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Comparative Performance Analysis of Optimization Methods for Detection of Various Brain Tumors in MRI Images

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Abstract:
Automatic defects detection in MR images is very important in Medical Applications. The project presents the MRI\CT brain diagnosis approach for structure segmentation and its analysis using spatial fuzzy clustering algorithm. The method is proposed to automatically segment normal tissues such as White Matter, Gray Matter, Cerebrospinal Fluid and abnormal tissue like tumor part from MRI/CT images. These MRI brain images are often corrupted with Intensity In homogeneity artifacts cause unwanted intensity variation due to non- uniformity in RF coils and noise due to thermal vibrations of electrons and ions and movement of objects during acquisition which may affect the performance of image processing techniques used for brain image analysis. Due to this type of artifacts and noises, sometimes one type of normal tissue in MRI may be misclassified as other type of normal tissue and it leads to error during diagnosis. The proposed method consists of preprocessing using wrapping based curve let transform to remove noise and modified spatial fuzzy C Means segments normal tissues by considering spatial information because neighboring pixels are highly correlated and also construct initial membership matrix randomly. The system also uses to segment the tumor cells along with this morphological filtering will be used to remove background noises for smoothening of region. The project results will be presented as segmented tissues with parameter evaluation to show algorithm efficiency.

I. INTRODUCTION

According to Brain Tumor Research Organization in U.K., there are more than 120 types of Brain Tumors each of which are graded according to how aggressive they are. Lower-grade tumors are known as Benign (Non-Cancerous) and higher-grade tumors known as Malignant (Cancerous).Basically tumors are classified as primary tumor and secondary tumor. The tumor cell is present within skull and grows within skull is called primary tumor. Malignant tumors are primary tumors. The tumor presents outside the skull and enter into the skull region called secondary tumor. Metastatic tumors are examples of secondary tumors. The tumor takes up place in the skull and interferes with the normal functioning of the brain. Tumor shifts the brain towards skull and increases the pressure on the brain. Detection of the tumor in its early stage is the key of its cure. The chances of survival can be increased if the tumor is detected correctly at its early stage. A tumor is an intracranial solid neoplasm or abnormal growth of cells within the brain and lung or the central spinal canal. Tumor is one of the most Common and deadly diseases in the world. There are many different types of tumors that make the decision very complicated. So classification of tumor is very important. A good classification process leads to the right decision and provide good and right treatment. Treatment may differ for each type, and usually Brain contains more number of cells that are interconnected to one another different cells control different parts of the body. Some cells control the leg movement. likewise others cells of the brain controls other parts in the body .Tumors may have different types of symptoms ranging from headache to stroke, so symptoms will vary depending on tumor location . Brain tumor is one of the most dangerous diseases occurring commonly among human beings, so study of brain tumor is very crucial. We have proposed an image segmentation technique to identify the tumor from the brain magnetic resonance imaging (MRI). Several existing thresholding techniques have produced different result in each image. Thus, to produce a satisfactory result on brain tumor images, they have proposed a technique, where the detection of tumor was done uniquely. Different location of tumor causes different functioning disorder.

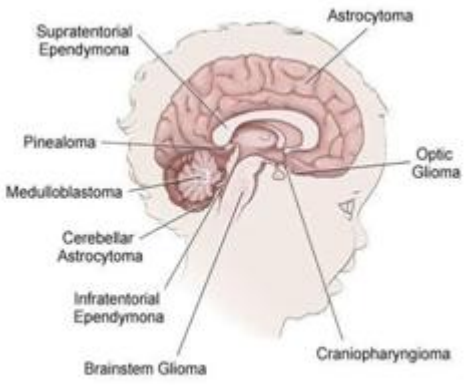


Figure.1. Location of Different Types of Tumors in the Brain
The general symptoms of tumor
1) Headache in early mornings.
2) Gradually loss of movement in leg.
3) Loss of sensation in arm.
4) Loss of vision in one or both eyes.
5) Speech difficulty.
It is very essential to diagnose tumors in the soft tissue of the brain. Magnetic resonance imaging (MRI) uses a powerful tool,

which gives detail information of exquisite soft tissue, and anatomic of the brain. MRI provides an unparalleled view inside the human body. In MRI we can see detailed information extra ordinarily compared to any other scanning like X-ray, CT scan. The contrast of tumor cell is high compared to normal brain cell.

