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Detection and Classification of Brain Hemorrhage

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Abstract:

Brain hemorrhage is a type of stroke, which occurs due to bursting of an artery in the brain, thus causing bleeding in the surrounding tissues. CT (Computed Tomography) images are used to diagnose bleeding and fractures in inner parts of the body. CT images are preferred over MRI (Magnetic Resonance Imaging) images due to wider availability, lower cost and sensitiveness to early stroke. This proposed is able to not only diagnose brain hemorrhage but also classify hemorrhage type. This system will help medical team to give best possible treatment to thepatients.

Keywords — **ANN – Artificial Neural Network, CT – Computed Tomography, GLCM – Grey Level Co-Occurrence Matrix, MRI – Magnetic Resonance Imaging.**

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I. 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 on rupture. This accumulation of blood is referred to ashematoma. 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), (CT) require further processing to predict exactly the presence of hemorrhage.

In this proposed system, CT images are used. These image after being pre-processed, are made to undergo certain morphological operations. Morphological image processing is a collection of non-linear operations related to the shape or morphology of features in an image. This technique probes an image with a small shape or template called as structuring element. The structuring element is positioned at all possible locations in the image and it is compared with the corresponding neighbor of pixels. Dilation and erosion are the two operators used in this system. In dilation, if the origin of the structuring element coincides with the 'black' pixel in the image, all pixels are made black, from the image covered by the structuring element. Similarly in erosion, the pixels are turned to 'white'. After this, the image is segmented using Threshold Algorithm. Image segmentation is a process of partitioning the image into non- intersecting regions, so that each region ishomogeneous.

Exact location of required objects and boundaries in images can be found through image segmentation. In Threshold Algorithm, we consider the image as a topographic relief, where the height of each point is directly related to its gray level, thus the threshold lines separates the catchments basins that are formed. The threshold transform is computed on the gradient of the original image, so that the catchment basin boundaries are located at high gradient points. The classifier used in this process is an Artificial Neural Network (ANN). It is a computational model based on structure and function of animal's nervous system in particular brain which is capable of machine learning and pattern recognition. ANNs are presented as system of interconnected neurons which exchange between each other. The neuron has two modes of operations: The training/learning mode and the using/testing mode. In a feed forward neural network, information flows in one direction along connecting pathways, from the input layer via the hidden layers to the final outputlayer.

Following are the two types of Hemorrhages

Types of hemorrhages:

A. IntracerebralHemorrhage(ICH):

This type of stroke occurs when the brain is deprived of oxygen due to an interruption of its blood supply. The location of ICH can be close to the surface or in deep areas of the brain. It is a type of stroke caused by bleeding within the brain tissuesitself.

B. Subdural hemorrhage(SDH):

It is the collection of blood, accumulating in the potential space between the dura and arachnoid mater of the meninges around the brain. The meninges are the connective tissue membranes that line the skull and vertebral canal. It encloses the brain and the spinal cord

II. METHODOLOGY

In this system first we are going to preprocess the images to convert them in ideal format. In preprocessing we perform three operations on images, Gray scale conversion, resizing and edge detection. Then preprocessed images undergo few morphological operations to enhance the structure of the image. Dilation and erosion methods are used to do the morphological operations. Opening by reconstruction, closing by reconstruction, compliment image. Calculating regional maxima superimposing the image these morphological operations performed onimages.

Then required features are extracted from the images these features are further required for the classification of images. Important features such as entropy, number of objects, energy, standard deviation etc. These extracted features are fed to classifier which classifies given image into normal or hemorrhage and if it is hemorrhage then it will detect its type. In this way given system works. It is effective and accurate than the previous systems and able to diagnose and detect the type of hemorrhage.

This block diagram shows us basic flow of the system and also gives the idea how the system works. It helps us to visualize the flow of the system.

