Hybrid Segmentation and Features Extraction of Ischemic stroke on CT brain

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Abstract— *Ischemic stroke is the blocking of blood clot in the artery which supply blood to the brain. Computed Tomography (CT) images are widely used to diagnose brain stroke. Segmentation is the process of segmenting ROI in an image. Feature extraction is a method of transforming large data into small amount of data. The traditional segmentation technique shows disadvantages like over segmentation in images. The main objective of this project is to eliminate over segmentation in brain stroke images by using Marker based water shed segmentation and the results are compared with k-means clustering technique and then performing features extraction. Initially the images are undergoing segmentation techniques and features extraction process. The primary segmentations are performed initially by using K-means clustering technique and then secondary segmentation are done by using Marker based water shed technique with the help of internal marker and external marker. The shape and statistical features were obtained from gray level co occurrence matrix method and histogram technique. By using features extraction technique can differentiate normality and abnormality in the brain.*

The abnormality of the brain is measured by calculating features such as statistical and shape by dividing the brain into two equal parts. Mathematical calculations and comparison of results with standard dataset values are performed in order to check whether the brain belongs to normal or abnormal condition.

Keywords — *Brain, Ischemic stroke, Segmentation, K-means clustering, Marker based water shed Transformation, Features extraction***.**

I. INTRODUCTION

The first step for the image analysis is image segmentation. The pre processing is the initial steps in segmentation process. The process include in pre processing steps is gray scale conversion and skull removal. The disadvantages in current image processing techniques for CT brain of Ischemic stroke segmentation are over segmentation. The over segmentation can be eliminated by using an effective technique called Marker based water shed segmentation [1]. Feature plays an important role in image prcessing. Feature extraction is a method of transforming large redundant data into a reduced data representation. The features extraction and classification techniques help to identify the region interested in an image and perform analysis. The disadvantages in current features extraction techniques for CT brain of Ischemic stroke are over segmentation. The over segmentation can be eliminated by using an effective feature extraction and technique [2]**.** The critical cerebrovascular condition are called stroke. It was the most life threatening disease. The strokes occur when the blood supply to part of the brain is suddenly interrupted. There are two types of stroke. They are ischemic stroke and hemorrhagic stroke. Ischemic stroke occurs when the blood supply to the blood vessels in the brain is suddenly interrupted. Hemorrhagic stroke occurs when the blood bleeds from the blood vessels. 85% of people affected with ischemic stroke. Whereas the remaining people affected with hemorrhagic stroke.

II. LITERATURE SURVEY

Toru Tamakia and Tsuyoshi Yamamurab (2000) describe propose a method for segmenting a color image into object-regions each of which corresponds to the projected region of each object in the scene onto an image plane. In conventional segmentation methods, it is not easy to extract an object-region as one region. Our proposed method uses geometric features of regions. At first, the image is segmented into small regions. Next, the geometric features such as inclusion, area ratio, smoothness, and continuity, are calculated for each region. Then the regions are merged together based on the geometric features. This merging enables us to obtain an object-region even if the surface of the object is textured with a variety of reectances; this isn't taken into account in conventional segmentation methods. They show experimental results demonstrating the effectiveness of the proposed method. Then the regions are merged together based on the geometric features. This merging enables us to obtain an object-region even if the surface of the object is textured with a variety of reflectence. The method is based on edge detection techniques, but other refinement is also applied.

Jong Kook Kim and Jeong Mi Park (2000) proposed Automatic medical image classification is difficult because of the lacking of training data. As manual labeling is too costly, they provide an automatic labeling solution to this problem by making use of the radiology report associated with the medical

images. The first segment and reconstruct the 3D regions of interest (ROIs) from the medical images, and extract pathology and anatomy information from the associated report. They use an anatomical atlas to map the ROIs to the anatomy part(s) and match the pathology information of the same anatomy parts from the text. In this way, the ROIs are automatically labeled with pathology types which can be served as class labels, and a training data set of a large number of training instances is generated automatically. They extract the volume, color, location, and shape features of the ROIs, and classify the types of ROIs using these features. The overall evaluation result is promising to doctors and medical professionals. The experiment is conducted using traumatic brain injury CT images; however, our framework of automatically labeling and classifying medical cases can be extended to medical images in other modality or of other anatomical part.

