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"An automated brain tumour detection and severity analysis using ANN"

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***Abstract*— A Brain Cancer is very serious disease causing deaths of many individuals. The detection and classification system must be available so that it can be diagnosed at early stages. Cancer classification has been one of the most challenging tasks in clinical diagnosis. At present cancer classification is done mainly by looking through the cells' morphological differences, which do not always give a clear distinction of cancer subtypes. Unfortunately, this may have a significant impact on the final outcome of whether a patient could be cured effectively or not. This paper deals with such a system which uses computer based procedures to detect tumour blocks and classify the type of tumour using Artificial Neural Network Algorithm for MRI images of different patients. Different image processing techniques such as image segmentation, image enhancement and feature extraction are used for detection of the brain tumour in the MRI images of the cancer affected patients.**

Detecting Brain tumour using Image Processing techniques involves four stages namely Image Pre-Processing, Image segmentation, Feature Extraction, and Classification. Image processing and neural network techniques are used to improve the performance of detecting and classifying brain tumour in MRI images. MRI scan images are taken for this project to process it.This work presents the artificial neural network approach. It is used to classify the type of tumor in MRI images. The whole system worked in two modes firstly Training/Learning mode and secondly Testing/Recognition mode finally gets a classified output.

This paper gives an overview of image segmentation technique based on Particle Swarm Optimization (PSO). PSO is one of the latest and emerging digital image segmentation techniques inspired from the nature. After segmentation features are extracted and submitted to a kernel support vector machine (KSVM).

***Index Terms*— Brain tumour detection, Artificial Neural Network, Magnetic Resonance Image.**

1. INTRODUCTION

The human body is made up of many organs and brain is the most critical and vital organ of them all. One of the common reasons for dysfunction of brain is brain tumour. A tumour is nothing but excess cells growing in an uncontrolled manner. Brain tumour cells grow in a way that they eventually take up all the nutrients meant for the healthy cells and tissues which results in brain failure. Currently, doctors locate the position and the area of brain tumour by looking at the MR Images of the brain of the patient manually. This results in inaccurate detection of the tumour and is also considered to be very time consuming.

A tumour is a mass of tissue that grows out of control of the normal forces that regulates growth (Pal and Pal,1993). Brain tumour s are abnormal and uncontrolled proliferations of cells. An inferior or metastatic brain tumour takes place when cancer cells extend to the brain from a primary cancer in a different component of the body

1.1 There are two common types of tumour :

[1] Benign tumour
[2] Malignant tumour

1.2 An artificial neural network (ANN): generally called neural network (NN), is a mathematical model or computational model that is inspired by the structure and/or functional aspects of biological neural networks. A neural network contains of an interconnected group of artificial neurons (processing element), working in unison to solve specific problems. ANNs, like people, learn by example.

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2.PRAPOSED SCHEME

In these project functional models of Artificial Neural Networks (ANNs) is proposed to aid existing diagnosis methods. ANNs are currently a "hot" research area in medicine, particularly in the fields of radiology, cardiology, and oncology. In this an attempt is made to make use of ANNs in the medical field One of the important goals of Artificial Neural Networks is the processing of information similar to human interaction actually neural network is used when there is a need for brain capabilities and machine idealistic. The advantages of neural network information processing arise from its ability to recognize and model nonlinear relationships between data. In biological systems, clustering of data and nonlinear relationships are more common than strict linear relationships .Conventional statistical methods can be used to model nonlinear relationships, but they require complex and extensive mathematical modelling. Neural networks provide a comparatively easier way to do the same type of analysis. Well design and training of Neural Network make it qualified for decision making operations when it faced with new data outside training data; this will provide ANNs with high reliability exactly like an expert person.

2.1 Image Processing :

Processing procedures fall into three broad categories: Image Restoration (Pre-processing); Image Enhancement; and Classification and Information Extraction. Image pre-processing and feature extraction techniques are mandatory for any image based applications. Pre-processing indicates that the same tissue type may have a different scale of signal intensities for different images. Pre-processing functions involve those operations that are normally required prior to the main data analysis . The pre-processed images will have some noise which should be removed for the further processing of the image. In this I convert the input image into grey image. After this stage the medical image is converted into standard image. The aim of pre-processing is improvement of the image data that enhances some images features important for further processing. Also it includes resizing of image data.

