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BRAIN TUMOR DETECTION USING IMAGE PROCESSING

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ABSTRACT

Brain tumor detection and classification is that the most troublesome and tedious task within the space of medicative image getting ready. Magnetic resonance imaging (Magnetic Resonance Imaging) may be a medicative procedure, typically adopted by the medical specialist for illustration of inner structure of the build with no surgery. Magnetic resonance imaging provides long information concerning the human delicate tissue, that helps within the conclusion of brain tumour . Precise segmentation of magnetic resonance imaging image is basic for the conclusion of brain tumour by laptop supported clinical device. This paper is concentrated towards the look of Associate in Nursing best and additional correct approach for the detection of neoplasm from brain magnetic resonance imaging scans and if it confirms the presence of tumor then it's focused on evaluating its stage, i.e., benign or malignant. We've through an experiment shown that our projected methodology features a larger accuracy than different existent strategies for classifying tumor kind to be either as Malignant or Benign.

Keywords: *Image Segmentation, Support Vector Machine, Self-Organized Mapping, MRI.*

1. INTRODUCTION

This project proposes two different methodologies to segment a tumor from an MRI image and determine the type of tumor. For this one segmentation and one clustering techniques have been implemented. Each MRI image is passed through an imaging chain where the image is preprocessed to remove noise and is further enhanced to improve the contrast of the image. This paper proposes two different techniques which are then applied on the image to extract the tumor. These segmentation techniques include SOM Clustering and SVM Classification. Applying each of the segmentation techniques allows us to determine the most appropriate method to segment the tumor from each of the images. The tumor region represents the pixel values for the foreground points extracted using the ginput() command from a texture image. The texture image is generated by applying the rangefilt() method. In order to enhance the texture characteristics of the image, smoothing filter is applied to the texture image. In this project, the major challenge faced was to locate and extract the proper tumor region from the image. Due to several lighting issues, unnecessary white portions were present in the image which could wrongly be segmented as a tumor. Also the unwanted noise and reduced contrast displays several regions from the image that are falsely claimed as a tumor. Another challenge faced was degraded quality of the MRI image due to several problems that would have occurred during the acquisition stage.

2. LITRATURE SURVEY

Swapnil R.Telrandhe, et.al [11] Proposed tumor detection inside which Segmentation separates an image into parts of regions or objects. In this it has to segment the item from the background to browse the image properly and classify the content of the image strictly. During this framework, edge detection is a vital tool for image segmentation. In this paper their effort was made to study the performance of most commonly used edge detection techniques for image segmentation and additionally the comparison of these techniques was carried out with an experiment.

Malathi Hong-Long et.al [12] , proposed approach by desegregation wave entropy based mostly spider net plots and probabilistic neural network for the classification of Brain MRI. Proposed technique uses two steps for classification one is wavelet entropy based mostly spider net plot for feature withdrawal and probabilistic neural network for

classification. The obtained brain magnetic resonance image, the feature extraction was done by wavelet remodel and its entropy worth was calculated and spider net plot space calculation was done. With the assistance of entropy worth classification of probabilistic neural network was calculated. Probabilistic neural network provides a general resolution for pattern classification.

Rajeshwari G tayade et.al [13], in their paper they gave a mixture of wavelet statistical features and co-occurrence wavelet texture feature obtained from two level distinct riffle remodel was used for the organization of abnormal brain matters in to benign and malignant. The planned system was consists of four stages: segmentation of region of interest, separate ripple disintegration, feature abstraction, feature choice, organization and analysis. The support vector machine was used for tumor segmentation. A grouping of WST and WCT was used for feature extraction of neoplasm region extracted from second level separate ripple remodel. Genetic algorithm was used to choose the best texture options from the set of well-mined options.

The probabilistic neural network was used to classify abnormal brain tissue in to benign and malignant and also the performance analysis was done by scrutening the classification results of PNN with alternative neural network classifier Lukas Let.al [14], proposed the work on information among the medical image and thereby vastly improve upon the machine speed for growth segmentation results. Significant feature points primarily based approach for primary brain tumour segmentation was planned. Axial slices of weighted Brain pictures with distinction improvement are analyzed. So as to extract vital feature points within the image, applied a feature purpose extraction rule based on a fusion of edge maps exploitation morphological and wave ways. Analysis of feature points so obtained has been done by geometric transformations and image scaling. A region growing algorithmic program was then utilized to isolate the tumor region. Preliminary results show that our approach has achieved good segmentation results. Also this approach was reduces a large quantity of calculation. Future work can involve associate investigation of the strategy in automatic 3D neoplasm segmentation, segmentation of ROI's in alternative medical pictures, still because the importance of enforced technique in medical image retrieval.

