

## **Implementation on Iridology Based Alzheimer's Disease Detection Using Image Processing**

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**Abstract**– Alzheimer's disease is an illness of brain which affects the memory, thinking capability and behavior of person. It is named after Alois Alzheimer, the German doctor who has described it in 1907. The brain cells eventually die and this means that information cannot be remembered. As Alzheimer's disease affects each area of the brain that causes a slow decline in memory, thinking and reasoning skills. As there is no cure system available for this disease, but early effective detection of disease can slow down the progression of disease. Several techniques are available like MRI scan, CT scans, PET scans; these can help to detect the Alzheimer's. A new innovative technique based on iridology is proposed in this paper. This paper presents a specific pattern which will be used to determine existence of Alzheimer's disease. The adaptive pattern recognition technique can lead to achieve better than 75% accuracy; which was last milestone. A good resolution image can give better results while blur; ambiguous image can degrade performance of pattern recognition of technique.

**Keywords**- Alzheimer's disease, Alois, Brain cells, MRI scan, CT scan, PET scan and Iridology.

### **I. INTRODUCTION**

Alzheimer's disease is a progressive disease that destroys memory and other important brain related functions. At early stage, someone with Alzheimer's disease may notice mild confusion and difficulty remembering the things. Even the people with this disease may forget important people in their lives and undergo dramatic personality changes. In Alzheimer's disease brain cells eventually die and this means that information cannot be remembered. Alzheimer's gets worse over time.

Alzheimer's disease is an irreversible, progressive brain disease that slowly destroys memory, thinking skills and in later stages, intellectual abilities. Alzheimer's disease symptoms mostly appear after age 60. Mostly the Alzheimer's disease accounts for 50 to 80 percent of dementia cases. The damage to the brain in Alzheimer's begins a decade before the symptoms are noticeable. Early symptoms include atrophy of the hippocampus. It belongs to the limbic system and its most important functions are the consolidation of information from short-term memory to long-term memory and spatial navigation. Humans generally have two hippocampi, one in each side of the brain basically the hippocampus is a part of the cerebral cortex and in primates is located in the medial temporal lobe, underneath the cortical surface. Alzheimer's disease affects all areas of the brain. Alzheimer's disease if diagnosed early, can facilitate timely access to diagnosis and health care. The Alzheimer's disease earlier diagnosis would provide critical time for medical intervention and diagnosis to be made easy as the disease progresses further more critical situation arises. In the early stages, the symptoms of Alzheimer's disease can be very hard to see. Other symptoms may include:

- Repeatedly saying the same thing.
- Vagueness or hard to follow in everyday conversation.
- Difficulty in determining time or place.
- Taking longer to do every day jobs
- Forgetting well-known people or places
- Not able to understand questions and instructions
- Difficulty in planning and problem solving skills.
- Difficulty in writing or speaking common words.

Symptoms vary and the disease progresses at a different pace according to the individual and the areas of the brain affected. A person's abilities may change for the better or the worse from day-to-day, or even within the one day, and can become worse in times of stress, fatigue or ill-health. For the person experiencing the symptoms, the very nature of the changes within the brain may mean that he or she is unable to recognize that there are any changes. Alzheimer's disease is a progressive disease that destroys memory and other important mental functions. At first, someone with Alzheimer's disease may notice mild confusion and difficulty remembering. Eventually, people with the disease may even forget important people in their lives and undergo dramatic personality changes. The brain cells eventually die and this means that information cannot

be remembered. Alzheimer's gets worse over time. Currently there is no cure system for Alzheimer's. But early detection of disease can slow down the damage eventually can stop further damage of brain.

## II.PROBLEM STATEMENT

To develop Iridology based early Alzheimer's disease detection and prediction. Implementation of Fourier transform and Hough transform led to better accuracy towards detection of Alzheimer's disease.

## III.RELATED WORK

**A. Image Training DB:** The training database is IITD for iris features extraction. The features like pupil x axis location, pupil y axis location, intensity of image, and entropy are extracted. The time required to generate cumulative feature extraction is approximately 25 min for database of 500MB. The time is directly proportional to size of database. MATLAB software is used for detection and prediction of Alzheimer's disease.