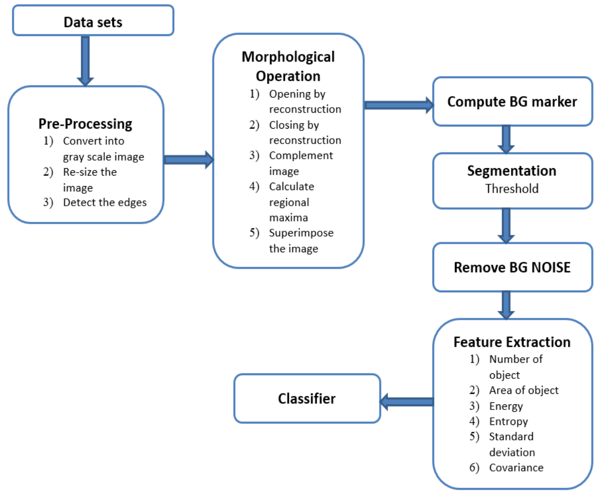
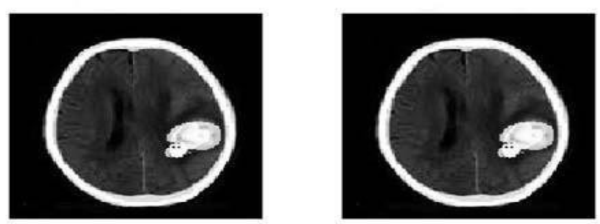


Fig. 1 Flow chart

III. RESULT

A1. Pre-processing

Pre-processing improves the quality of an image. In this system, pre-processing techniques are developed to remove the skull portion surrounding the tissues. The CT image is converted into grey scale image to make it contrast. The contrast image helps in giving exact information about the tissues.



a) Original Image b) Gray Scale Image

Fig. 2 Pre-processing results

A2. Resizing

Resizing is an important step in image preprocessing. It is required for various purposes such as display, storage and transmission of images. While displaying an image, the resolution of the display devises imposes constraints on the maximum size of the display screen. The acquired image is resized according to the requirement of the system. 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 256pixels size.

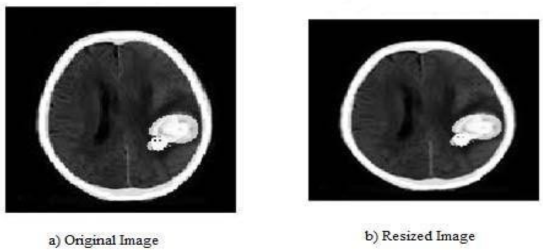


Fig. 3 Resizing results

A3. Edge Detection

Edge detection refers to the process of identifying and locating sharp discontinuities in an image. The discontinuities are abrupt changes in pixel intensity which characterizes boundaries of objects in a scene. 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 inexpensiveintermsofcomputations.Mathematically,theoperatorusestwo3×3kernels which are convolved with the original image to calculate approximations of the derivatives - one for horizontal changes, and one for vertical.

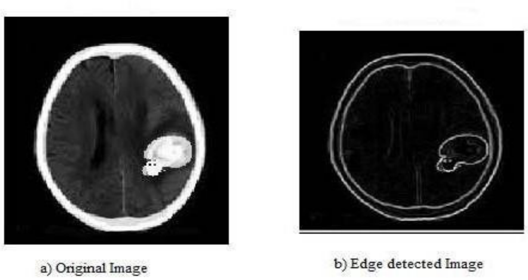


Fig. 4 Edge Detection results

B1.MorphologicalOperations

Dilation and erosion operators are further used in complex sequences of opening and closing. Opening consists of an erosion followed by dilation and can be used to eliminate all pixels in regions that are too small to contain the structuring element.

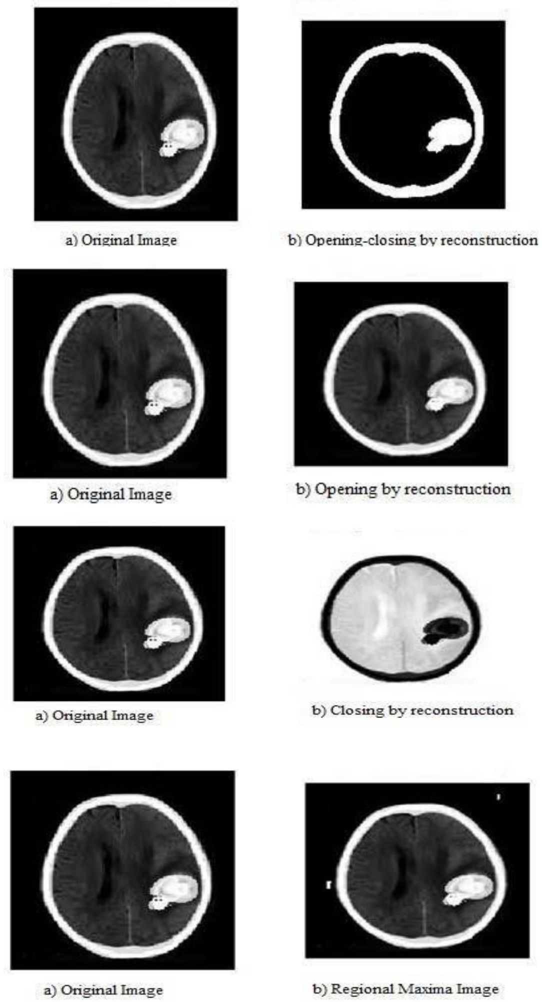


Fig. 5 Morphological operations results

After opening and closing reconstruction operation, the complement of the gray scale image is taken, to calculate the regional maxima. Calculating the regional maxima of these reconstructed images is done to get smooth edge foreground objects. Later, we superimposed these markers on the original images.

