

DETECTION OF BRAIN TUMOR USING MATLAB

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Abstract - Now-a-days Medical image processing is the most important challenging and emerging field. The image processing plays an important role in detecting various diseases of human body. Magnetic Resonance Imaging (MRI) is one of the dominant techniques for analyzing human body. This paper describes how to detect the brain tumor from the patient's MRI scanned images using the basic concepts of image processing like wavelet transform, principal component analysis (PCA), kernel support vector machine (KSVM). Here MATLAB software is used in the process of detection.

Key Words: Tumor, brain, DWT, PCA, KSVM, Magnetic resonance imaging (MRI).

1. INTRODUCTION

For the past few decades among the children and adults brain tumor is the major cause in decreasing the life span. Tumor is defined as the abnormal growth of the tissues and unwanted cells. These cells grow and multiply in an uncontrollable manner. There are different types of tumors in which some are non-cancerous also called as benign, and some are cancerous called as malignant. The medical analysis shows that brain tumors are the cause of one quarter of all cancer deaths in children.

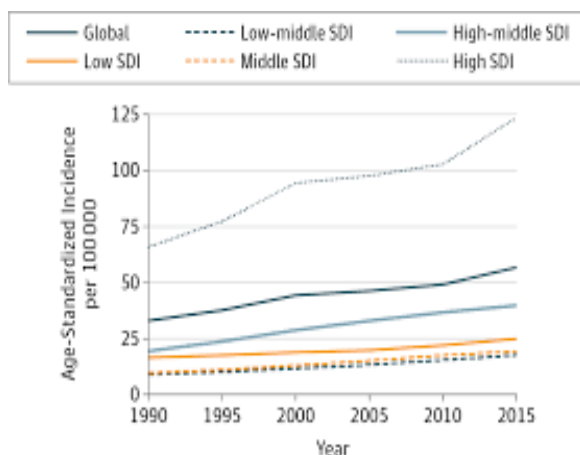


Fig: Graph of mortality rate

Magnetic Resonance Imaging (MRI) is an advanced and emerging medical imaging technique. For the classification of MRI images, we can use various methods. They are fuzzy methods, neural networks, atlas methods, and knowledge based techniques, shaped methods, and variation segmentation. The foremost steps in the analysis of images are pre-processing of MRI images, which also include image enhancement as well as noise reduction techniques. It is used to enhance the quality of image and feature reduction and classification is also done using principal component analysis and SVM's respectively.

Brain tumor diagnosis is done medically. There are many ways of diagnosing the brain tumor. Some of them are MRI scan, CT scan and biopsy of the head etc. The image of the brain is taken from various and different angles and combined together to produce the output. In MR image processing radio waves are used to detect and also to obtain digital images of tissues which are present in the brain.

In biopsy method a physical portion of the brain of the tumor present in the brain is detected under a microscope. There are different types of biopsy's. Some of them are open biopsy, needle biopsy etc.

Brain is the most vital part of the body and the center of human central nervous system. It is made up of nerve cells numbered approximately 50-100 billion forming a gigantic neural network that receive and transmit messages through nerves and control all the parts of our body. Each cell have their own special function.

Many of the cells in the body grow and divide to form a new cell for proper functioning of the human body. As brain is made up of many cells when the cells grow old and damaged cells die, new cells replaces them. Sometimes damaged cells don't die as they should and new cells grow when the body doesn't need them. It gives rise to extra cells which forms a mass of tissue called a tumor.

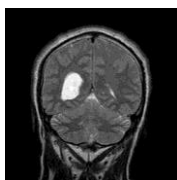


Fig: Benign tumor

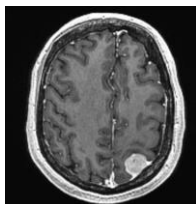


Fig: Malignant tumor

The process of growing abnormal tissues in any part of the brain is called a brain tumor. Broadly these tumors can be divided into benign and malignant tumors. Benign tumors do not spread quickly over the body as they grow slowly. But as they slowly increase in size they can cause pressure on the normal brain and interfere with mental and bodily functions. These tumors can be removed by surgical process and there is less chance of growing again. Malignant tumors grow faster than the benign tumors and it may spread all over the brain and it may also enter the spine. These tumors have a chance of reoccurring even after the removal of the tumor.

The detection of tumor takes a lot of time and tedious process manually. This problem can be overcome by processing the MRI images through MATLAB software by using efficient algorithms. In the image processing graphical user interface is used during the featuring of MRI images. Using the "guide" of MATLAB, we can have other methods of image processing running at the same time with image segmentation. Use of MATLAB GUIDE (GUI) helps with image segmentation and makes it easy to customize it to all different MRI image.

