

IMAGE SEGMENTATION USING CLASSIFICATION OF RADIAL BASIS FUNCTION OF NEURAL NETWORK IN BRAIN TUMOR DETECTION

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ABSTRACT - The location of with tumors in the brain is one of the factors that determine how a brain tumor affects an individual's functioning and what symptoms the tumor causes. Along with the Spinal cord, the tumor forms the Central Nervous System (CNS). The brain tumor can occur at any stage. Image pre-processing techniques are used to improve the quality to an image before processing and sending into an application. The image processing techniques use a small neighborhood of a pixel in an input image to get a new brightness value in the output image. These pre-processing techniques are also called as separation and discerning enhancement. The algorithm incorporates steps for pre-processing, image segmentation, and feature extraction of the GLCM. The RBFN is a 3-layer network where the input vector is the first layer, the second "hidden" layer is the RBF neurons, and the third layer is the output layer containing linear combination neurons. Finally, using the segmentation technique and morphological operations tumorous region is isolated from an abnormal input image.

INTRODUCTION

The size can vary extensively. Real-time diagnosis of tumors by using more reliable algorithms has been the main focus of the latest developments in medical imaging and identification taking part in brain tumor using MRI images. The segmentation of the cells and their nuclei from the rest of the image content is one of the main problems faced by most of the medical imagery diagnosis systems. The process of determining in most powerful and diagnosis segmentation. Image Segmentation is performed on the input images.

A. Operations and Types of Tumor:

3D appearance segmentation aids in the automated diagnosis of brain diseases and helps in qualitative and quantitative analysis of images such as measuring accurate size and volume of the detected portion.

B. Tumor:

An enlargement part of the body, generally without inflammation, caused by an unusual development of fleshy tissue, whether nonthreatening or malignant.

C. Types of Tumor:

There are three types of tumor:

1) Benign; 2) Pre- Malignant; 3) Malignant.

1) Benign Tumor:

A benign tumor is a tumor is the one that does not develop in an unexpected way; it doesn't affect its neighboring healthy tissues and also does not enlarge to non-neighboring tissues. The secret agent is the common example of benign tumors.

2) Pre-Malignant Tumor:

It is also a precancerous stage, imitated as a disease, if not precisely treated it may lead to the tumor.

3) Malignant Tumor:

Malignant is fundamentally a medical word that defines a severe progressing disease. The malignant tumor is a term which is normally used for the description of cancer. The Magnetic Resonance Imaging (MRI) is to view the internal structures of the body in element particularly for imaging soft tissues and it does not use any particle emission. The major problem in image segmentation is the inaccurate diagnosis of the tumor region which gets reduced mainly due to the contrast, blur, noise, artifacts, and distortion. Even a small amount of noise can change the classification. (1)

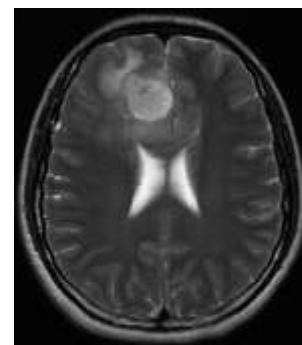


Fig.1 input MRI image

MATERIALS AND METHODS

In this phase, an image is improved in the way that finer details are enhanced and noise is uninvolved from the image. Most commonly used enhancement and noise reduction techniques are applied that can give the best possible results. Development of result in more prominent edges and a perfected image is developed, a noise will be concentrated on the distorting effect of the image.

The Magnetic Resonance Imaging (MRI) is to view the internal structures of the body in detail exclusively for imaging soft tissue and it does not use any radioactivity. The brain tumor is an abnormal growth of tissues in the brain and is mainly caused by radiation to the head, genetic risk, HIV infection, cigarette smoking and also due to environmental toxins. The major problem in image segmentation is the inaccurate diagnosis of the tumor region which gets reduced mainly due to the contrast. (6)