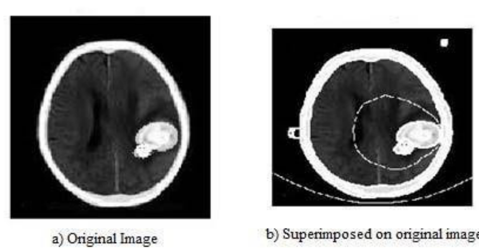
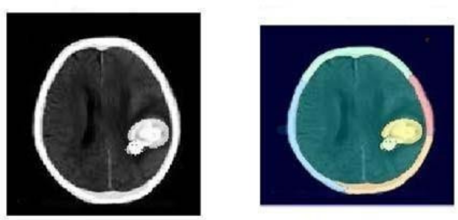


Fig. 6 Superimposed image results

B2. Segmentation

Threshold transforms works for images even with low contrast. Thus it helps in separating out the distinct regions. The threshold transform is computed on the gradient of the original image, so that the catchments basin boundaries are located at high gradientpoints.



a) Original Image   b) Segmented Image

Fig.7 Segmented image

B3. FeatureExtraction

After segmentation, we extract certain features of the image and input it further to a classifier. Thus main aim of this feature extraction is to reduce the original datasets by measuring certain features. The classifier used is a GLCM (Grey Level Co-occurrence Matrix). The GLCM functions characterize the texture of an image by calculating how often pairs of pixel with specific values and in a specified spatial relationship occur in an image, thus creating a GLCM, and then extracting statistical measures from this matrix. A GLCM is a matrix where the number of rows and columns is equal to the number of gray levels, G, in the image.

The following parameters are extracted from theimage:

1. Number of Objects: It shows the type of hemorrhage. If N is equals to three or more than three, then the type of hemorrhage is ICH. If N is equals to two, then the type of hemorrhage is SDH. If N is equals to one, then it shows the normal brainimage
2. Area of Objects: It shows the intensity ofbleeding.
3. Energy: Measure of energy content in theimage.
4. Entropy: Entropy is a statistical measure of randomness that can be used to characterize the texture of the inputimage
5. Covariance
6. StandardDeviation

C1. Classification

ANNs are represented as system of interconnected neurons which exchange information between each other. The neurons have two modes of operation: The training/learning mode and the using/testing mode. In ANN, feed forward back propagation network is used and therefore the accuracy of result is more. In the training phase of this system, six input images were taken from a given location; to extract input features and the known output will be found by naming the images from the type of hemorrhage. Then the net file can be generated using a train tool for the first time after going through few testing iterations by providing the saved input and output files. Once the input features are calculated and the vector is created, to add the image to train, the output will be defined according to the value that has been received as the output result. Once the input and output files are saved, system can be trained with them. This logic can be used to train the tested images aswell.

C2. GUI - Graphical User Interface

Graphical user interface is a system of interactive visual components for computer software. A GUI displays and represents actions that can be taken by the user. Here in case of this system we design a GUI that will be user friendly and can be operated with ease. This will be the interface via user can interact or use the system. Here in this GUI there are five push buttons for performing different operations. First is for browsing the input image second is for displaying the path third for image conversion and then for training and testing.

The graphical representation is for showing the accuracy and loss of the classifier.

