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BRAIN HEMORRHAGE DETECTION USING IMAGE PROCESSING

*Dr.E.Thenmozhi M.E,PH.D,[1]Ms.G.Thejoshree,[2]Ms.U.Nandhini

*Associate Professor, Department of Information Technology,

1,2 Students, Department of Information Technology
Panimalar Institute of Technology, Chennai

Abstract--*The visual representations of the inner constituents of body along with the functions of either organs or tissues comprising its physiology are developed in medical imaging.. The objective of the system mentioned in this paper is to detect the presence of hemorrhage and to classify the type of it when detected. CT images are considered here to find the hemorrhage. Pre-processing techniques are done to make the input image suitable for further processing. After pre-processing the images go through morphological operations .Then watershed algorithm is employed for the purpose of segmentation. Active contours are drawn and features extracted .The final outcome can be viewed and interpreted with a medical assistance. The outcome of this research increases the chances of predicting hemorrhage in the image and then classifies its type. The average accuracy of the system in classifying the three types of hemorrhage is found as 98%.*

Keywords— CT, Intracerebral Hemorrhage, Subdural Hemorrhage, Extradural Hemorrhage, Subarachnoid hemorrhage, Watershed Algorithm.

1.INTRODUCTION

A brain hemorrhage is a particular type of stroke which is caused as a result of bleeding due to the result of a ruptured artery or some other reason such as sudden movement of the brain resulted as an accident. The nearby tissues are affected because of the pooling of blood onrupture. This accumulation of blood is referred to as hematoma.

Trauma and high blood pressure are found to be the main sources for hemorrhage. The severity of hemorrhage depends on the bleeding and may need immediate medical assistance. So Medical imaging is required to create the visual representations of the organs and tissues of the brain to diagnose them accurately. These medical images acquired by any of the techniques such as Magnetic Resonant Imaging (MRI), Computed Tomography (CT) require further processing to predict exactly the presence of hemorrhage.

2.RELATED WORKS

- SinachettraThay and there team published based on the detection of hemorrhage using CT scan slices . A fast and accurate method to detect hemorrhage using decision tree is used here. Based on the features extracted decision tree is employed for both images with and without hemorrhage. Features related to intensity and other parameters are considered..

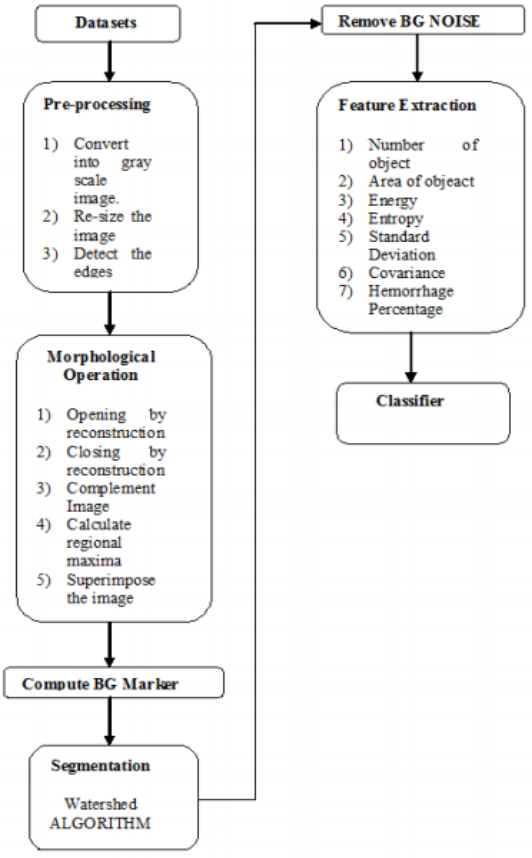
- Amutha Devi and there team published based on MRI images that are stroke and non strokeimages. Features are extracted using Watershed segmentation and Gabor filter . The extracted features are classified using Multilayer Perceptron (MLP). Experiments have been conducted to evaluate the efficiency of the proposed method with varying number of features.

- Meera Kumar and there team published based on investigate the intracranial hemorrhage detection problem and built a deep learning model to identify the hemorrhages. They trained and tested a ResNet50 model for predicting the hemorrhage type.

3. PROPOSED SYSTEM

In this system, the CT image of the brain undergoes certain preprocessing operations.The concept proposed focuses on early detection of hemorrhage. The image is processed; meaningful features are extracted and combined with an Artificial Intelligence classifier system for good and accurate diagnosis. Here processing the

image involves pre-processing and morphological operations followed by segmentation to detect the presence of hemorrhage. Watershed algorithm helps to classify distinct regions in the system using watershed lines. Active contour are used to extract features and classify them accordingly if hemorrhage is present.



A.PREPROCESSING:

The aim of pre-processing is to segment the interesting pattern from the background by removing the unwanted data present in the scanned image.

