

# RECOGNITION OF ALZHEIMER'S DISEASE USING MRI SCANS BY ARTIFICIAL NEURAL NETWORK

**Sushma V<sup>1</sup>**  
Assistant Professor  
Department of CSE  
ATMECE, Mysuru

**Mohamed Naumaan<sup>2</sup>**  
UG Student  
Department of CSE  
ATMECE, Mysuru

**Shazia Baig<sup>3</sup>**  
UG Student  
Department of CSE  
ATMECE, Mysuru

**Sheeban E Tamanna<sup>4</sup>**  
UG Student  
Department of CSE  
ATMECE, Mysuru

**Sharvani N Pande<sup>5</sup>**  
UG Student  
Department of CSE  
ATMECE, Mysuru

\*\*\*

**Abstract-** Alzheimer's Disease (AD) is a permanent and dynamic psyche disease that consistently wrecks memory force and thinking capacity aptitudes that it impacts the ordinary everyday practice of person. The work showed currently is that the utility of picture dealing with the Magnetic Resonance Image (MRI) compasses to assess the opportunity of an early acknowledgment of AD. The paper shows the utilization of a couple pre-picture planning procedures, for instance K-infers bundling - implies, wavelet change, watershed estimation, fake neural framework and besides a changed figuring tweaked for some specific case. It very well may be executed utilizing open source stages, for example, OpenCV and Qt, which helps the usage and value of the created filters in the medical clinics without requiring a specific programming. The results obtained by this endeavour could help in recognizing Alzheimer's patients and sound individuals, and investigating the AD patients with the psychological results and could as needs be help the pros in perceiving the malady at earlier stages. This could intelligently help in perception and treating AD.

**Keywords - Watershed, OpenCV, Wavelet Transform**

## I. INTRODUCTION

Alzheimer's Disease is a steadily expanding mind sickness which gradually harms the whole memory, thinking limit and finally organizes, the scholarly capacities. Indeed, even before the side effects of this disease are been perceived, the harm to the mind by the sickness happens 10 years before of its notification. It's been discovered that 50 to 85 percent of dementia cases are caused because of the Alzheimer's sickness. Early symptoms fuse the rot of hippocampus district of the mind, which has a place with the limbic framework and it plays out the most significant assignments, for example, the combination of data from momentary memory to long haul memory, memory components and official capacity communications. On the off chance that Alzheimer's illness could be distinguished at a beginning period, it will help in introductory analysis and getting it keep up the steady and great well being. The ordinary procedure of clinical distinguishing proof for a previous determination would give vital time to clinical intercession and analysis to be made. By using the manual following strategies various of analyses have been performed which there consequently affirmed that the exactness of utilizing decay of the average fleeting projection would be increasingly powerful. As the illness propels all the influenced zones of the cerebrum begin to wither. At the point when area division and highlight extraction, choice was tried on a gathering of individuals (counting equivalent number of ordinary subjects and AD patients) alongside clinical reports a high precision of about 90% would be accomplished by the accompanying technique utilized right now. The paper is sorted out with a focal point of utilizing the fundamental strategy to separate the locale of intrigue, the division strategies used to partition the portions relating to the dark issue and white issue and the methodological procedure to be followed to ascertain the mind volume. It at that point presents the end apparatus which is available to the customer as open source use, and its UI. Right now paper is been engaged to look at the viability of arrangement between AD patients and those of the sound individuals utilizing picture division which help fit as a fiddle investigation of the cerebrum data.

## II. LITERATURE SURVEY

- Ben RabeH Amira, Benzarti faouzi, Amiri Hamid, Mouna Bouaziz et al [1] proposed that the disease Alzheimer's ailment is neurodegenerative dementia. It is extremely hard to recognize sound and to arrive at that subject. In any case, accomplishing the hippocampus shows up previously the principal clinical indications of the ailment, in the mellow subjective impairment (MCI) stage. The hippocampus region to encourage early conclusion. A

programmed PC support conclusion gave a new assessment to the radiologist and that framework ordinarily starts with a pre-treatment to acquire a progressively coherent what's more, less boisterous picture. Right now propose a strategy, which is in view of the depiction of the hippocampus volume to facilitate analyze Alzheimer's malady. This paper utilizes the normal channel as a pre-treatment to expel dynamic shape model (ASM) to find the zone of hippocampus and a powerful execution strategy for arrangement.