Domagoj Kovacevic and Sven Loncaric (2000) proposed a method for the computed tomography (CT) image labeling is presented. CT images used in this work are obtaine from patients having the spontaneous intra cerebral hemorrhage (ICH). The images are segmented into three tissue classes (skull, brain, and ICH) and the background. The method consists of two steps. In the the first step, the image is divided into a number of regions using the K-means clustering algorithm. Regions used are dark, medium dark and bright region. In the second step, the regions are labeled using the modified Hopfield neural network. The stable state of the network represents possible solution to the labeling problem. Simulated annealing is used as algorithm for network simulation.

Xiangyun Ye and Mohamed Cheriet (2001) Global gray-level thresholding techniques such as Otsu's method, and local gray-level thresholding techniques such as edge-based segmentation or adaptive thresholding method are powerful in extracting character objects from simple or slowly varying backgrounds. However, they are found to be insufficient when the backgrounds include sharply varying contours or fonts in different sizes. In this paper, a stroke model is proposed to depict the local features of character objects as double-edges in a predefined size. This model enables us to detect thin connected components selectively, while ignoring relatively large backgrounds that appear complex. Meanwhile, since the stroke width restriction is fully factored in, the proposed technique can be used to extract characters in predefined font sizes. To process large volumes of documents efficiently, a hybrid method is proposed for character extraction from various backgrounds. Using the measurement of class separability to differentiate images with simple backgrounds from those with complex backgrounds, the hybrid method can process documents with different backgrounds by applying the appropriate methods. Experiments on extracting handwritings from check image, as well as machine-printed characters from scene images demonstrate the effectiveness of the proposed model.

Ying Liu and Xiaofang Zhou (2004) proposed that lots of work has been done in texture feature extraction for rectangular images, but not as much attention has been paid to the arbitrary-shaped regions available in region-based image retrieval (RBIR) systems. In this paper, we present a texture feature extraction algorithm based on Projection Onto Convex Sets (POCS)theory. POCS iteratively concentrates more and more energy into the selected coefficients from which texture feature of an arbitrary-shaped region can be extracted. Experimental results demonstrate the effectiveness of the proposed algorithm for image retrieval purposes.The paper present a texture feature extraction algorithm based on Projection Onto Convex Sets (POCS) theory. POCS iteratively concentrates more and more energy into the selected coefficients from which texture feature of an arbitrary-shaped region can be extracted. Experimental results demonstrate the effectiveness of the proposed algorithm for image retrieval purposes.

Wen-Nung Lie and Wen-Hung Peng (2006) this paper presents an efficient content-based computed tomography (CT) brain image retrieval system for medical training or diagnosis. They focus on the analysis of lateral ventricle features to help physicians to distinguish hydrocephalus and atrophy from normal cases. The system is composed of four modules are ventricle region segmentation, feature computation, feature indexing, and database search. In the first module, we apply the Otsu's thresholding plus gradient vector flow (GVF) snake to segment out ventricles

III. METHODOLOGY

The over segmentation can be eliminated by using an effective segmentation and feature extraction technique. Initially the images are undergoing preprocessing techniques such as gray scale conversion, skull insulation, masking and filtering. The segmentations are performed by using Marker Based Water shed technique with the help of Internal and External markers in order to avoid over segmentations in an images. The normality and abnormality of the brain were identified by using the extraction techniques. The abnormality of the brain are measured by calculating features such as statistical and shape by dividing the brain into two equal parts includes abnormal area and normal area. The statistical features were calculated from histogram technique. Comparisons were made between the histograms of the two parts to check which part carries the stroke. The shape and texture features were obtained from and gray level co occurrence matrix method respectively. By using mathematic morphology to extract brain area. The

data sheet are obtained form data set image website. CT images need preprocessing operations because of unorganized nature of the brain tissue so applying method for the diagnosis of the infraction.

