Novel method for efficient Parkinson's disease detection using Iridology followed by MRI analysis using Image Processing

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Abstract— This paper proposes a method for early detection of Alzheimer's and Parkinson's disease, unlike other methods where detection is possible only at a much later stage. Here, we have combined the existing way of processing brain MRI scans with the relatively newer concepts of Iridology. Thereby, by scanning the iris of the eye, we can observe whether the subject suffers from dementia or not, and by further processing the brain scans, we can conclude if the subject is suffering from Alzheimer's or Parkinson's disease.

Index Terms— Daugmann Model , Dementia , Image Processing, Iridology, MRI Analysis, Parkinson's disease, Substantia Nigra.

1 INTRODUCTION

DEMENTIA is a neurological disorder which is very common at an older age. It is very hard to detect in its initial stages and, by the time it can be detected, it already does severe damage to the brain. Dementia occurs as a result of **Parkinson's** disease.

Our main task has been to find a newer method of detection of these diseases at a much earlier stage so that proper diagnosis can be administered. For that purpose, we are using the concepts of **Iridology**, as effects of dementia can be observed on the iris of our eye, in its earlier stages of development. **Parkinson's** disease affects a specific part of the brain, namely, the **substantia nigra**, which will undergo further MRI analysis, if results come positive in the **Iridology** process.

To this end, we will be using various **Image Processing** techniques to finely process the raw images of the iris and the MRI brain scans and then compare the processed images with that of a normal test subject to conclude whether the subject is affected or not.

2 PROBLEM STATEMENT

Dementia can cause severe symptoms in humans like memory problems, reduced concentration, behavioural changes etc. Unlike several other such diseases, it cannot be diagnosed at its early stages and remains almost un- detected until the symptoms start appearing. Thus, the main task is to find a suitable method of detection of de- mentia at its early stages so that proper medication can be given. In this paper, we try to find such a method for the detection of **Parkinson's** disease, which is a major cause of dementia in humans.

3 PROPOSED METHODOLOGY

For early detection of the diseases, we combine the concepts of **Iridology** with the existing way of detection by MRI brain scans. The method can be broadly divided into two halves:

a. Processing raw image of **iris**.

b. Processing raw image of **brain scans**.

A. Iris Scan

The raw images of eye are processed using the **Daug- man Model of Iris Recognition**.

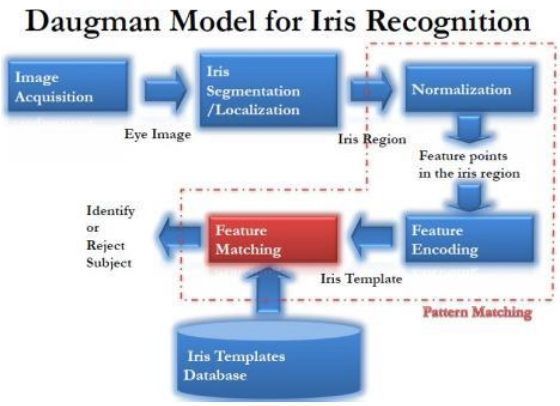

FIG. 1. Daugman Model

In this model, we use segmentation to cut out just the iris of the eye, using **Hough Transform[3]**, in the shape of two concentric circles. Then, we normalize the processed image into a rectangular structure, of which we just consider the middle portion, using **Daugman's Rubbersheet Model[3]**. This is the part of the iris that gets affected by dementia. The detailed process of **Iridology** can be seen using the following images