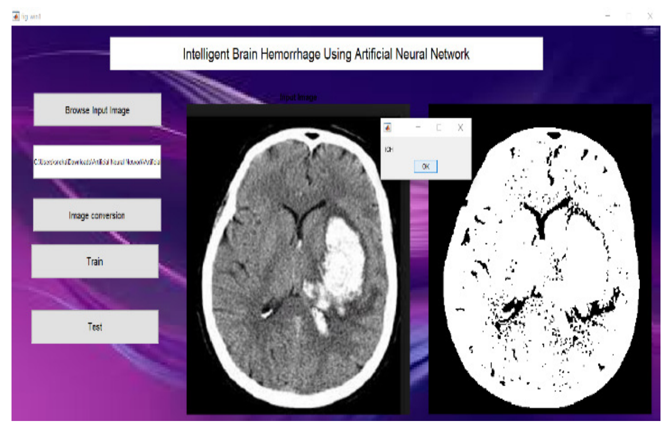


Fig.8 Graphical User Interface

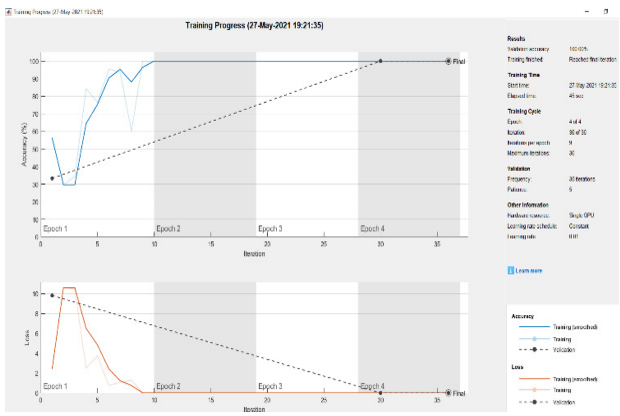


Fig.9 Graphical representation

IV. CONCLUSION

Detecting the type of hemorrhage is a very crucial step, in a medical treatment to save life of the patient. Automatic detection of hemorrhage is a very complex task. The segmentation of the images using threshold algorithm smoothens the image. Before application of the threshold algorithm, morphological operations are performed to compute the foreground and background markers. The use of feed-forward network with back propagation has helped in reducing error at the output, thus detecting the hemorrhage efficiently. Even non-technical users will find this concept useful since this system is implemented using GUI (Graphical User Interface), thus making the system easier to operate. This work is better from previous because by using proposed method user can easily classify the type of hemorrhage. Thus as per result, it is clear that proposed method is best suitable for ICH and SDH type of hemorrhages. This system is able to detect hemorrhage as well as its type and it is easy to operate.

REFERENCES

[1] Dr. Vinay J. Nagalkar, Dr. Gajanan G. Sarate [2019] Quantification and Identification of Ischemic Stroke using SVM. IJRAR June 2019.

[2] Dr. V. V. JayaRamakrishnanGanesan, R., Radhakrishnan, S. [2009]. Segmentation of Computed Tomography Brain Images Using Genetic Algorithm. International Journal of Soft Computing, 4[4], 157- 161.

[3] C.Amutha Devi and Dr. S. P. Rajagopalan [2013] Brain Stroke Classification Based on Multilayer Perceptron Using Threshold Segment and Gabor Filter.Journal of Theoretical and Applied Information technology, ISSN:1992-8645.

[4] Mayank Chawla et. Al., A Method for Automatic Detection and Classification of Stroke from Brain CT Images. 31st Annual International Conference of the IEEE EMBS, Minneapolis, Minnesita, USA, Sepember2009.

[5] Mesut Togacar, ZaferComert and BurhanErgen**.** Brain Hemorrhage Detection based on Heat Maps, Auto encoder and CNNArchitecture.

[6] John Napier, Carl James Debono Paul Bezzina& Francis Zarb 978-1-5386-9301. A CAD System for Brain Hemorrhage Detection in Head CTScans.

[7] Nivedhita P. Shankar S. and Dhanlakshmi R. Detection of Brain Hemorrhageusing Decision Tree Classifier. (IJRTE) Sept2019.

[8] Mahmoud Ai-Ayyoub, DuaaAlawad, Khaldun-Al-Darabsah, and InadAljarrah, 2013. Automatic Detection and Classification of Brain Hemorrhages. WSEAS Transactions on Computers, E-ISSN: 2224- 2872, October2013.

[9] Ganesan, R., Radhakrishnan, s. [9] (2009) had proposed 'Segmentation of Computed Tomography Brain Images Using Genetic Algorithm'. International Journal of Soft Computing, 4[4],157-161.

[10] Liu et al. [2009]. Hemorrhage Slices Detection in Brain CT Images. In Pattern Recognition, 2008. ICPR 2008. 19th International Conference on. Tampa, FL 23 January 2009. IEEE.1-4.

[11] Myat Mon Kyaw, [2013]. Computer Aided Detection system For Hemorrhage Contained Region. International Journalof Computational Science and Information Technology (IJSCE),ISSN:2231-2307.