A. Gray Image Conversion

Initially the image is received from CT scan. The colour image is limited to the application of various techniques. So there is a need for conversion image into gray scale.

B. Skull Removal

The main challenging of isolation of brain is the removal of skull. Perfect removal of skull generally increases the accuracy of segmentation. The following methods and mathematical operation are used to perform the skull removal.

C. Region Growing

The region growing is the process of grouping of pixels based on intensity values. Initially the seeded pixels are chosen and the grouping of pixel takes places base on intensity value similarities.

D. Image Masking

Masking is the technique used for improving image quality. Generally 2x2 matrixes are used. Convolution process helps to perform the masking operation. The middle value of the pixel was replaced by the masked image value. Here the masking process helps to removal the cortex which is present in an image. This process makes the of study into back while convert the remaining region into white.

E. Filtering

CT image consist of noise. Removal of noise plays an important role in the image quality. Here the median filter is used to remove the noise which is present in a stroke image.

F. Opening and Closing Technique

Opening and closing is one of the important morphological technique used in segmentation process. The morphological techniques used here is dilation and erosion. The opening technique followed by dilation and the closing technique followed by erosion. The morphological reconstruction also used in this techniques for the removal of over segmentation in ischemic stroke of CT image. Opening with a closing can remove the dark spots and stem marks.

G. K-Means Clustering Technique

It one of the clustering technique. Clustering in the sense meaning of grouping. Basic idea in this technique is grouping the pixels based on calculating the distance. Initially cluster is mentioned and calculating of centroid taking place. The grouping of pixel occurs by mathematical calculation.

H. Marker Technique

The main advantages of this technique are to avoid over segmentation in an images. Generally two types of marker were available for the effective removal of over segmentation. They are internal and external marker. The internal marker was followed by edge detection and thresholding techniques. The phenomenon followed in maker based water shed method is image considered as landscape. The filling of water shed based on gray scale values. By this way an effective removal of over segmentation takes place in an image.

I. Features Extraction

Feature extraction is the process of transformation of large number of data into smaller one. It helps to identify the region of interest which present in an image. The shape, texture and stastitical features of the stroke were calculated from GLCM method and histogram method respectively.

J. GLCM

Gray level co-occurrence matrix. A co-occurrence matrix also referred to as a co – occurrence distribution. It is defined as the distribution of co-occurring values in an image. It is a matrix that is defined the distribution of co-occurring values.

K. Co-Occurring Values

The GLCM is created from a gray- scale image. The values occur by calculating the relationship between pixel and gray level is called co-occu rrence values.

L. Histogram

It is the distribution of gray scale values in an image. Load the image. Perform histogram of the image. Calculate GLCM by using operator. Calculate mean, standard deviation, energy, entropy, skewness and kurtosis by using formulas.

M. Feature Extraction Calculation Steps

1) Mean

The mean is the average value in an image. It generally shows the details of brightness in segmented image. The normal part has largest mean in comparison with abnormal part of segmented ischemic stroke image. The mean can be defined as follows

$$mean = \bar{g} = \sum_{g=0}^{L-1} gP(g) = \sum_{r=0}^{height-1} \sum_{c=0}^{width-1} \frac{I(r,c)}{M}$$

2) Standard Deviation

The standard deviation also denoted as SD. It gives information about the contrast in segmented stroke image. It is the square root of standard deviation. It directly depends on mean hence the largest region of segmented ischemic image shows higher SD than

the abnormal part. The standard deviation is defined as follows:

$$\sigma_g = \sqrt{\sum_{g=0}^{L-1}(g-\bar{g})^2 P(g)}$$

3) Skewness

The skewness shows the gray scale asymmetric characteristics. It also indicates the unbalance distribution of gray scale values. Obviously the abnormal region shows high asymmetric conditions than the normal part because of the presence of ischemic stroke in an image.

$$skew = \frac{1}{\sigma_g^{\,3}} \sum_{g=0}^{L-1}(g-\bar{g})^3 P(g)$$

4) Energy

The distribution of gray scale level is mentioned by energy. The good image in the sense it shows less energy values. From this can conclude that the abnormal region has high energy than the normal region. It is given by the following equation.

$$energy = \sum_{g=0}^{L-1}[P(g)]^2$$

4) Entropy

Entropy is the measure of amount of information in an image. In image processing, it indicate the relationship between the image and the pixels in ischemic stroke image.

$$entrophy = -\sum_{g=0}^{L-1} P(g)\log_2[P(g)]$$

IV RESULTS AND DISCUSSION

A. Preprocessing

Preprocessing is the initial step in all image processing sector. It consist of skull removal and gray scale co version process.