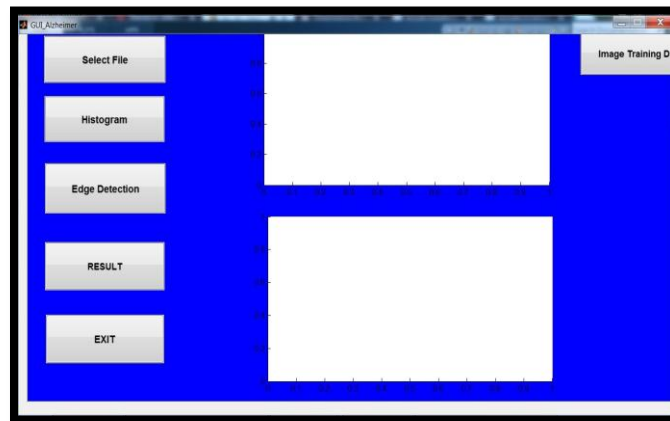


Figure 1: Basic GUI of Project

**B. Select File:** This option is used to take input image which is tested for Alzheimer. This image is taken as input, further the features are extracted and compared with cumulative features of database.

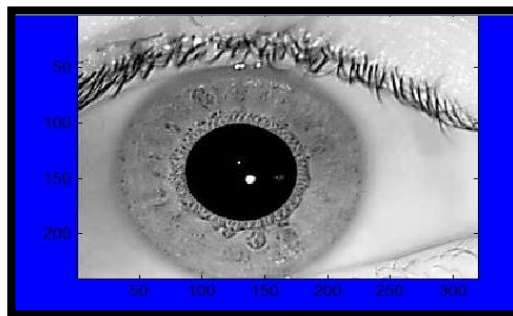


Figure 2: Input image is selected for Alzheimer detection

**C. Histogram:** A histogram is an accurate representation of the distribution of numerical data. It is an estimate of the probability distribution of a continuous variable and was first introduced by Karl Pearson. The histogram of input image is calculated using this option.

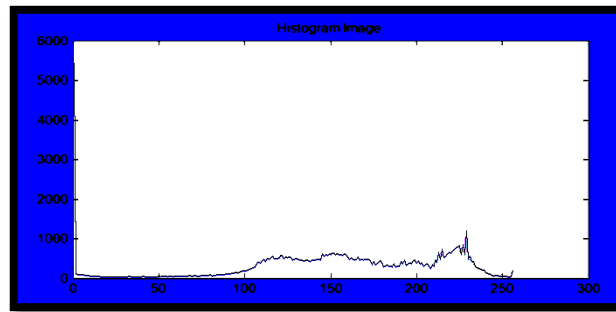


Figure 3. Histogram of input image

**D. Edge Detection:** It is necessary to detect iris from whole image. Using edge detection algorithm the iris is separated from whole image.

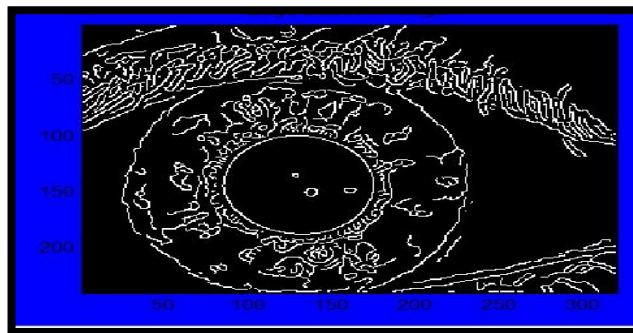


Figure 4. Edge Detection

**E. Result:** The final result is calculated using this option. The result shows probability of Alzheimer detection. There are three different types of Alzheimer detection.

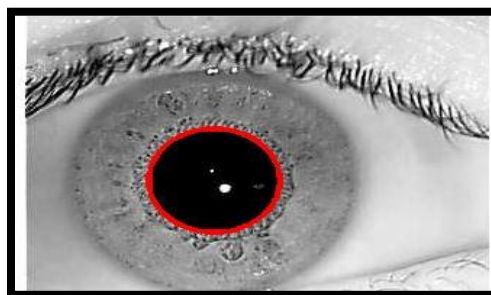


Figure 5. Pupil Detection

**F. SVM classification:** SVM classification is the important part of the approach because the overall process depends upon the classification done through this algorithm. SVM is relatively new method of classification and it expands very quickly. That will certainly cause wider use of SVM in different areas, also in medicine.

**G. Training dataset:** IITD iris image database is taken as training database. The database of 500MB size is used to training purpose.

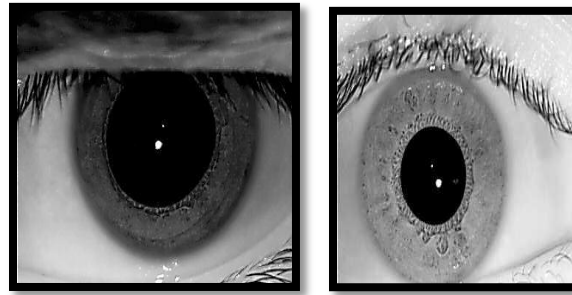


Figure 6. Training dataset

The final result of execution is either one option of following option

- 1) Alzheimer is not present
- 2) Alzheimer detection is 25%
- 3) Alzheimer detection is 50%
- 4) Alzheimer detection is 75%.