Treatments techniques for the tumor are,

1) Surgery
2) Radiation therapy
3) Chemotherapy

In the surgery process doctor remove as many as tumor cells from the brain. Radiotherapy is the common treatment used for tumors, the beta rays or gamma rays are passed into the brain and applied on the tumor and kill tumor cells. Chemotherapy is another way of treatment for brain cancer. In this we use medicine which controls the tumor cells to reach blood and blood barriers. In chemotherapy the medicine stops the growth of tumor cells, in chemotherapy treatment the patients face significant side effects. The proposed system is an efficient system for detection of tumor and classification for given MRI images .The method of detection and classification work is carried out during the process explained in the coming section. This method is developed in Matlab simulation environment in order to check for applicability of proposed method.

II. RELATED WORK

The project is processed on tumor MR images and CT for detection and Classification on different types of tumors. We are going to use image processing techniques like histogram equalization, image adjustment, and image segmentation for Detection of tumor. Fig. 1 explains flow of tumor detection and classification

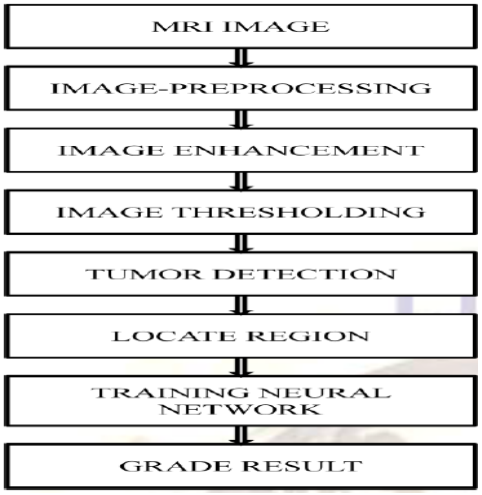


Figure.2.Flow for tumor detection and Classification

The first step in my project is to extract tumor from MRI image. We are going to use various functions one by one for the detection of tumor from MR image .Generally the MR images are very dark in nature it is difficult to extract tumor from MR image. The fundamental enhancement is needed. First function is pre-processing of MR image. In this pre-processing color MR image is converted to gray color MR image. In gray scale image it is easy to identify properties of an image. The pixel values vary from 0 to 255 range in gray scale image .Next step is image enhancement, by using this technique we can increase contrast of the whole image .Histogram equalization technique is used for image enhancements, and image adjustment is also another image enhancement technique, it adjust intensity values of an image. Generally the intensity value of tumor cell is higher than normal brain cell .Tumor looks brighter in the MR image. There is contrast difference between whole brain and tumor but human eye can't find the difference. Thresholding is the simple method of image segmentation. Segmentation sub divides an image into sub parts .In this paper our main aim is to separate tumor from the background. Segmentation sub divides an image into sub parts this process is continuous until the edges of the tumor get detected. In this paper segmentation is done by the single parameter i.e. intensity thresholding. The intensity value of tumor is higher than normal brain. So, this technique is best suited for the project to detect the tumor from background. The threshold value is compared with each and every pixel of MR image. If the threshold value is greater than pixel value of an image then remove that pixel from an image. If the threshold value is lower than pixel value of an image then that will remain as it is (i.e. not removed from the image). After thresholding we get binary image since the MI image has only two values binary '0'(0),binary value'1'(255).The pixel whose values is greater than threshold value those pixel values set to binary value'1'(255),remaining set as binary '0'(0).The output image is tumor with dark background.

III. TUMOR CLASSIFICATION

The various tumor detection approaches are classified into 4 categories. These are as follows: 1) Thresholding approaches, 2) Region growing approaches, 3) Genetic Algorithm approaches, 4) Neural network approaches. Several authors suggested various algorithms for segmentation.