B. Input Image

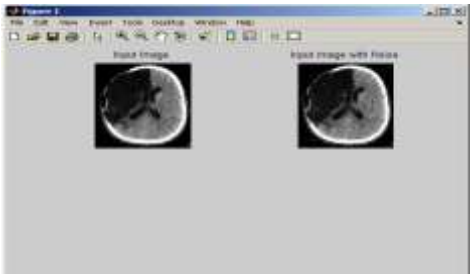

Figure 4.1 shows the input image.

The images received from CT scans, they are converted into gray-scale image. The input image has inbuilt noise. The gray scale conversion is the essential process for performing the application of various techniques.

C. Gray Image Conversion

Figure 4.2 Gray Scale Conversion Image

The figure 4.2 shows gray image conversion. The images received from CT scans. They are converted into gray-scale image by eliminating brightness in-formation.

D. Skull Removal

The removal of the bony skull surrounding the brain tissue is considered as a challenge to the brain isolation process. It is the process of removal of bony skull in an ischemic stroke image.

E. Image Masking

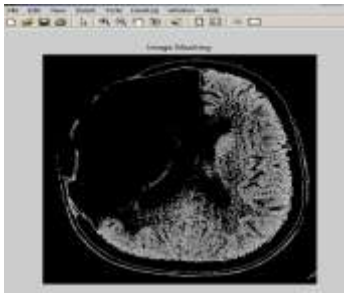

Figure 4.3 Masked Image.

The figure 4.3 shows masking image. To remove the cortex, the masking technique is applied. This makes the region of study black. The mask is a two dimensional matrix which help to isolate the stroke region in an image. The black colour in an image is indicated as masking. The masking image results mentioned in center pixel. This process will continue until all the pixels are replaced by masking value.

F. Filtering and Region Growing

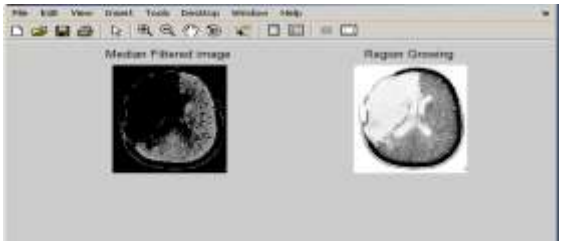

Figure 4.4 Filtering and Region Growing Image

The figure 4.4 shows filtering and region growing Image. The region growing is the process of growing of region based on intensity values. Initially the pixel was chosen and growing of pixel takes places with the help of their intensity values.

G. K-Means Clustering Image

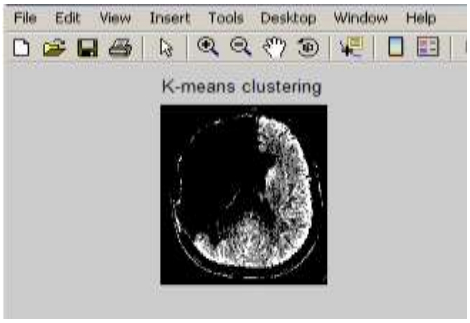

Figure 4.5 K-means Clustered Image

The figure 4.5 shows K-means clustering Image. K-means clustering is performed on ischemic stroke image. The black region in a image shows the stroke region whereas the normal part in white colour.