The results of the evaluation are presented in terms of accuracy, sensitivity, specificity and predictive capacity. Total 75 iris images are tested for Alzheimer detection where obtained results are

VP=68  
 VN=3  
 FP=3  
 FN=7

The accuracy, sensitivity and specificity are calculated as follows.

$$Accuracy = \frac{(VP + VN)}{VP + VN + VFP + FM} 100\%$$

$$Sensitivity = \frac{VP}{VP + FN} 100\%$$

Here VP=68 and VP+FN=7

$$Specificity = \frac{VN}{FP + VN} 100\%$$

- i) VP – true positive; ii) VN – true negative; iii) FP – false positive; iv) FN – false negative

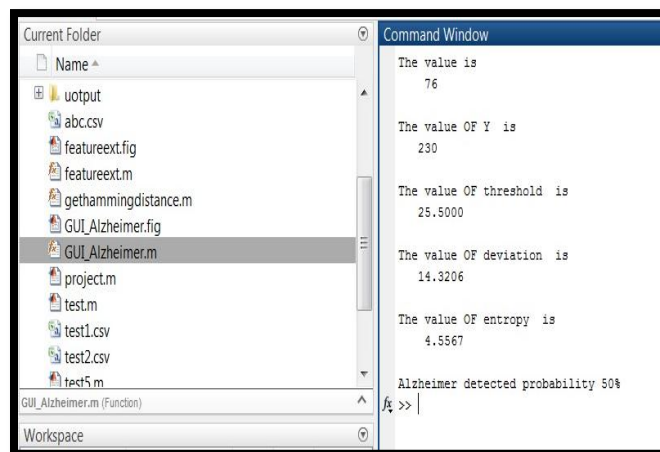


Figure 7: Final result of Alzheimer's disease detection

- The value is 76
- The value OF Y is 230
- The value OF threshold is 25.5000
- The value OF deviation is 14.3206
- The value OF entropy is 4.5567

#### IV. FEATURES EXTRACTED

**A. Entropy:** Entropy is a measure of image information content, which is interpreted as the average uncertainty of information source.

3.5105235e+00	3.5715754e+00	3.6214331e+00	3.6935030e+00	3.7624858e+00	3.7205634e+00	3.7573241e+00
3.7440344e+00	3.7106517e+00	3.6833868e+00	3.6851308e+00	3.6892793e+00	3.6860306e+00	3.6823811e+00
3.6853742e+00	3.6624101e+00	3.6771804e+00	3.6786151e+00	3.6736736e+00	3.6594418e+00	3.6635131e+00
3.6720820e+00	3.6916886e+00	3.7159802e+00	3.7474361e+00	3.7348934e+00	3.7482328e+00	3.7445541e+00
3.7607771e+00	3.7571188e+00	3.7638270e+00	3.7650826e+00	3.7806213e+00	3.7859586e+00	3.8004644e+00
3.7871720e+00	3.8020353e+00	3.8013858e+00	3.7824079e+00	3.7488170e+00	3.7259639e+00	3.7229461e+00
3.7153877e+00	3.6918608e+00	3.6765439e+00	3.6709854e+00	3.6725653e+00	3.6957712e+00	3.6944990e+00
3.6941732e+00	3.6850470e+00	3.6895045e+00	3.6996056e+00	3.7211867e+00	3.7304715e+00	3.7552741e+00
3.7685694e+00	3.7855727e+00	3.8128304e+00	3.8082836e+00	3.7789811e+00	3.7637383e+00	3.7612490e+00
3.7587138e+00	3.7533430e+00	3.7264143e+00	3.7148426e+00	3.7149169e+00	3.7056714e+00	3.7016057e+00
3.7039221e+00	3.7006808e+00	3.6925416e+00	3.6702890e+00	3.6852056e+00	3.6868870e+00	3.6727744e+00
3.6802241e+00	3.7094456e+00	3.7217195e+00	3.7024473e+00	3.6919075e+00	3.7007874e+00	3.6976071e+00
3.7371727e+00	3.7800629e+00	3.8067528e+00	3.8325506e+00	3.8651936e+00	3.9245777e+00	3.9882773e+00
4.0085081e+00	4.0449531e+00	4.0493718e+00	4.0591378e+00	4.0657539e+00		

The entropy calculated is stored in text a file which is used for Alzheimer detection purpose.