- Martin Prince, Renata Bryce and Clusea Freri's et al [2] had a view that to exploit the Alzheimer's disease they would need to train the neural systems. There was a requirement for programmed analysis certain ailments from medical pictures that could support a specialist for additional activity towards treating the disease. Alzheimer's malady is brought about by decay of certain cerebrum locales and by synapse passing. X-ray filters uncover this data however decay locales are distinctive for various individuals which makes analysis somewhat trickier and regularly gets miss-analyzed by specialists. The dataset utilized for the undertaking contained more than 400 subjects 100 of which were having gentle to extreme dementia and is enhanced by MMSE and CDR principles of conclusion in a similar setting. Convolution Neural Systems, the issue can be unravelled with negligible blunder rate. The was mean to utilize libraries like CUDA CuDNN for utilizing GPU.
- Ane Alberdi, Alyssa Weakley, Maureen Schmitter-Edgecombe, Diane J. Cook et al [3] had a objective to assess the possibility of utilizing unpretentiously gathered action mindful savvy home conduct information was used to identify the multimodal side effects that are regularly seen as debilitated in promotion. In the wake of social affair longitudinal keen home information for 29 more established grown-ups over an normal term of >2 years, they naturally marked the information with relating action classes and removed time arrangement insights containing 10 sOcial highlights. Versatility, perception and temperament were assessed like clockwork. Utilizing these information, they made a relapse models to anticipate the side effects as estimated by tests and an element choice investigation as performed. Order models worked to distinguish solid total changes in the scores foreseeing manifestations. SmoteBOOST and RACOG calculations were used to defeat the class awkwardness where required. The results described that all versatility, insight, and discouragement side effects could be anticipated from movement mindful brilliant home information. It recommended that not every single social element contribute similarly to the expectation of each indication.
- B R Pushpa, P S Amal, Nayana P Kamal et al [4] proposed that Alzheimer's disease is one of the leading disease all over the world. AD may also lead to death as it causes various changes in the brain region especially in hippocampus, enlarged ventricles, entorhinal cortex, temporal and parietal lobes. The diagnosis involved heterogeneous clinical assessment such as patient history, neuropsychological test, family history, blood test etc. it was said as the diagnosis of AD was important and challenging, with the early prediction of AD the treatment can be effectively introduced at the early stages. Their work proposed that it began with noise removal of MRI brain images which includes denoising using Median filtering and DnCNN. Further brain tissue were segmented based on voxel based that is hite matter and gray matter and cerebrospinal fluid and region based segmentation and finally a deep convolution neural network was used for classifying the different phases of AD.
- Tao Chen et al[5] introduced an approach for segmentation of the images used to detect the Alzheimer's disease by using deep learning methods. Median filter was used for denoising of images which is also known as Tri-State Median (TSM). The input was given as image which was processed with the Standard Median (SM) filter and a Center Weighted Median (CWN) filter. And therefore the output of the noise was detected by using the impulse detector which compared the origin value to make decision for tri-state. This technique effectively reduced the impulse noise without losing image details.
- Karl Backstron et al [6] had proposed Alzheimer Disease detection using Deep Convolution Neural Network based on the features from MRI scanned images. The algorithm was been tested and trained by the 3D CovnNet with five layers of feature extraction. It also used the deep technique model to classify whether AD exists or not. And it is stated that this method helped in increasing the accuracy of finding the percentage of AD in a patient. SRAN was used for classification it provided reduction of figure of samples and also enhanced performance when compared to other classifier and minimized computational effort.
- Hae- Yeoun Lee et al[7] described the data related to the segmentation of the ventricular region of the brain by using active counter model and the iterative thresholding. In iterative thresholding it was initially used to recognize the endocardial border and evaluate the blood and myocardium signal, the algorithm they have proposed increased the accuracy and clearly segmenting the left ventricular region of the brain tissue.

### III. METHODOLOGIES

Fig 1 speaks to the stream outline for the preparing of mind MRI picture to recognize Alzheimer's malady. This procedure incorporates distinguishing Brain decay and Hippocampus mind area and applying diverse image segmentation technique for the accompanying.