3. PROPOSED METHOD

In this project, we have described our objective in two parts, the first half deals with detection of brain tumor that is the presence of the tumor in the provided MRI. The other part that is the second part contains the classification of the tumor. Here, we will analyze the MRI images which will conclude the stage of the tumor as benign or malignant. In general the diagram for our process. The input images will undergo various stages which can be summarized as follows that are shown in the figure 1.

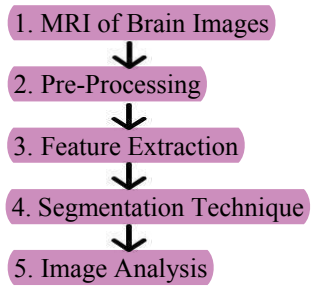


Figure 1: Brain tumor detection steps

3.1 MRI of Brain images

This is the first step of our proposed project .In this the data is been provided that is the magnetic resonance images(MRI) that are been collected in their original format's that are (.ima, .dcm). Mostly the mri images are of .dcm (DICOM[13]) Digital imaging and communications in medicine. We have used file operations fopen(), fclose() available in matlab to read MRI images. Here the gray scale MRI images are been provided as input to the system.

3.2 Pre-Processing

Pre-processing phase of our project mainly involves those operations that are ordinarily essential before the goal analysis and extraction of the required data and ordinarily geometric corrections of the initial image. These enhancements embrace correcting the information for irregularities and unwanted region noise, removal of non-brain element image and converting the data so that they are correctly reflected in the original image. The first step of pre-processing is the conversion of the given input MRI image into a suitable form on which further work can be performed.

This conversion of DICOM image to .jpeg is done by using function dicom2image()[7]. Major issues related to the pre-processing stage are as follows:-

a. Noise,
b. Blur Low Contrast,
c. The bias,
d. The partial-volume effect.

This pre-processing stage is used for reducing image noise, highlighting important portions, or displaying obvious portions of digital images.

3.2.1 De-noising method

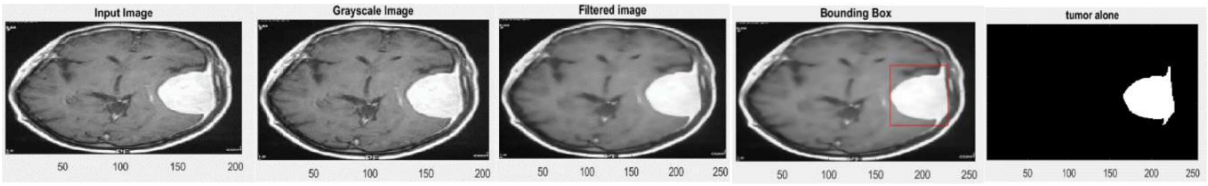
In spite of the presence of considerable variety of state of the art ways of de-noising however correct removal of noise from magnetic resonance imaging image is a challenge. Here, Wavelet based method is been used as a denoising. In frequency domain this method is used for de noising and preserving the actual signal. This builds the scaling coefficients freelance of the signal and therefore are often simply removed. We have used the Wavelet toolbox in matlab [8] and used lifting wavelet transform (LWT) [15] functions that are lwt2(), ilwt2(), lwtcoef2().By the help of these functions noise is been removed from the taken input that is the MRI image. These functions make it possible to recover weak signals from noise and the processed image in this way can be cleaned up without blurring or losing the clarity.

3.2.2 Images Enhancement and Filtering

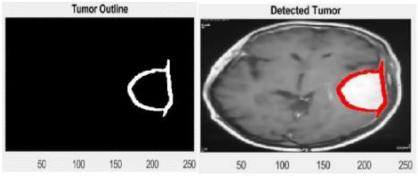
In this project image improvement that is the improvement of digital image quality with none of the data concerning the first supply image degradation. The enhancement of the image starts by first converting the gray scale image to black and white image this is done by the use of function im2bw(gray_image)[7].Here the threshold value taken in our project is 0.6.As Image improvement strategies improve the visual look of pictures from tomography and also the distinction enhancing brain volumes are linearly associated. For image sharpening the imsharpen()[7] is been used,similiarly imadjust()[7] for image adjustment, freqz() for setting frequency response of image are been used.The Gaussian smoothing operator is been for the two dimensional image convolution operators that is used to `blur' images and remove detail and noise.Gaussian is random incidence of white intensity worth and its intensity worth is drawn from Gaussian distribution, thus it is very much use to reduce Gaussian noise and as with linear filter it's computationally economical and enhances image quality with the image boundaries.for implementation of gaussian filter the imgaussfilt()[7] is been used in our project. Color areas,which indicate the colors in an exceedingly benchmark approach by employing a reference frame and a topological space within which every color is delineated by one point of the coordinate system. The colour spaces used in our image processing methods are Gray, Binary form and RGB.