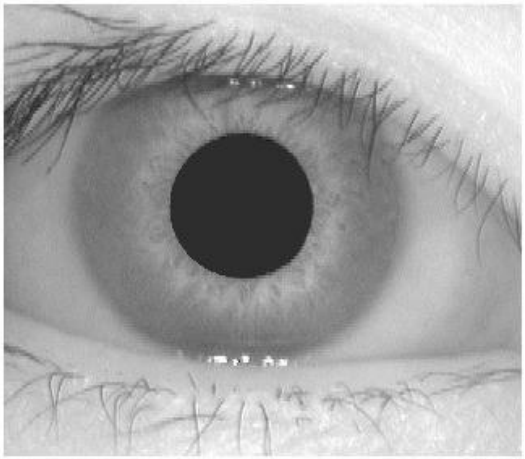

FIG. 2. Raw Eye Data

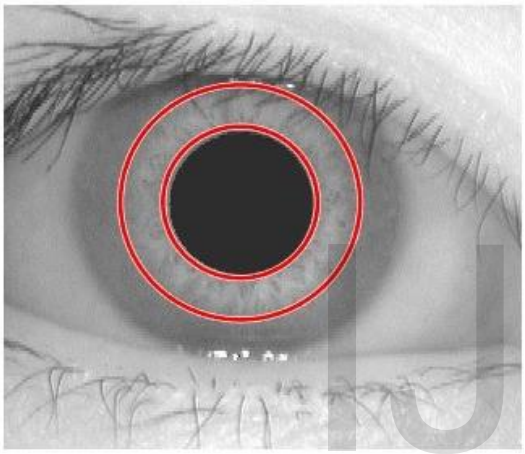

FIG. 3. After Hough Transform

FIG. 4. Iris after Normalisation

Using the result of this Hough Transform, we provide the input to the Daugman Rubbersheet Model for the iris to undergo normalisation. Here, we change the circular shape of the iris into a rectangular one for further analysis.

B. Brain Scan

For the brain part, we will observe one specific region of the brain, namely the **substantia nigra[5]**. The brain scans are available in RGB format. We use those as in- puts and convert them into grey scale ones.

FIG. 5. Raw MRI

This grey scale output is made to undergo HSV (Hue, Saturation, Value) to provide a coloured output.

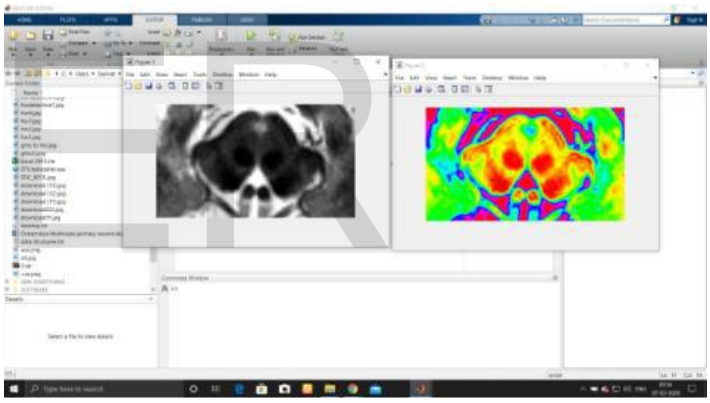

FIG. 6. After HSV

We can observe that a red colouration occurs in the substantia nigra of the brain. This colour intensity de- pends on the maximum concentration of grey matter. Thus, we can understand the variation in intensity of grey matter in this part of the brain, depending on the red colour intensity.

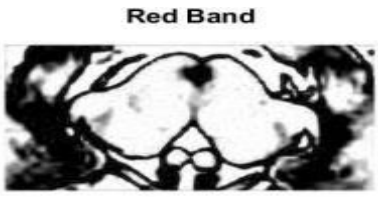

FIG. 7. Red Band

Finally, we can find the grey matter density based on the red colour intensity.
Here, we set a threshold value in this image and calcu- late the affected area of the substantia nigra. If this value is above the set threshold value, the subject is normal else the subject is suffering from Parkinson's.