#### FLOWCHART

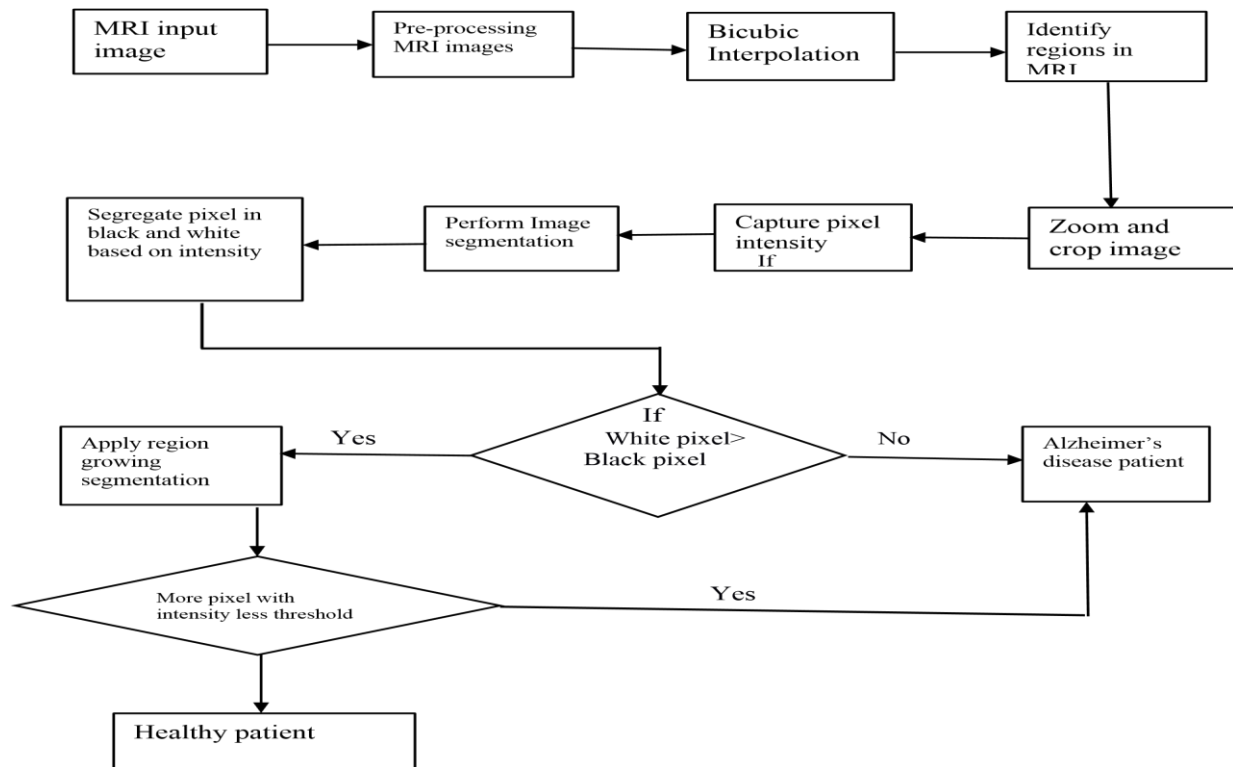


Fig1: Block Diagram of Brain MRI image processing steps.

#### Brain MRI Input Image

Magnetic Resonance imaging (MRI) was created during the abandonment of ultra sound. This was generally used to distinguish mind tumor through imaging. X-ray makes point by point picture of organs of human body . Radio waves and solid attractive field are utilized here which watches the piece of the body that were prior impractical X-beams, CT-Scan or Ultra sound. Specialist can see inside ligaments, tendon, muscles, ligament and joints [11].