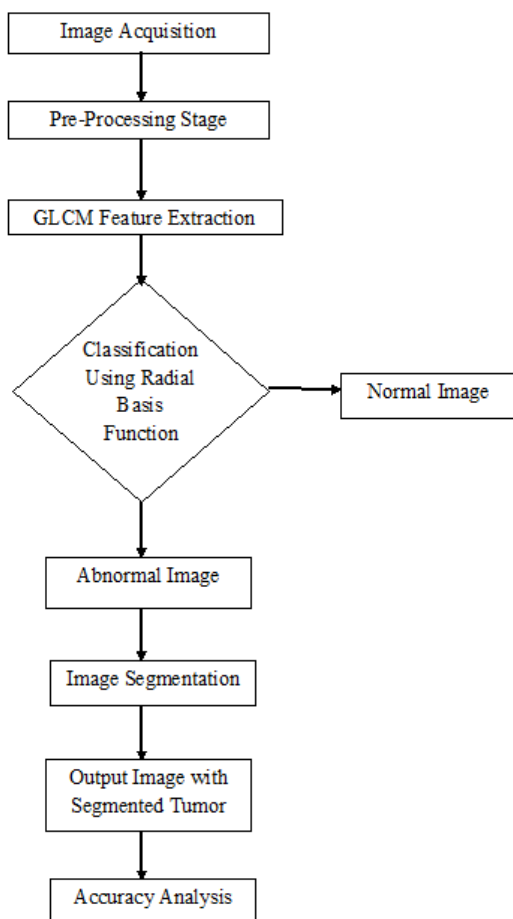


Fig 2 Flow chart of Proposed Methodology

A. Image Acquisition

Images are obtained using MRI scan & displayed in 2D having pixels as its elements. MRI scan was stored in a database of images in JPEG image formats. These images are displayed as grayscale images. The entries of grayscale images are ranging from 0 to 255, where 0 point to total black color and 255 signifies the whole white color.

B. Pre-Processing Stage

The sum of contrast augmentation for some greatness is directly proportional to the slope of the Cumulative Distribution Function (CDF).

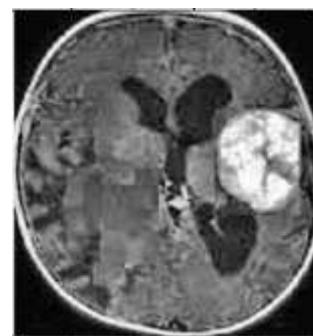


Fig 3 Filtered Images

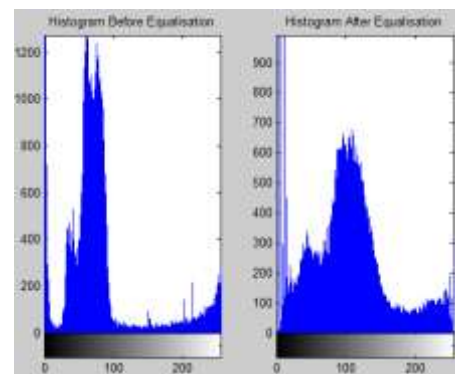


Fig 4 Adaptive Histogram Equalization

C. Extraction of Texture Feature

Gray-level co-occurrence matrix (GLCM) is the Statistical method of investigating the textures that consider the spatial relationship of the pixels. The GLCM functions characterize the texture of an image by calculating how frequently pairs of a pixel with specific values and in a specified spatial relationship that present in an image, forms GLCM. It is the most broadly used and more generally applied method because of its high accuracy and less computation time. Let N_h be the total number of pairs, then $C_{ij} = c_{ij}/N_h$ is the elements of normalized GLCM.

Texture feature extraction by using GLCM

It even provides a contrast between malignant and normal tissue, which may be below the threshold of human perception. The statistical features of MR images are obtained using Gray Level Co-occurrence Matrix (GLCM), which is also known as Gray Level Spatial Dependence Matrix (GLSDM). GLCM, introduced by Haralick is a statistical approach that can well describe the longitudinal connection between pixels of dissimilar gray intensities. GLCM is a two-dimensional histogram in which (i, j) the element is the frequency of event I that occurs with j.

D) Classification using RBF

The next step in the proposed system is to classify and train the extracted signal. We use the RBF network as described in the below Figure 3 to train and test the signals of MRI. Learning is of 2 stages: using two methods such as unsupervised methods, supervised methods¹⁴. The basic RBF is of the three-layer network, as shown in Figure 3.

The main features of RBF are as follows and shown in the above Figure 3. They are 2 layer feed forward network. RBF consists of a set of the hidden layer. MLP is used to implement the output nodes. It covers even smaller regions also. It is much faster than BPN since it has 2 stages of learning. The different learning algorithms are:

The architecture of the Radial Basis Function Network

RBF has wide-ranging research importance because they are world-wide approaches, fast learning speed due to locally tuned neurons and they have compressed topology than other neural networks. Radial basis function network is used for a wide range of applications primarily because it can approximate any regular function and its training speed is faster than multi-layer perceptron (MLP). The architecture of the RBF network is given below.

