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Brain MR Image Segmentation for Tumor Detection using Artificial Neural

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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. Medical Image Processing is the fast growing and challenging field now days. Medical Image techniques are used for Medical diagnosis. Brain tumour is a serious life threatening disease. 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 tumor in MRI images.

Keywords: 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

Analogy to the Brain The exact workings of the human brain are still a mystery. Yet, some aspects of this amazing processor are known. In particular, the most basic element of the human brain is a specific type of cell which, unlike the rest of the body, doesn't appear to regenerate. Because this type of cell is the only part of the body that isn't slowly replaced, it is assumed that these cells are what provide us with our abilities to remember, think, and apply previous experiences to our every action.

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.

2. LITERATURE REVIEW

The literature shows the various methods for the detection of brain tumour. This method used an approach to detect brain tumour using four different methods namely Otsu, K-means, Fuzzy-c-Means and thresholding. The main objective of this paper is to develop a fully automated brain tumour detection system that can detect and extract tumour from MR Image of brain. This paper also gives the comparison between the algorithms presented [1].

This project 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 histogram equalization, image segmentation, image enhancement, morphological operations and feature extraction are used for detection of the brain tumour in the MRI images of the cancer affected patients[2]

This work has introduced one automatic brain tumour detection method to increase the
accuracy and yield and decrease the diagnosis time. Here, it is tried to give clear description from brain tissues using Multi-Layer Perception Network, energy, entropy, contrast and some other statistic features such as mean, median, variance and correlation. It is used from a feature selection method to reduce the feature space too. This method uses from neural network to do this classification.[3]

In this paper, a survey has been made on the applications of intelligent computing techniques for diagnostic sciences in biomedical image classification. This study gathers representative works that exhibit how AI is applied to the solution of very different problems related to different diagnostic science analysis. It also detects the methods of artificial intelligence that are used frequently together to solve the special problems of medicine. SVM neural network issued in almost all imaging modalities of medical image classification. Similarly fuzzy C means and improvements to it are important tool in segmentation of brain images. Various diagnostic studies like mammogram analysis, MRI brain analysis, bone and retinal analysis etc., using neural network approach result in use of back propagation network, probabilistic neural network, and extreme learning machine recurrently. Hybrid approach of GA and PSO are also commonly used for feature extraction and feature selection [4]

In this paper noise free image is given as a input to the k-means and tumour is extracted from the MRI image. And then segmentation using Fuzzy C means for accurate tumour shape extraction of malignant tumour and thresholding of output in feature extraction. Finally
approximate reasoning for calculating tumour shape and position calculation. The experimental results are compared with other algorithms.[5]

This paper presents an automated recognition system for MR imaging using ANNs. It was observed that when Elman network was used during the recognition process, the duration time and the accuracy level were high, compared with other ANNs systems.[6]

This paper reviewed the techniques of the MRI image enhancement in terms of tumour pixels detected. They studied several digital image processing methods and discussed its requirements and properties in brain tumour detection .This paper gives enhanced information about brain tumour detection and segmentation. The marked area is segmented and the assessment of this tool from the radiologist, whom the project is concerned with, is positive and this tool helps them in diagnosis, the treatment procedure and state of the tumour monitoring.[7]

This paper presents a automated recognition system for the MRI image using the neuro fuzzy logic. Features are extracted from raw images which are then fed to ANFIS (Artificial neural fuzzy inference system).ANFIS being neuro-fuzzy system harness power of both hence it proves to be a sophisticated framework for multi object classification. A comprehensive feature set and fuzzy rules are selected to classify an abnormal image to the corresponding tumour type.[8]

The system developed in this study classifies and identifies pathological tissues in a non
invasive and automated fashion. The designed brain tumour detection and classification system uses conceptually simple classification method using the neural network. Textures features are used in the training of the ANN. Co-occurrence matrices at different directions are calculated and GLCM features and Gabor features are extracted from the matrices.[9]

3. PROBLEM DEFINITION

In the existing system four different segmentation methods have been used for extracting the brain tumour from MRI. The algorithms presented in this are fully automatic in nature so that no human intervention is required for tumour extraction. A fully automated system for brain tumour detection using K-means, Fuzzy c-means, Otsu's method and thresholding. K-means is an effective segmentation method which aims to divide the image into a fixed number of clusters. Otsu's thresholding divides the image into two classes of regions namely foreground and background. Fuzzy c-means uses fuzzy logic by assigning membership values to each pixel. Thresholding works by defining a threshold and then testing various pixels of an image against the threshold.