#### Pre Processing of MRI Images

Right now MRI will be handled by utilizing image segmentation technique. This technique improves the element of the picture .This doesn't include additional component yet expels bothersome element from picture. Picture resizing, Image Conversion, and force modification of pictures are done here. Image pre-preparing and include extraction systems are required for any image based applications. The precision and combination pace of such procedures must be fundamentally high so as to guarantee the accomplishment of the resulting steps. In any case, more often than not, the centrality of these strategies stay unnoticed which brings about sub-par results. Right now, significance of such methodologies is featured with regards to Magnetic Resonance (MR) mind picture order and division. Right now, pre-handling procedures are created to evacuate the skull partition encompassing the cerebrum tissues. Additionally, surface based component extraction systems are likewise shown right now. The trial results are examined as far as division effectiveness for pre-preparing and separation measure for highlight extraction systems. The assembly pace of these methodologies is additionally examined right now. Trial results show promising outcomes for the proposed approaches.

## Bicubic Interpolation

In Original Brain MRI the locale are not all that smooth with the goal that it very well may be utilized recognize highlights controlled by pixel. Subsequently, Interpolation is the method that is utilized to improve picture to such an extent that it is sufficiently smooth and utilized in a few picture preparing application.

## Region of Interest

Recognizes the Region of Interest in the MRI picture. To identify Alzheimer's the area of interests are Hippocampus decay, mind decay, parietal projection.

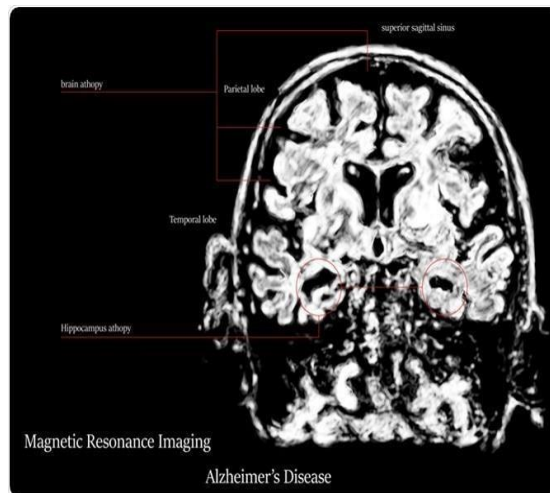


Fig 2 : Region Of Interest

## Pixel Intensity

A pixel is a little square that speaks to the measure of dim power to be shown for that specific part of the picture. For most pictures, pixel esteems are numbers that extend from 0 (dark) to 255 (white). The 256 potential dim force esteems are demonstrated as follows. Grayscale picture has dark qualities extending from 0-255 where 0 =black, 255= white while the highly contrasting picture has just 0 and 1 qualities where 0 =black, 1=white.

## Image Segmentation

The Co-ordinates of the area of intrigue is distinguished and the chose district is edited and zooms. The picture got in the wake of editing is utilized for changing the pixel force. The pixel is characterized dependent on the force of the pixel as white and dark for edited picture. Here, White district speak to the living tissue and dark locale speak to the dead tissues. The check of white pixel and dark pixel is estimated and if the quantity of dark pixel is little in correlation with white pixel then the patient is sound. In view of the quantity of the dark pixel the patient is delegated mellow intellectual impedance, Alzheimer's malady or Healthy patient. Thresholding is one of the systems to perform picture division. Right now division will be performed on greyscale or pixel force. It additionally bolster staggered thresholding bolster in excess of two class in which pixel is arranged .

## Segregation based on pixel

Black and White image is a special case of Grayscale image where the gray value/level is restricted to be pure white or pure black only in contrast to varying gray level of white or Black in case of gray scale image. X-ray is the analytical instrument of decision for neurological tumours over CT, as it offers better representation of the back cranial fossa, containing the brainstem and the cerebellum. The difference gave among dim and white issue settles on MRI the best decision for some states of the focal sensory system, including demyelinating maladies, dementia, cerebrovascular illness, irresistible ailments, Alzheimer's ailment and epilepsy. Since numerous pictures are dismantled milliseconds, it shows how the mind reacts to various upgrades, empowering analysts to consider both the practical and basic cerebrum anomalies in mental disorders. MRI likewise is utilized in guided stereotactic medical procedure and radiosurgery for treatment of

intracranial tumours, arteriovenous abnormalities, and other precisely treatable conditions utilizing a gadget known as the SN-localizer.