The major step and the most important task in image processing is segmentation. Its task is to extract the details from an image. The process of segmentation is used in various and different applications like in medical fields, computer aided operations. There are many types in the process of segmentation. They are boundary approach, edge based approach and region based approach. The above three techniques play a prominent role in the processing of an image. Initially the given MRI image is processed and converted into gray level image.

Proposed Methodology

In this paper the used version of MATLAB is R2017a. It consists of many advanced features.

Wavelet transform (WT) is a windowing technique which has variable size that preserves both time and frequency information of the signal. In the implementation of discrete

wavelet transform (DWT), dyadic scales and positions are used in the WT.

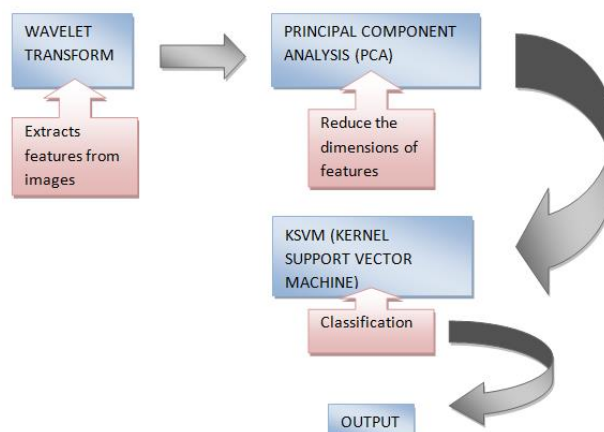


Fig: Block diagram of methodology

To eliminate the noise present in the image filtering method is used. When the image is converted into gray scale images some noise is added to the image. Thus it is essential to use filtering method to remove unwanted noise. The filtering method removes noises like salt and pepper noise. The image which acquired may have low contrast. So in order to increase the contrast of an image, enhancement techniques are applied on the image.

During the feature extraction storage memory and computation time increases which increases the complication of processing. So, it is necessary to reduce the number of features. To reduce the dimension of an image this is consisting of a large number of interrelated variables while retaining most of the variations. For this purpose principal component analysis (PCA) is used.

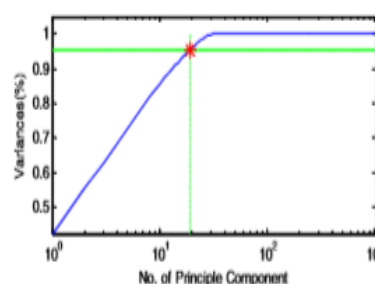


Fig. variances against no of principle components

Classification problem arises due to this feature reduction. In order to overcome this problem SVM's are used. In these days, there are many improved SVMs which have grown very rapidly, among them kernel support vector machine (KSVM) are the most popular and effective. Hence, in this paper the methodology uses kernel SVM.

In traditional SVMs to classify the image a hyper-plane is constructed which cannot deal with the different types of data which are located at different sides of the hyper-plane. So kernel concept is applied to the image processing. It has numerous advantages and they are as follows.

(1) Practiced in different fields and work very well which have been successful in the present era.

(2) Tunable parameters are very less.

(3) Training often involves convex quadratic optimization.

Result

Using the proposed methodology, code is written in the editor window of MATLAB software. After the code is run a display prompt appears. In the display window the selected MRI image is loaded from the dataset. Segmented image is shown on clicking the respective button.

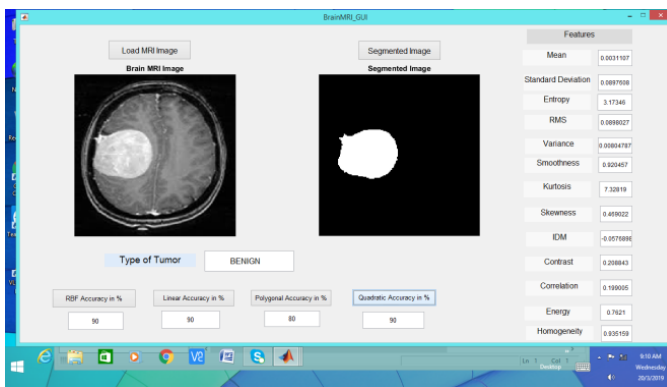


Fig: Output of the methodology

The final output is displayed as shown in the above fig. The features of the image are obtained and accuracy values are also shown.

3. CONCLUSIONS

Using the MATLAB software, normal and abnormal MRI brain images are distinguished and given the accurate result. With the addition of algorithms we can display the abnormality if there is any and the characteristics also. It has the future scope in the fields of image guided surgeries and 3D anatomical bodies. When there is no availability of doctor the tumor can be detected by human itself.

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