ABSTRACT

Numerous approaches and practicals for detecting Alzheimer's disease have been developed over time. Understanding the scanned images of the human brain is the initial stage in this procedure. This explain the extent to which the brain has been damaged. The "Image Segmentation" software is used to examine the brain images. To extract usable information from an image, Image Processing employs a number of algorithms. Each algorithm generates output in its own way. As a result, the efficiency of each method differs. A few image segmentation algorithms are employed to segment the photos in order to obtain the needed information, and ground truth is used to validate the results. This validation is used to compare the segmented image's accuracy to the ground truth, indicating the algorithm's efficiency. The research focuses on U-net techniques, as well as the results obtained utilizing these algorithms. This result served as the foundation for the creation of an algorithm for detecting Alzheimer's disease. Because it is based on Alzheimer's disease, the entire procedure is based on 2-D brain pictures, and the outcome will be 2-D images that will be validated. Based on the portion of the brain to be segmented, brain MRI scans in various orientations are used as input.

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1. Introduction:

Alzheimer's disease is a brain disorder that affects people of all ages. At first, the symptoms are modest, but as time passes, they get more severe. It was named after Dr. Alois Alzheimer, who described the illness for the first time in 1906 Trusted Source. Alzheimer's disease is a mild and progressive condition, meaning that the symptoms get severe over time. Memory loss is a flagship, and this will be one of the first symptoms to hit. The symptoms appear gradually, over months or years. If they being developed over long period, a person may require medical attention. One of the most affected part due to this Alzheimer's is Corpus Callosum which is responsible for communication in the brain.

1.1 **Statistics**: Alzheimer's disease affects over 5.5 million people in the US aged over 60. Eighty percent of those surveyed are over 75. Alzheimer's disease is expected to effect 60 to 70 percent of the approximately fifty million people globally who already suffered with dementia.

1.2 Symptoms:

1. Causes Anterograde Amnesia
2. Reduces speaking ability
3. Infects the frontal lobe of the brain
4. Causes Mood imbalance
5. Minimize Decision making ability.

1.3 **Background:** Human brain consists of a main part called Neuron. Neuron which transfers information to body parts. There are nearly over 80 billion of Neurons in a human brain connect with each other as in picture. The linked part two neurons is called a Synapse, highlighted by circling in the below picture. The Synapse is the location where neurotransmitters such as glutamine are released and transmission of data or information takes place in between the neurons. In addition to neurotransmitters, it also releases a small peptide called beta amyloid. Normally amyloid beta is cleared away by microglia, the cells of our brain. Due to hypertension release of amyloid beta increase to much of increase and less

clearance of amyloid beta, they

FIGURE 1.2: Synapse

Figure 1.1: Neurons

accumulate each other form sticky aggregate called amyloid plaques. These amyloid plaques block information transfer from one neuron to neuron, which the main reason for Alzheimer's disease. Due to rapid release of amyloid plaques, microglia set off hyper activated and emits chemical that ruin synapse. A necessary neuron called "tau" becomes hyper phosphated twisted themselves in order to form a structure named tangles, which squash the neurons from inside

1.4 **Prevention**: At Present, there is no specific drug or medicine for healing AD. In

FIGURE 1.3: Plaques

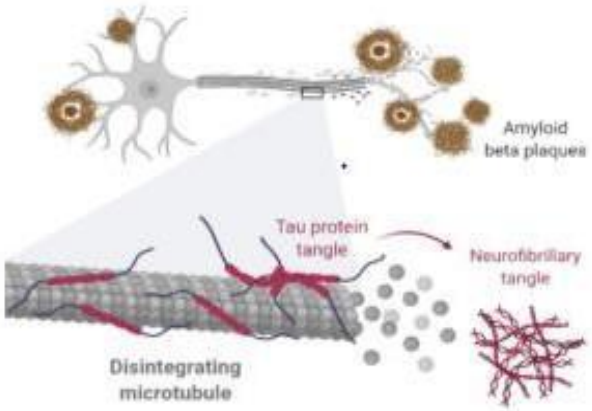

FIGURE 1.4: Tangles

general, the lower levels of acetylcholine in the brain leads to the initiation of AD. Cholinergic drugs are used to prevent AD. All these precautions measured are pertinent theoretically, but no practical way of curing AD.

1.5 **Corpus Callosum Role in Brain:** Our brain is of two hemispheres which are connected together by a thick bunch of nerve fibres called Corpus Callosum which assure communication and transmission of signals between two hemispheres. The information such as Sensory, Cognitive, and Motor will be constantly transmitted between these two hemispheres through a

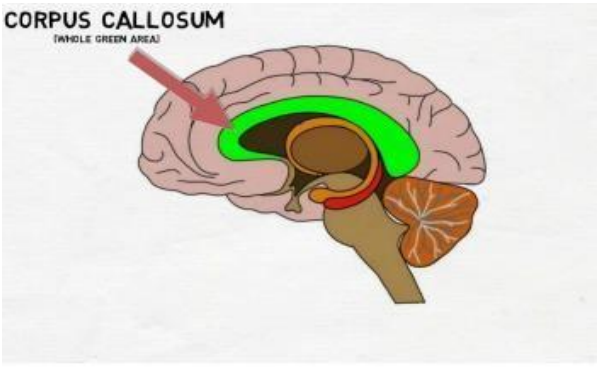

FIGURE 1.5: Corpus callosum

Neutral Highway. And, this is main part of brain will get damaged, for Alzheimer's affected patients.