### Watershed Segmentation

Mind decay is plainly obvious for persistent that is in introductory period of Alzheimer's infection. Along these lines, further cerebrum harm can be ensured by taking legitimate drug and evolving way of life. To distinguish mind decay division method is utilized. The working of district based division is given as follows:

- Watershed division will now not be applied quickly to picture anyway could be applied to angle of photo. Picture is managed as 3 dimensional and least factor is processed for every pixel. Fig three comprises the angle of Brain MRI.
- The pixel having indistinguishable negligible focuses are gathered altogether or pixel together structure catchment bowl.
- If water drop is situated, the drop tumbles to sure negligible. There are basic factor in which the water drop is put, it tumble to a few least with same chance.
- These basic point structure the peak line. Watershed calculation chooses this watershed line.

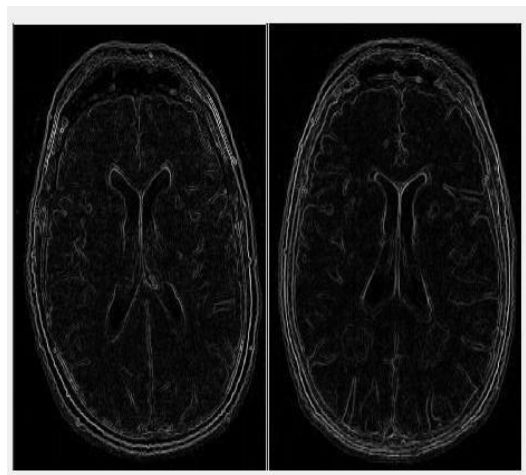
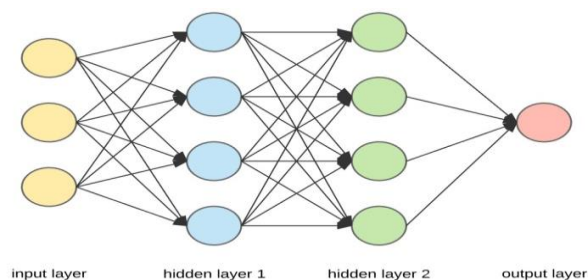


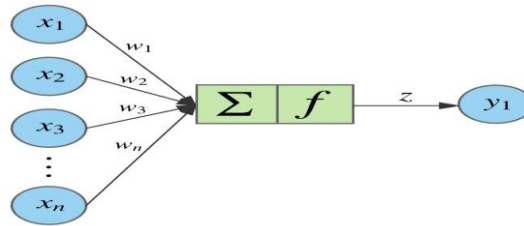
Fig.3 : Gradient of the original image using Watershed Segmentation

### Algorithm

Artificial Neural Network (ANN) is multi-layered totally neural system they are comprised of an information layer different shrouded layers and a yield layer. Each hub in one layer is related to each other hub in the following layer. This paper helps in making the system more profound by expanding the individual from hid layers.



In the event that it is been zoomed into one of the covered up or yield hubs what will be experience appeared in the figure underneath.



A predefined hub considers its weighted aggregate information sources and goes it through a non straight enactment work. This is yield of the hub which indicates the contribution of the mother hub in following layer. The sign streams from left to right and the last yield is determined by executing this methodology for all the hubs. Preparing this profound neural system implies learning the weight related with all the edges.

The condition for a given hub looks as follows. Its weighted entirely inputs went through a non direct initiation work. It very well may be spoken to as vector speck item where n is the quantity of the contributions for the hub.

$$z = f(x \cdot w) = f \left( \sum_{i=1}^n x_i w_i \right)$$

$$x \in d_{1 \times n}, w \in d_{n \times 1}, z \in d_{1 \times 1}$$

By barring the capacities term for soundness. Predisposition is a contribution to all the hubs and reliably has the value 1. It grants to move the after effect of the initiation work left to right. It additionally causes the model to prepare when all the info highlights are 0. On the off chance that this sounds convoluted right now you can securely overlook the inclination terms. For respectability the above condition looks as follows with the predisposition included.

$$z = f(b + x \cdot w) = f \left( b + \sum_{i=1}^n x_i w_i \right)$$

$$x \in d_{1 \times n}, w \in d_{n \times 1}, b \in d_{1 \times 1}, z \in d_{1 \times 1}$$

Hence, this *forward pass* describes meaning of how for the given an input and weights the output is calculated.