1.RESIZE IMAGE

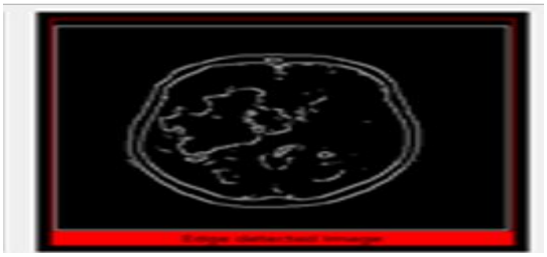
Resizing is an important step in image preprocessing. It is required for various purposes such as display, storage and transmission of images. Resizing is changing the dimensions of an image. It is done so as it fits on the system user interface. The converted gray scale image is resized to 256 pixels by 256 pixels size.

2. CONVERSION OF GRAYSCALE

The CT image is converted into gray scale image to make it contrast. The contrast image helps in giving exact information about the tissues.

3.EDGE DETECTION AND SHARPENING

Edge detection refers to the process of identifying and locating sharp discontinuities in an image. Edges themselves are boundaries of object surfaces which often lead to oriented, localized changes of intensity in an image. In this system, Sobel operator is used for edge detection. The Sobel operator is based on convolving the image with a small, separable, and integer valued filter in horizontal and vertical direction and is therefore relatively inexpensive in terms of computations. Mathematically, the operator uses two 3×3 kernels which are convolved with the original image tocalculate approximations of the derivatives - one for horizontal changes, and one for vertical.



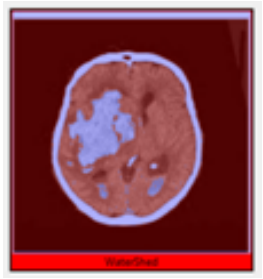
B.Morphological Operations

Morphological image processing is a collection of non-linear operations related to the shape or morphology of features in an image. Morphological operations rely only on the relative ordering of pixel values, not on their numerical values, and therefore are especially suited to the processing of binary images. Morphological operations can also be applied to greyscale images such that their light transfer functions are unknown and therefore their absolute pixel values are of no or minor interest.

C. Image Segmentation

In computer vision, image segmentation is the process of partitioning a digital image into multiple segments. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Segmentation is the process of partitioning the image into multiple segments

so as to render the image easier for further analysis and understanding. The technique used here is watershed segmentation. Watershed transformation also called, as watershed method is a powerful mathematical morphological tool for the image segmentation. It is most commonly used in biomedical and medical image processing.



D.Feature Extraction

Feature extraction is the process of reducing the number of constraints that are needed for representing the original data in an informative way. Segmented image is considered to draw the contour. In general the gray pixel values of hemorrhage will lie in the range 180-240. The algorithm considers the region of interest by making the range values as the threshold using the kernel check method from segmented image. 3x3 kernel is built to compare the neighbouring pixels with the threshold and mark or unmark the region as "Region of Hemorrhage" and contour is drawn.

E. classification.

The extracted features are considered and fed into the classifier to find the type of hemorrhage. Active contours can also be used in motion tracking and stereo tracking. Thus, the active contours segmentation is used for the separation of pixel of interest for different image processing.

The extracted features by using contours are as:

Number of Objects: The number of objects shows the type of hemorrhage.

• Area of Objects: Area of objects shows the intensity of bleeding.

• Energy: is a measure of unorderedness or information content in an image.Energy = $\{pi, \}2ji$

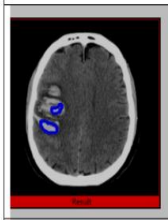
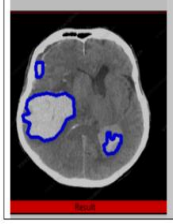
• Entropy: Entropy is a statistical measure of randomness that can be used to characterize the texture of the input image.

Entropy = $- pi, \log(pi,j\ )ji$

• Hemorrhage Percentage: The hemorrhage percentage is calculated by,Hemorrhage percentage = (object area)$(256*256)* 100$

• Based on this Hemorrhage Percentage will classify the type of hemorrhage into ICH,SDH,SAH and EDH.

4. RESULTS

INPUT IMAGE	TYPE OF HEMORRHAGE	AREA OF % AFFECTED
	Internal Cereberal Hemorrhage	4.5%
	Epidural Hemorrhage	44.665%

5.Advantage

- In image processing GPU is not required
- The proposed system gives the type of hemorrhage and the percentage of affected area.
- Cost is efficient.

6.Future work

As an extension to this research, other classifiers can be used and their accuracies can be compared to get an efficient result. This work can also be carried on for the diagnosis of similar such medical emergencies by using other feature extraction techniques accordingly.

7. Conclusion

The system is successfully trained with brain CT images and classification has been done if hemorrhage is detected. The problem of over-segmentation has beenovercome by using watershed algorithm along with markers. After segmentation with the extracted contour features, decision tree classifier is employed. CT images with and without hemorrhages are considered. The overall classification accuracy is found to be 99%, 97% and 99% for ICH, SDH and SAH respectively.

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