objects and border objects are removed as shown in figure 4.5

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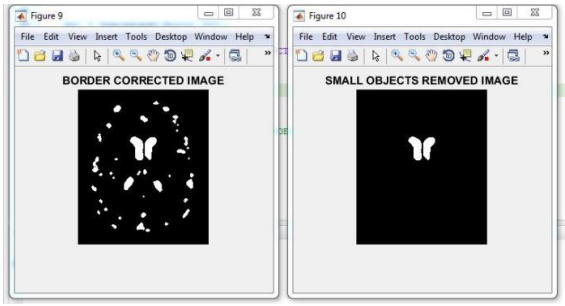

FIG 4.5 Border Corrected and Small Objects Removed Image

Now finally to extract the exact disease spread the process is iterated for 100 times over and over to get the accurate result. And the image is segmented and resized.

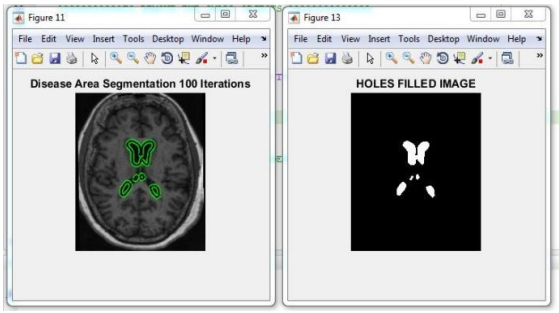

FIG 4.6 Masking and Segmented image

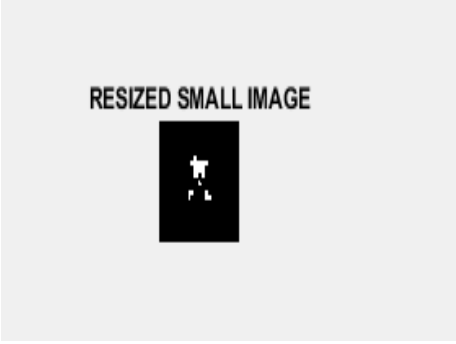

FIG 4.7 Resized small image

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FINAL OUTPUT IMAGES :

Here the below Fig 4.8 shows that the severity of the disease for the patient is normal.

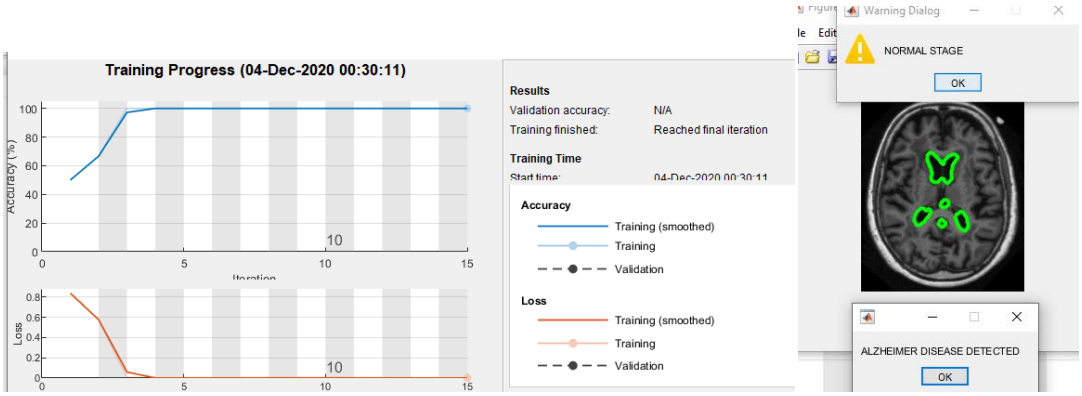
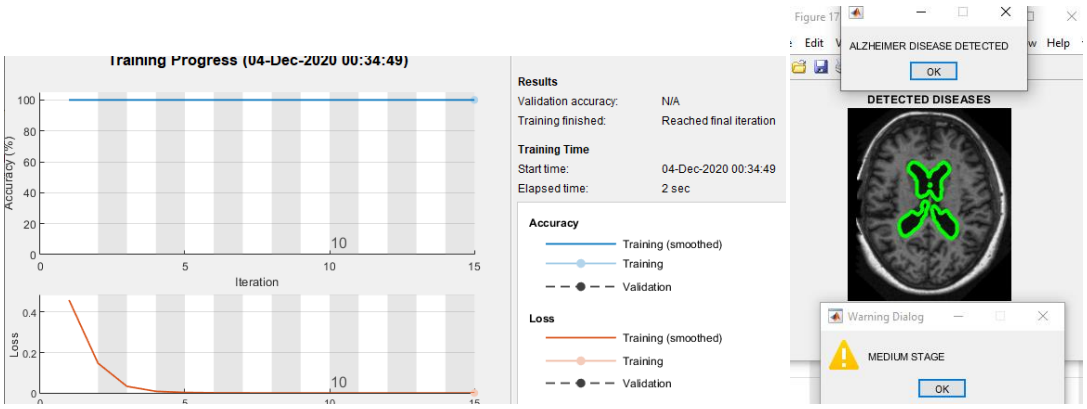