## CONCLUSION

In the present investigation, this paper is centred around to inspect the viability of grouping of AD patients and typical patients utilizing cerebrum shape data. The outcomes uncovered a precision pace of 90%. The precision pace of the present strategy surpasses if the exactness of volume data strategies are known in profound, which are broadly utilized for customary assessment of morphological changes. Accordingly, the data recommend that shape examination might be increasingly valuable for conclusion. Besides, the utilization of shape data is probably going to be valuable in the early location of AD.

## REFERENCES

- [1] Ben Rabeh Amira, Benzarti faouzi, Amiri Hamid, Mouna Bouaziz, "Computer-assisted diagnosis of Alzheimer's disease",2013
- [2] Martin Prince, Renata Bryce and Clusea Freri's, G. J. Awate , S. L. Bangare, "Detection of Alzheimer's Disease from MRI using Convolutional Neural Network with Tensorflow ", 27-30 Nov 2006
- [3] Ane Alberdi, Alyssa Weakley, Maureen Schmitter-Edgecombe, "Smart home-based prediction of multi-domain symptoms related to Alzheimer's Disease", 25 Jan 2018
- [4] B R Pushpa, P S Amal, Nayana P Kamal, "Detection of Stagewise Classification of Alzheimer Disease Using Deep Learning Methods", IJRTE Volume 10, Issue 10, Feb 2019
- [5] Chen, L H, K K and Chen, T., "Tri-state median filter for image processing" IEEE Transactions on Image Processing, 2017

- [6] Karl Backstrom, Nazari M, Jakola A S, "An efficient 3D deep convolution network for Alzheimer's disease diagnosis using Biomedical images", April 18, 2018
- [7] Hae-Yeou Lee, Codella Cham, Weinsaft J, Wang Y, "Automatic left ventricle segmentation using iterative thresholding and an active counter model with adaptation on short-axis cardiac MRI", March 2015
- [8] Peter J Nestor, Philip Scheltens, John R Hodges, "Advances in the Early detection of Alzheimer's disease", Nature Reviews Neuroscience, July 2004.
- [9] Yih-YianSitoh, Jagannathan Karthip, Jagath C Rajapahe, Wee-Tin Hong, Wei-Ling Lee, "Cerebral and Hippocampal Volumetry in Early Alzheimer's Disease", Proc.Intl. Conf. on Neural Information Processing (ICONIP'OZ),Vol. 3, Nov. 2002
- [10] Benson Mwangi, Klaus P Ebmeier, Keith Matthews, J Douglas Steel, "Multi-centre diagnostic classification of individual structural neuroimaging scans from patients with major depressive disorder". Brain-Oxford Journals, vol. 135, Issue 5, May 2012,
- [11] Burger W, Burge MJ, Digital Image Processing, Springer Verlag London, 2016
- [12] Iwatsubo T, Iwata A, Suzuki K, "Japanese and North American Alzheimer's Disease Neuroimaging Initiative studies : harmonization for International trails, Alzheimer's Dement, 2017
- [13] A Chakraborty, NM de Wit, WM van der Flier, HE de Vries, "The Blood brain barrier Alzheimer's Disease ", 2016
- [14] L Mesrob, B Magnin, O Colliot, "Identification of Atrophy Patterns in Alzheimer's Disease based on SVM, Feature Selection and Anatomical Parcellation", Medical Imaging Augmented Reality, Springer, 2008
- [15] F Glenn, S Jonathan, "SVM Feature Selection for classification of SPECT images of Alzheimer's Disease using Special information, Springer, 2007
- [16] Priyanka Lodha, Ajay Talele, Kishori Degaonkar, "Daagnosis of Alzheimer's Disease using Machine Learning", IEEE, 2018
- [17] A Bhagtani, T Choudhury, G Raj, M Sharma, "An effective survey to detect Alzheimer's disease using Data Mining Techniques" IEEE International Conference, 2017
- [18] Peter J Nestor, Philip Scheltens, John R Hodges, "Advances in the Early Ditection of Alzheimer's Disease", Rsearch Gate, 11 April 2014
- [19] C Patil, "Using Image Processing on MRI Scans", IEEE, 2015
- [20] Nida M, Zaitoun, Musbah J Aqel, "Survey on Image Segmentation Techniques", ICCMIT, Science Direct 2015