2.2 Image Segmentation:

Image Segmentation is concerned about segmenting the image into various segments using various techniques. In early days a semi-automatic approach was being used to detect the exact boundaries of the brain tumor. However the semiautomatic methods were not very successful as they had human induced errors and were time consuming. A better application of tumor detection was made by introducing fully automated tumor detection systems. Various methods have been proposed like Markov random fields method, Fuzzy c-means (FCM) clustering, Otsu's thresholding, K-Mean's, neural network. In this project, four different algorithms namely Otsu's method, Thresholding, K-means method and Fuzzy c-means and PSO have been used for designing the brain tumor extraction system. Various segmentation techniques which will be used in this project to segregate the different regions on the basis of interest are described as follows:

a) K-means: K-means is a clustering technique which aims to partition a set of observations so as to minimize the within cluster sum of squares (WCSS). The evaluating function for an image a (m, n) is given as:

$$c(i)=\text{Arg min}|mx_{y2}.nx_y^2|$$

Where i is the no. of clusters in which the image is to be partitioned.

b) Otsu's Method: Otsu's Method divides the image into two classes of regions namely foreground and background. The background and foreground regions are selected using the following weighted class variance:

$$\sigma 2=W1\sigma 2+W2\sigma 2$$

Where W1 and W2 are class variance for background and foreground region respectively.

c)Fuzzy-c-means: Fuzzy-c-means is also a clustering technique based on fuzzy logic to segment the image. Fuzzy clustering algorithms determine an optimal (fuzzy) partition of a given data set as follows:

$$A = \{ xj \mid j = 1\ldots..n\}$$

Where, A is the image and is partitioned into c clusters by minimizing the following objective function:

$$f = \sum_{m=1} \sum_{j=1} u_{mj} d_{mj}$$

Where, m and n are the rows and columns of the image.

d) Thresholding: It is a process of creating a black-and white image out of a grayscale image consisting of setting exactly those pixels to white whose value is above a given threshold, setting the other pixels to black.

$$a(m,n) = f(x) \begin{cases} 1 \text{ , object if } a(m,n) \geq 0 \\ 0 \text{ , background otherwise} \end{cases}$$

Different techniques listed above are used in this project

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are used for segmented the preprocessed image.

e) PSO : PSO is a heuristic global optimization method and also an optimization algorithm, based on swarm intelligence. The concept of PSO is originated from the behavior of particles of swarm and the social interaction between particles. While searching for the food, the birds get scattered or they move together to find the food is the nature of behavior. The birds search for the food from one place to another, the bird which is nearer to food can smell the food. The basic algorithm of PSO consists of n swarm particle, and the position of each of the particle stands for the potential solution.

2.3. Feature Extraction:

It can be done by using morphological analysis. Morphological Analysis: Morphological analysis is basically defined as the analysis of shapes and boundaries of object. Erosion, dilation, open and close are some of the morphological techniques that are used in the existing literature for extracting the required features from an image. In this project, feature extraction done using DWT .

2.4 Classification :

This is a 2D classification technique. Here, we treat the classification of MR brain images as a two class pattern classification problem. In every wavelet-coded MR image, we apply a classifier to determine whether it is normal or abnormal. The use of SVM involves training and testing the SVM . Training an SVM is the most essential part of the machine learning process. The standard training and testing sets are created.