H. Marker Image

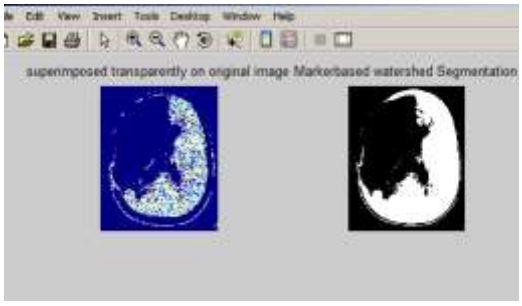

Figure 4.6 Marker Controlled Watershed Transformated Image

The figure 4.6 shows marker controlled watershed transformated image. The watershed transform applied on the pre processed ischemic stroke region. The water shed was applied according to their gray scale values in an image by considered image as landscape. The black region in an image shows the stroke region whereas the normal part in white colour.

I. Image Partition

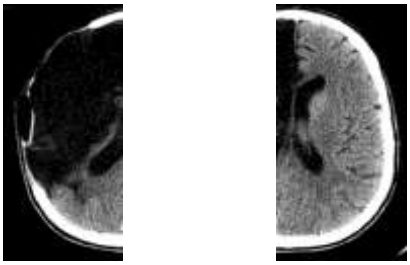

Figure 4.7 Image Partition

The figure 4.7 shows image partition. First dividing the stroke image into two equal half. Then calculate histogram of given stroke image. Histogram indicates the gray level distribution of the image.

J. GLCM Images of Stroke Affected Region

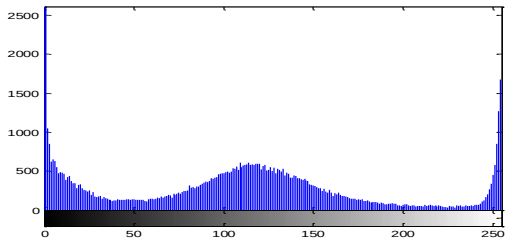

Figure 4.8 GLCM Images of Stroke Affected Region

Find GLCM of divided portion. Perform mathematical calculation for finding mean, standard deviation, energy, kurtosis, entropy, and variance. Compare the results with standard values. Conclude that the proposed algorithm is superior to conventional algorithm such as k-means clustering in terms of over-segmentation. Features extraction techniques help to find the normality and abnormality of the given stroke image by making comparison with standard data set value with the help of mathematical calculation. The proposed algorithm is superior to conventional algorithm in terms of over-segmentation. It is evident that the proposed algorithm gives better result than the conventional algorithm. The problem of over segmentation is overcome by applying markers on the gradient image and features extraction techniques. Ischemic stroke is the blocking of blood clot in the artery which supplies blood to the brain. It is a very common disease that affects blood vessels in the brain causing cerebral tissue damage. Computed Tomography (CT) images are widely used to diagnose brain stroke because of lower cost and sensitiveness to early stroke. Feature plays an important role in image prcessing. Feature extraction is a method of transforming large redundant data into a reduced data representation. The features extractions

techniques help to identify the regionm interested in an image and perform analysis. By using this technique can differentiate normality and abnormality in the brain. The abnormality of the brain are meaured by calculating features such as statistical and shape by dividing the brain into two equal parts.The shape, statistical features and texture features were obtained from gray level co occurrence matrix method and histogram technique. Comparisons were made between the histograms and calculations are performed in order to check whether the brain status.

V. CONCLUSION AND FUTURE SCOPE

The main objective of this project is to eliminate over segmentation in brain stroke images by using segmentation and features extraction techniques. By using this technique can differentiate normality and abnormality in the brain. The abnormalities of the brain are measured by calculating features such as statistical and shape by dividing the brain into two equal parts. The proposed algorithm is superior to conventional algorithm in terms of over-segmentation. It is evident that the proposed algorithm gives better result than the conventional algorithm. The problem of over segmentation is overcome by applying markers on the gradient image and features extraction techniques. In future, the over segmentation are avoid in all the medical images. The efficiency of the system can be increased by using different methods**.** In image segmentation the objects in the image are separated and labeled for further analysis. This is usually done with the help of a wide range of image segmentation techniques. Each technique has its own advantages and disadvantages. The effectiveness of a particular image segmentation and feature extraction algorithm is determined with respect to a particular class of images. Generally a combination of two or more techniques is used to get the desired output for a particular application.

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