3.3 Feature Extraction

In this phase the features of the given input image is been extracted . These features include smoothness, entropy, variance, kutosis, skewness, idm, correlation, homogeneity, mean and standard deviation . And on the basis of these features the image is analysed and the detection of the tumor region is been done. Below in the figure 2 there are output result of an mri image uptill the feature extraction phase of the project.



(a) (b) (c) (d) (e)



(f) (g)

Figure 2:- (a)Input image, (b)Grayscale image, (c)Filltered image, (d)Bounding box, (e)Tumor alone image, (f)Tumor outline, (g)Detected tumor.

3.4 Segmentation

By segmentation in this project means the method of partitioning a picture to many segments however the most difficulties in segmenting are associated with degree of pictures and pictures is also non-inheritable within the continuous domain like on X-ray film, or in distinct house as in MRI. In 2-D distinct pictures, the placement of every activity is termed an element and in 3-D pictures, it's referred to as a voxel. For simplicity, typically we use the term 'pixel' to see each the 2-D and 3-D cases.

When the constraint that regions be connected is removed, then determinant the sets referred to as pixel classification and also the sets themselves are called classes. Pixel classification instead of classical segmentation is usually a fascinating goal in medical pictures, significantly once disconnected regions happens to a similar tissue category ought to be known.

There square measure many kinds of phase action potential to segment a tumor from MRI of brain, those segmentation have several advantages and disadvantages. These advantage and disadvantage have delineated terribly fastidiously with output square measure describe here. There no such algorithms that forever manufacture excellent results for all variety of MRI of brain pictures. Though optimal selection of features, tissues, brain and non–brain elements are considered as main difficulties for brain image segmentation. Thus accurate segmentation over full field of view is another very much problem .To handle this problem we have used the most reliable methods of segmentations that are support vector machines and self-organized maps to determine weather there is tumor or not in the input MRI image and if it is there then classifying the type of tumor that being benign or malignant.

Support Vector Machine (SVM) approach is considered as a good candidate due to high generalization performance, especially when the dimension of the feature space is very high. The SVM uses the subsequent idea. It maps the input vector x into a high-dimensional feature house Z through some non-linear mapping, chosen a priori. SVM accepts, exploitation pictures as input, it give accuracy corresponding to neural-network with hand-designed options in an exceedingly handwriting recognition task. Those training points for which the equality in of the separating plane is satisfied those which wind up lying on one of the hyper planes(H1 , H2), and whose removal would change the solution found, are called Support Vectors (SVs) .A SVM classification to classify the brain into the neoplasm and non-tumor categories victimization T1-weighted and distinction increased T1-weighted pictures. Here in our project some of the functions that are been used for the implementation of svm are fitsvm()[7],crossval()[7],kfoldloss()[7] are been used.

The SVM methodology has the advantage of generalization and dealing in high dimensional feature area, it assumes that knowledge is independently and identically distributed that isn't acceptable for tasks like segmenting medical images with irregularity and noise then it should be combined with different strategies to think about abstraction of data and even have the benefits of such classifiers are that area unit they're freelance of the spatiality of the feature house with the results obtained square measure correct, although the training time is very high. In addition the matter of patient-specific learning and storage should be additional to the disadvantage of SVM-based strategies. We also see that SVMs do not consider the negative information which cannot learn the feedback well.

Self-organizing maps (SOM)[10] that is the another classification technique used in this project . It madeup of two layers first is the input layer and the number of neurons in this layer is equal to dimension of input and second is the competitive layer and each nerve cell in this layer corresponds to a category or pattern The number of neurons in this layer depends on the amount of clusters and is organized in regular geometric mesh structure. Each association from input layer to a nerve cell in competitive layer is appointed with a weight vector. The SOM functions in two steps, firstly finding the winning neuron i.e. the most similar nerve cell to input by a similarity issue like geometer distance, and second, change the burden of winning nerve cell and its neighbour pixels supported input.