FIG 4.8 Normal Stage

Here the below Fig 4.9 shows that the severity of the disease for the patient is medium.



.**FIG 4.9** Medium Stage

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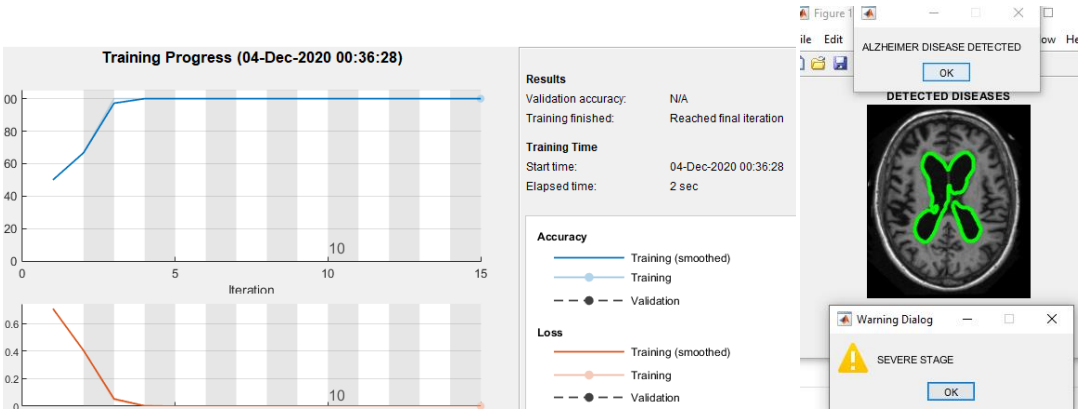

FIG 4.10 Severe Stage

Here the above Fig 4.10 shows that the severity of the disease for the patient is severe.

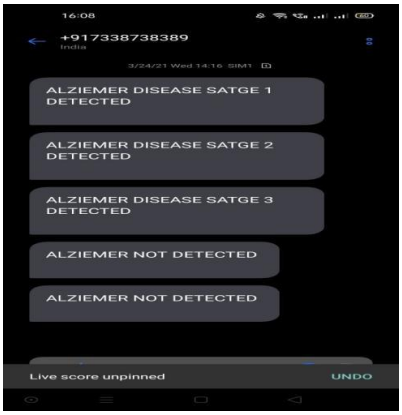

FIG 4.11 Output message received through GSM

Here the above Fig 4.11 shows the results of the severity of the disease for the patient sent as a text message to the patient's mobile number through GSM.

5,CONCLUSION AND FUTURE WORK

In this paper, we demonstrated that the AD detection and classification task using a small dataset can be better solved using different image processing techniques with deep learning concepts. This method can effectively improve the accuracy of the classification in small sample sets. Researchers can use this method to relieve the challenge of extremely limited sample size, particularly when collecting neuroimaging data is difficult and computer-aided diagnoses with limited samples are required. Our work may also assist researchers to make better use of shared data and promote the exchange of collected data. In future, with more time and with more comprehensive research the proposed system can be made more accurate. Also new Alzheimer's disease detection algorithms can be added so as to give the doctor a wider variety of options to choose from.

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