**B. Deviation:** It shows how much variation or "dispersion" exists from the average (mean, or expected value). A low standard. Deviation indicates difference from what is normal or expected.

7.2192772e+00	7.5635147e+00	5.9708526e+00	5.7783749e+00	5.4920806e+00	5.6485983e+00	5.8854414e+00
6.0299997e+00	5.6097378e+00	5.4861292e+00	5.1834116e+00	5.4250113e+00	5.3158282e+00	5.5924705e+00
5.6806757e+00	5.7128363e+00	5.8189362e+00	5.3522559e+00	5.0567149e+00	5.3333653e+00	5.9768015e+00
6.1113536e+00	5.8780761e+00	5.7972592e+00	6.3169953e+00	6.8317188e+00	6.6699439e+00	6.6973505e+00
6.1187096e+00	5.8714363e+00	5.6724206e+00	6.0181561e+00	6.7263554e+00	7.3389394e+00	7.2829200e+00
7.1317539e+00	6.8766505e+00	7.9914943e+00	8.0889225e+00	7.5350007e+00	7.8480403e+00	7.5652499e+00
6.8304959e+00	6.7096807e+00	7.0781544e+00	6.6349268e+00	5.7027018e+00	5.2949021e+00	5.5586599e+00
5.4422199e+00	5.4484976e+00	4.9674150e+00	4.8416065e+00	4.8420086e+00	5.0452684e+00	5.4854227e+00
5.5629619e+00	5.7303644e+00	5.7846642e+00	5.6977984e+00	5.6717477e+00	5.7390207e+00	5.2481884e+00
5.0092300e+00	5.2824039e+00	5.3585897e+00	5.3545899e+00	5.7922967e+00	6.2859237e+00	6.1472809e+00
5.9417127e+00	6.2533707e+00	5.9870413e+00	5.9505508e+00	6.1140214e+00	6.4845419e+00	6.9383170e+00
7.1111609e+00	6.7930050e+00	7.1836910e+00	6.7780908e+00	6.4281985e+00	6.0746646e+00	6.4028117e+00
6.4746184e+00	6.2802209e+00	6.5673633e+00	6.3243006e+00	6.5152301e+00	6.8553407e+00	6.9650854e+00
7.3164979e+00	7.4471561e+00	7.3544845e+00	7.4040321e+00	7.2140395e+00	6.6469980e+00	6.7342147e+00
7.0339146e+00	6.8156081e+00	6.7635149e+00	6.6469734e+00	6.9670994e+00	7.0683859e+00	7.0752819e+00
7.0754184e+00	6.6085307e+00	6.4631363e+00				

**C. Intensity:**

7.6910131e-01	7.3931373e-01	7.3905229e-01	7.3993464e-01	7.4093137e-01	7.3957516e-01	7.4281046e-01
7.4321895e-01	7.4135621e-01	7.3874183e-01	7.3709150e-01	7.3686275e-01	7.3717320e-01	7.3843137e-01
7.4014706e-01	7.4165033e-01	7.4088235e-01	7.3846405e-01	7.3743464e-01	7.3892157e-01	7.3266340e-01
7.3191176e-01	7.3155229e-01	7.2674837e-01	7.2941176e-01	7.2913399e-01	7.3403595e-01	7.3632353e-01
7.3367647e-01	7.3326797e-01	7.2892157e-01	7.3357843e-01	7.3651961e-01	7.4236928e-01	7.4174837e-01
7.4568627e-01	7.4781046e-01	7.4392157e-01	7.3388889e-01	7.2794118e-01	7.3120915e-01	7.3143791e-01
7.3297386e-01	7.3243464e-01	7.3138889e-01	7.2380719e-01	7.2348039e-01	7.2380719e-01	7.2647059e-01
7.2593137e-01	7.2307190e-01	7.2251634e-01	7.2375817e-01	7.2390523e-01	7.2509804e-01	7.2730392e-01
7.2857843e-01	7.2635621e-01	7.2740196e-01	7.3326797e-01	7.3388889e-01	7.3052288e-01	7.2950980e-01

## V. CONCLUSION

This mechanism presented works efficiently for detection of Alzheimer. The probability of Alzheimer detection varies from 0 to 100. The range is 25%, 50%, 75%. The accuracy of this project is 87.65% and sensitivity 90.66%. This iridology based Alzheimer detection is cost effective method than MRI scan mechanism. The mechanism provides accurate diagnosis of Alzheimer. The accuracy obtained varies from 83% to 89%.

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