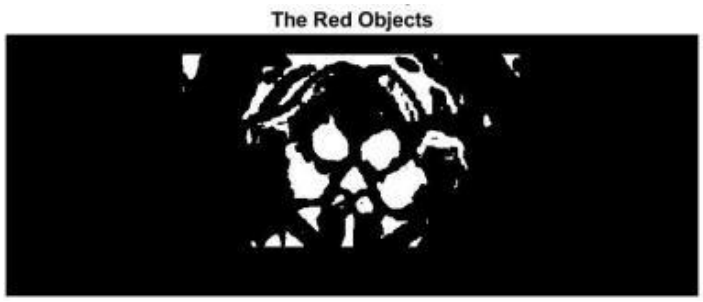

FIG. 8. Red Objects

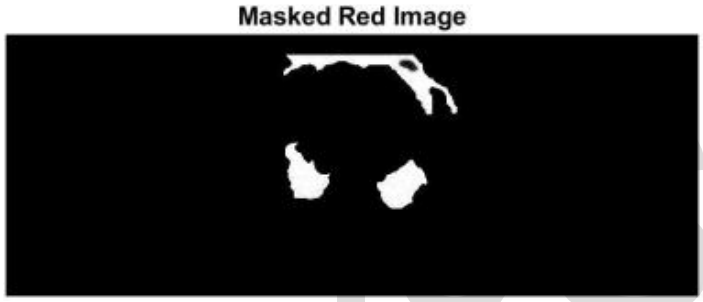

FIG. 9. Masked Red Image

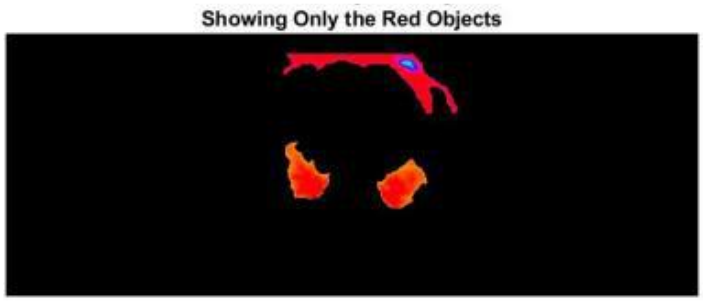

FIG. 10. Final Brain Image

Combining the above two processes together, we can conclude whether the subject has dementia or not. If demen- tia is found through the iris of the eye, we go to the next phase of the detection process, which is, the MRI analysis of the subject. The output of this analysis is compared to understand whether the subject is being affected with Parkinson's disease or not. The entire process can be summed up through this following flowchart:

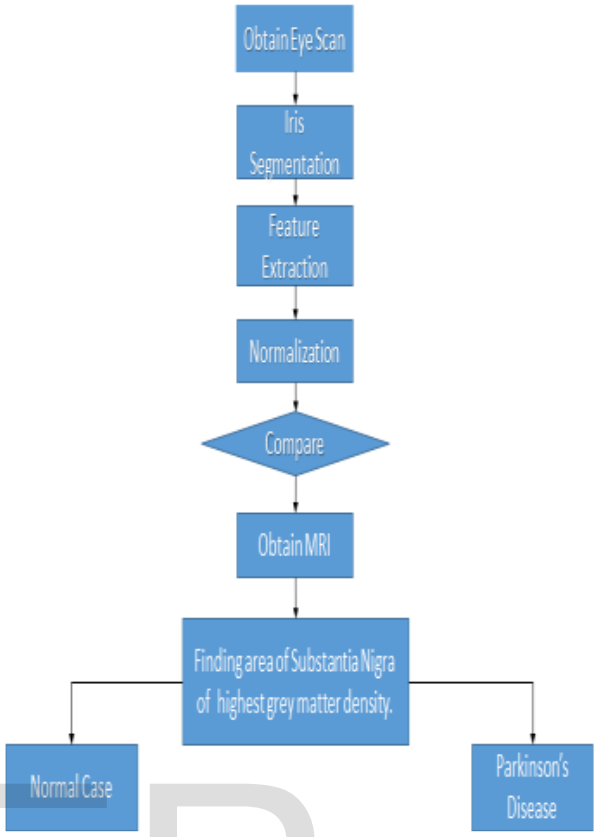

FIG. 11. Proposed Methodology

4 CONCLUSION

So thereby, we can conclude that, by merging the concepts of **Iridology** with the existing method of processing brain MRI scans, we can achieve detection of early stages of dementia. By image segmentation, we can easily obtain the specific part of the iris concerned with brain. This helps us in understanding whether the subject is suffering from dementia or not.

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