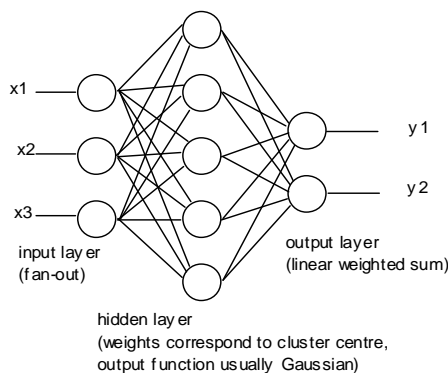


Fig 4 Architecture of RBF

However, if pattern classification is required, then a hard-limiter or sigmoid perform can be placed on

the output neurons to convey 0/1 output values and also the cluster. The single feature of the RBF network is the process performed in the out of sight layer. Furthermore, this distance measure is made non-linear, so that if a design an area that is close by to a cluster interior it gives a value close to 1. Then the Gaussian operate most typically used radial-basis operate may be a Gaussian operate. In associate degree RBF network, r is the distance from the cluster center. The equation represents a Gaussian bell-shaped curve.

The distance measured from the cluster center is usually the Euclidean distance. For each neuron in the hidden layer, the weights represent the coordinates of the center of the cluster. The root-mean-square distance between the current cluster center and its P nearest neighbors is calculated, and this is the value chosen for. So, if the current cluster center is c_j, the value consider.

Advantages/Disadvantages

- RBF trains faster than an MLP
- It is slower than an MLP, so wherever speediness is a factor an MLP may be more applicable.



Fig 5 The Given Image is Abnormal

E) Image Segmentation

Image segmentation can partition the brain imaging scan image into multiple segments (sets of pixels, conjointly called super pixels). One of the simplest methods is that of histogramming and Thresholding. If we plot the Number of pixels which have a specific grey value versus that value, we create the histogram of the image. Properly normalized, the histogram is essentially the probability density function of the grey values of the image. Assume that we have an image consisting of a bright object on a dark background and Assume that we want to extract the object. For such an image, the histogram will have two Peaks and a valley between them. We can choose as the threshold then the grey value which corresponds to the valley of the histogram, indicated by t in figure 6.2a, and label all pixels with grey values greater than as object pixels and all pixels with grey values smaller than as background pixels.

Image segmentation is typically used to locate objects and boundaries (lines, curviest) in images is that

the method of allocating a label to each element in a picture such pixels with the similar label share assured visual physical characteristics. The result of image splitting up is a set of segments that mutually cover the entire image or a set of contours extracted from the image. The main difficulties in the edge recognition process are that the malignant cells near the spacious of the MRI are very fat, thus look like very dark on the MRI, which is very mystifying in the edge recognition process. To overcome the difficult, two steps were completed.

a. Histogram Equalization

Histogram equalization is used to enhance contrast. In some case were histogram equalization can very poor and then decreasing the contrast.

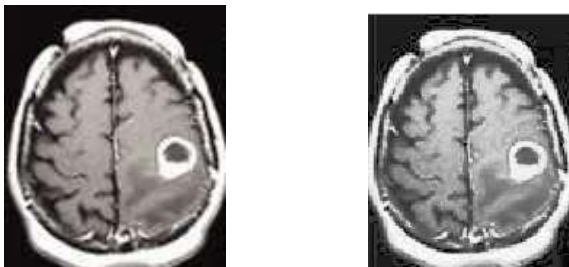


Fig 6: a) The original MRI b) Histogram Equalized MRI

b. Thresholding

Thresholding is the simplest method of image segmentation. From a grayscale image, Thresholding can be used to create binary images in many vision presentations, it is convenient to be ably isolated out the constituencies of the image.

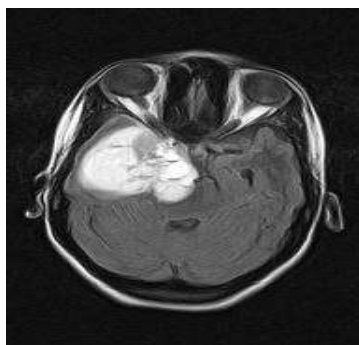


Fig 7: Original MRI Image

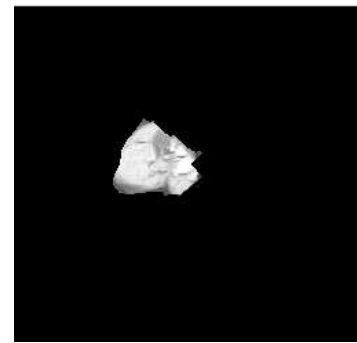


Fig 8: Threshold Segmented Image (White portion indicates tumor)

CONCLUSION

Finally, for the recommended system, the essential effect Image has to be chosen for determining better segmentation techniques. An effective database with high recognition has to be implemented. Early detection of the tumor will be useful to the patients for who are smaller tumors that are class 1 and class 2 tumors which can be cured easily.

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