SOM algorithms being an un supervised learning technique are highly rely on the training data representatives and the initialization of the connection weights. Secondly, they are terribly computationally costly since because the dimensions of the information is increasing, dimension reduction visual image techniques become additional vital, however sadly the time to calculate them conjointly increases. Self-organizing maps(SOM) is associate degree agglomeration network that maps inputs which may be high dimensional to two dimensional distinct lattice of neuron cell units. Input data is classified according to their grouping in input space and neighbouring neuron and moreover learns distribution and topology of input data.Some of the functions that are used from matlab library for the implementation of som are writeBlksomOffset()[7], readBlkSomOffset()[7]. For calculating that black and white similarity map, the more neighbors it use to calculate the distance the better similarity map we will get, but the number of distances the algorithm needs to compute increases exponentially.

3.5 Image Analysis

After the type of tumor is been identified the image analysis is been done to determine the accuracy of the result. Here in this project four type of accuracy are been shown that are Rbf accuracy, Linear accuracy, Polygonal accuracy and Quadratic accuracy. These accuracies help in analysis of the image result.

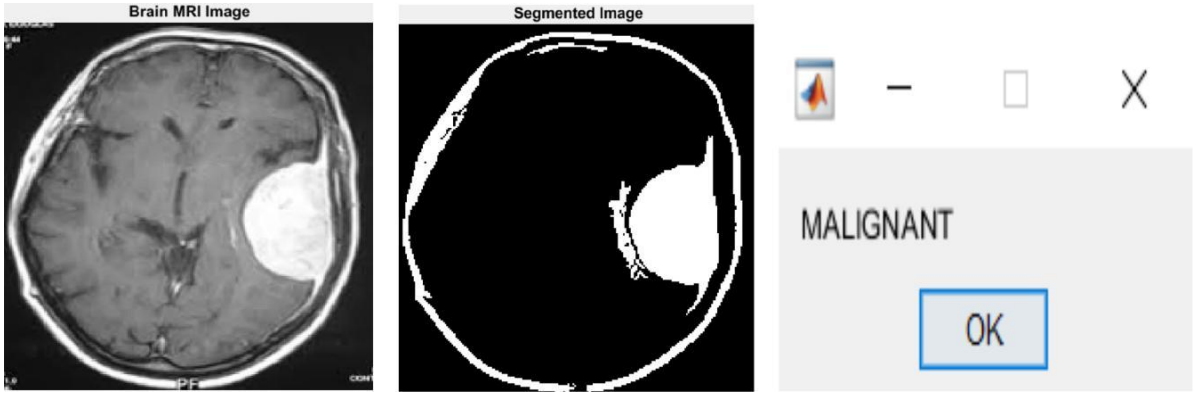


Figure 3:- Showing the result of the taken mri image and providing the classification of the type of tumor.

4. CONCLUSION

In this project we have automated the diagnosis procedure for the brain tumor detection by the use of image processing. Apart from several existing brain tumor segmentation and detection methodology are present for MRI of brain image our project has proved to provide an aver all accuracy by upto 97%. All the steps for detecting brain tumor that have been discussed startimg from mri image acquisition ,pre-processing steps to successfully classification of the tumor using the two segmentation techniques is been done.

Pre-processing involves operations like wavelet based methods has been discussed. Quality enhancement and filtering are important because edge sharpening, enhancement, noise removal and undesirable background removal are improved the image quality as well as the detection procedure. Among the different filtering technique, Gaussian filter suppressed the noise without blurring the edges and it is better outlier without reducing sharpness of the images. reduces the noise; enhance the image quality and computationally more efficient than other filtering methodology. After the image quality improvement and noise reduction discussed here, segmentation methodology for a brain tumor from MRI of brain image is been used. Classification based segmentation segment tumor accurately and manufacture sensible results for big information set however undesirable behaviours can occur in case wherever a category is unrepresented in training data. Clustered based segmentation performs is straight forward, quick and manufacture sensible results for non-noise image except for noise pictures it leads to serious inaccuracy within the segmentation . In neural network based segmentation perform better on noise field and no need of assumption of any fundamental data allocation but learning process is one of the great disadvantages of it. In spite of several dealing of problems, an automization of brain tumor segmentation using combination of threshold based and classification with SVM and SOM overcame the problems and gives effective and accurate results for brain tumor detection. These classification methods are able to firstly detect weather there is tumor or not and if it is there then they are able to determine weather the tumor is benign or malignant type.

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