A suitable artificial neural network classifier is designed here to identify the different grades of tumors. Artificial neural networks are composed of simple elements operated in parallel. These elements are inspired from biological nervous system. Each element in a network is called neuron. The sum of multiplication of weights and inputs plus bias at the node is positive then only output elements fires. Fire means it discharges energy to next element. Otherwise it doesn't fire. The artificial neural network is an adaptive system. Adaptive means system parameters are changed during the operation. The system parameter is nothing but weights. Two layer feed forward neural network is taken by us. The two layer feed forward neural network consists of one input layer and one output layer and one hidden layer,. In the hidden layer 10 nodes are taken. The two layer feed forward network with two log sigmoid functions are more widely used in classification, pattern recognition .It gives better results in these classification. The neural network system is designed in two phases.

1) Learning/Training
2) Recognize/Testing

There are four steps in training process

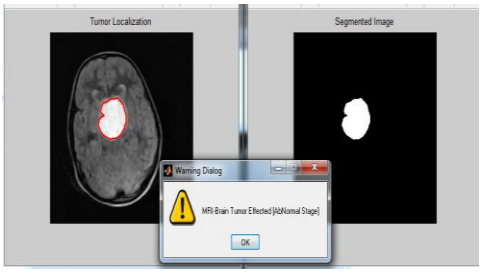
1) Assemble the training data
2) Create the two layer feed forward network
3) Training the network
4) Simulate the network

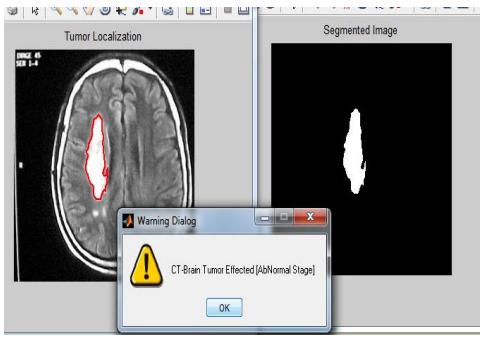
The known samples are applied to the two layer feed forward neural network is trained with back propagation algorithm Training/Learning means changing the weights of the network. Change the weights until it gives the proper output. After training the neural network, the network parameters are fixed. In

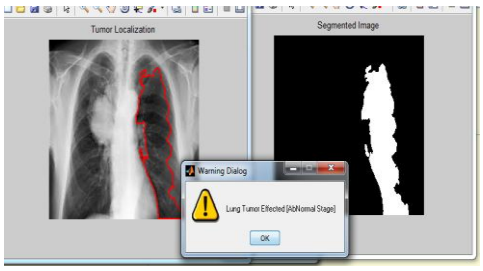
this paper we trained the neural network with 36 MRI tumor samples. Total four classifications are in the tumors .Each of 9 samples for four different classes. Total 36 input MRI tumor samples are trained to neural network through back propagation learning/training. Train the neural network until it gives proper output. In the second stage i.e. in recognize/testing the unknown samples are applied to the trained network. The trained network compares the unknown sample with the all trained input samples and classifies the unknown sample based on trained input samples. In this paper totally four tumor grades exist. Take different known MRI and CT samples for different grades and apply to trained neural network and check whether it is working properly or not. The proposed method gives correct output for the known samples and then it is tested for the unknown samples. The proposed method has given better performance in this paper.

IV. EVOLUTION

The proposed system efficiently classifies the MRI /CT tumor images. The tumor is isolated from the MRI brain images by using above mentioned techniques/ methods. The Classification of MRI /CT tumor images are also successfully implemented by using artificial neural networks. The proposed system efficiently classifies the tumor MRI images into different grades.







V.CONCLUSION

In this paper the tumor detection and classification is successfully implemented by a novel algorithm for Tumor Classification is presented. This new method is a combination of Dual tree wavelet Transform and convolution Neural Network along with the implementation of GLCM. By using these algorithms an efficient Tumor Classification method was constructed with maximum recognition rate Simulation results using Tumor database demonstrated the ability of the proposed method for optimal feature extraction and efficient Tumor classification. The ability of our proposed Tumor Classification method is demonstrated on the basis of obtained results on Tumor image database. On other Tumor image databases the other combinations are there for training and test samples.

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