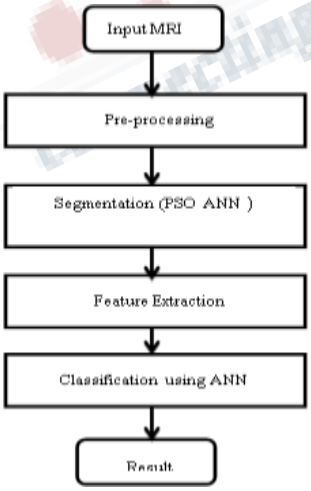

Figure 2.1 Flow diagram of proposed system

3. RESULTS:

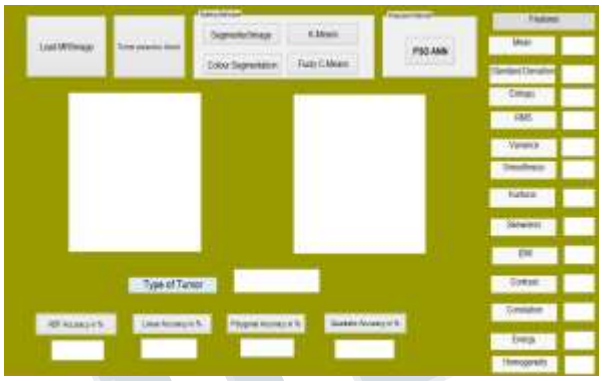

Figure 3.1 : Basic GUI of the System

Figure 3.2 : Input Image

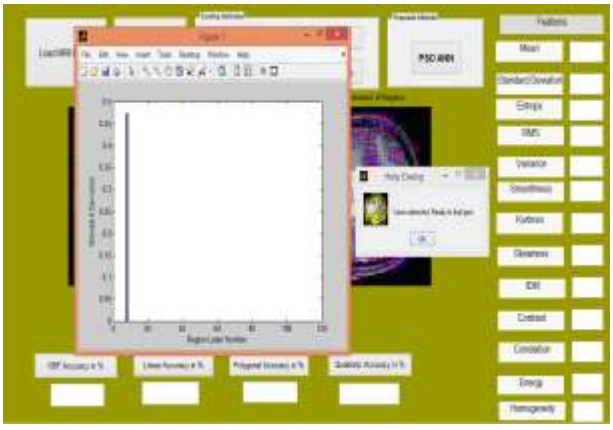

Figure 3.3 : Result 1

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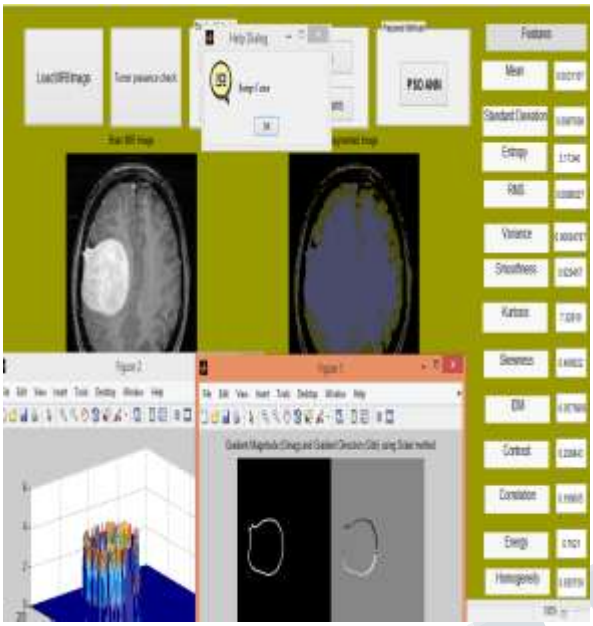

Figure 3.4 : Result 2

Figure 3.5 : Accuracy measure by praposed system

After implementation and getting the results, the results are evaluated.For a better view the results are presented in a tabular form.

4. CONCLUSION

Image processing has become a very important task in today's world. Today applications of image processing can be found in number of areas like medical, remote sensing, electronics and so on .If we focus on medical applications and image segmentation is widely used for diagnosis purpose. In this paper, we have proposed a system that can be used for segmentation of brain MR Images for detection and identification of brain tumor. There are different types of tumors available. They may be mass in the brain or malignant over the brain. The work mainly focused on the development of technique that could promptly and accurately diagnose brain tumour both in their early and advanced stages of growth using artificial neural network. This was not an easy task especially in poor quality images. This paper presents a fast, automatic and accurate method for segmenting brain tumors. The main objective of the paper is to develop a system which can accurately detect tumor from brain MR Image.

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