1.6 **Motivation:** With the current technological advancements in the medical sector, it has become possible to track and cure diseases. Even after this, there are certain diseases which are difficult to track and cure, one such disease is Alzheimer's. There are various organizations and research communities worldwide that are working hard to find a permanent cure for AD. This requires a lot of man hours to get a significant result.

1.7 **Objective of Work:** This can be possible by Image Processing. The person's brain who are affected by AD are analyzed and, thereby generalizing a pattern in which a person is affected by AD. By observing the structure of the brain, several major differences can be found between a normal brain, MCI brain and AD brain. These differences form a way for the identification of AD at its early stages, which can be done by segmenting the affected part of the brain. It is not possible to cut a person's brain to find whether he has AD or not and can be only done through Image Processing. This helps in early detection of AD, which improves prevention process, since curing may not be possible. It is miserable for anyone to be affected by AD, but it has become one of the most common and unrecognized diseases, using several image processing techniques at least we can extend the time taken for going from MCI to AD. For segmenting the Corpus Callosum, there's a need to compare the accuracy results of different algorithm. Here we chosen Histogram and U-Net algorithm to process image segmentation. The results of Segmentation done using Histogram are not clear where as the results obtained by U-Net algorithm is more précised when compared to Histogram. U-Net algorithm can be trained numerous times such that we can get more and more Précised segmented image as output. Thus, we have chosen U-Net algorithm to make a step forward.

2. Literature Survey

To estimate the possibility of early detection of Alzheimer's disease, MRI scan can be used in Image Segmentation Process. Intensity adjustment technique is used for Image Segmentation of MRI scan, for extraction of white and grey matters, k-means clustering and Region growing algorithm are utilized. By using the same algorithm volume of brain could also be calculated. From axial plane (top view), coronal plane (back side) and sagittal plane (side view) in Brain quantitative and literature analysis are done using MATLAB tool [2].The procedure of uprooting region of interest from an image with the help of several Image segmentation procedures is known as Image processing. Region growing, watershed, thresholding, split and merge and K-means clustering method all these are components of Image segmentation technique. Segmentation of radiographic weld pictures which include flaw like porosity and absence of fusion, partial piercing and hyperspace are observed. The mentioned method is also utilized in spotting distorted region. Thus, they could be vaguely used in medical imaging, machine vision and optical scanning [3]. Another extensively used algorithm is K-means clustering for clustering. The reformed version of k-means algorithm is disputed in this paper in order that primary limited stretching improvement is enforced to picture in order to improve the clarity of image. Initial center of cluster and potential of data point, both are generated using subjective cluster method. For segmentation of images by k-means clustering the above generated center is utilized [4]. For detection of Alzheimer's disease a deep learning architecture is proposed, which conquer the downside of machine learning algorithm approach used in detection. Both Alzheimer's and MCI cases are discovered by the proposed deep learning model. It suggest a deep learning architecture that make use old stacked auto encoder and softmax output layer in order to identify the initial stage of Alzheimer's and MCI. Detection using domain earlier skill inspecting several classes of training and slight labelled training sample [5]. Another life threatening disease is stated as Brain tumor in which image processing will be tremendously useful in detection. To propose an algorithm which can able to detect the tumor in brain is the main purpose of paper. Thus, K-means clustering algorithm is used. K points are selected in the MRI scans itself, once the algorithm works, Entire points having minimum differences in each of their intensities begin going to their own centroids, when all the clusters finishes their movement towards their centroid, tumor

will get visible in MRI

[6]. The shape of brain not always disfigure due to disease, there exist a routine process by which the brain maintains its shape. Thus, it will be more demanding to distinguish the disfiguring of shape of brain due to pathology reason. For identification of deforming reason a mathematical model can be evolved. The flexible property of the brain is utilized to reimburse the deformation on non-pathological ground. This will assist us in recognition of deforming of the shape of the brain due to pathological reasons. Classification of patients based on diseases like Schizophrenia, AD healthy volunteer and normal-pressure hydrocephalus [8]. From 3-D MRI Identification of both Alzheimer's and Parkinson disease is much precise as much remarkable feature are contemplated. The metamorphic optimization algorithm counting Particle Swarm Optimization, Bat Algorithm, Simulated Annealing and Pattern search and genetic algorithm are utilized. The precision of identification is improved by enforcing this algorithm to Alzheimer's disease feature uprooting to output optimum result and elevated precision [9]. The current methodology is working on principle of brain volume harmed due to Alzheimer's. The count of what matter "Tau Tangle" keep on increase with respect to the patient going forward toward Alzheimer's. Due to no transmission of data between Neuron cell and brain cell the size of brain reduces gradually. The present technology focuses on spotting the size of brain from various views named as axial plane, coronal plane and Sagittal Plane Also quantify the percentile of grey and white matter. White matter percentile of 65 and 68 are considered as initial and consequent stage of AD. The cases of hippocampus atrophy is not considered in this detection mechanism [2]. In recognizing of Alzheimer's we should not only consider the outer region of the brain exhibit key role but also the harmed part of the brain in the central region. This comprise vascular region enlarged and damage made to the hippocampus [3].