4. PROPOSED 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.

5. SYSTEM ARCHITECTURE

5.1 Modules:

1. Image Preprocessing: As input for our system is MRI scanned image and it contain noise. So our first aim is to remove noise from input image. As explained in system flow we are using high pass filter for noise removal and pre-processing.

2. Segmentation; Region growing is a simple region-based image segmentation method. It is also classified as a pixel-based image segmentation method since it involves the selection of initial seed points.

3. Connected component labeling: After recognizing connected components of an image, every set of connected pixels having same gray-level values are assigned the same unique region label.

4. Tumour Identification: In this phase we are having dataset previously collected brain MRIs from which we are extracting features. Knowledge base is created for comparison.

5. Stage Identification: As in the previous step we have identified that patient is suffering from brain tumour it is also necessary to find in which stage it is. We are also training the network to find that if it is beaning or malignant.

5.2 Flow Diagram:

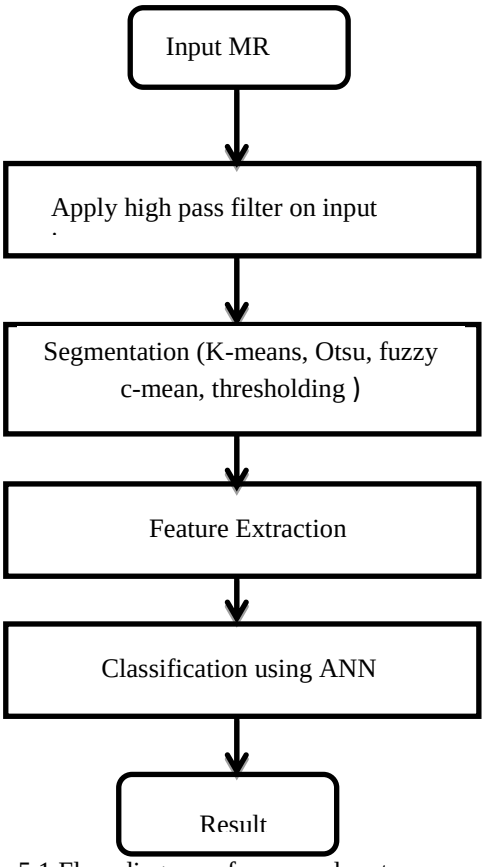

Figure 5.1 Flow diagram of proposed system

6. APPLICATION

A) NEUROLOGY:

MRI (Nuclear magnetic resonance imaging) is rapidly substituting CT as the best structural neuro imaging technique. MRI has also potential for the study of the biochemistry and physiology of the nervous system. In general the first clinical applications were mainly finding of space occupying lesions (expanses and tumours in brain, as well as brain infarcts, intracerebral and other intracranial haemorrhages).
MRI is much more sensitive than CT to be used in the analysis of tissue pathology; in evaluation of degenerative and atrophic processes.

B) ONCOLOGY:

The term oncology literally means a branch of science that deals with tumours and cancers. Oncology depends on diagnostic tools like imaging studies like X-rays, CT scanning, MRI scanning, ultrasound and other radiological techniques.

The field of medicine that is devoted to cancer. Clinical oncology consists of three primary disciplines: medical oncology (the treatment of cancer with medicine, including chemotherapy), surgical oncology (the surgical aspects of cancer including biopsy, staging, and surgical resection of tumours), and radiation oncology (the treatment of cancer with therapeutic radiation).

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