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Brain Tumor Detection using Haar Transform and PCA

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Abstract:
The digital image processing plays vital role in establishing digital system. The major applications of digital image processing are pattern identification, remote sensing, figure sharpening, color video transform and medical. Tumor detection is more concerned in recent days. This paper presents new approach to detect and classify tumors using MRI images. HAAR transform is used to extract features and principal component analysis is done. Later the network is trained through kernel Support vector machine. This network can be used to detect tumor in MRI images and help doctors. Malignant and benign tumors can be classified and detected with this approach.Classifier is used for calculating more accurate result from trained data set, but it's not used on liberated dataset. After applying of KSVM method on various kernels and calculate the accuracy of these kernels. By merging cross confirmation approach in it, we reduce the repletion of data.

Keywords: Image processing, Medical Image Processing, Tumor detection, segmentation, clustering, Magnetic resonance images

I. INTRODUCTION

Several image processing operations are done to extract helpful information and enhanced image. Currently, image processing has vast application in automation. Analog and digital are two types of processing used. Medical informatics is a leading part of medical image processing [1]. computer-aided diagnosis which is based on image and bio-signals are the challenging aspect of medical image processing. Simultaneously Different mobile health application is developed. We bring the root variations in medical image processing by using a medical image. Recently, instruments, disorders, healing applications that are based on imaging approaches and processing is an advanced area in medical image processing. The innovation of modern healthcare technologies is part of medical image processing.

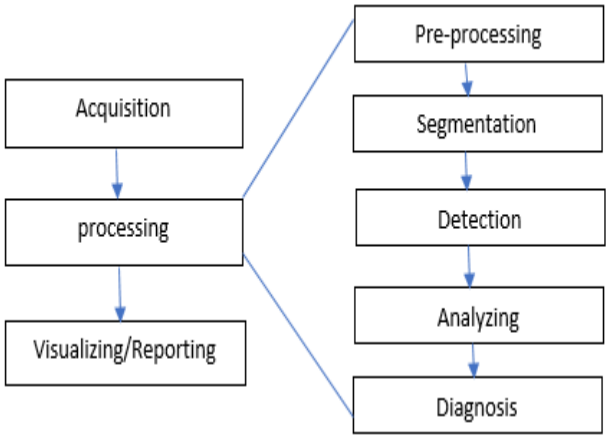

Figure.1. basic structure of medical image processing

The undisciplined growth of tissues is known as a tumor [2]. Halt of giving attention to the normal tissues that overgrow. There are three levels in tumor growth. They are cancerous, non-cancerous and pre-cancerous. Cancerous occur when the abnormal growth of cells will spread into nearby tissues. Non-cancerous tissues do not spread into other parts of the body, they can be removed and cured completely. Precancerous are odd cells that have chances to convert into tumors if not treated in early stage. Segmentation is used for clipping the complicated information from an image [3]. Various approaches are used for the segmentation of the image such as- K-Means clustering, self-organizing map, fuzzy-c-Means, neural network, Hierarchal SOM, morphology operations, watershed segmentation etc. To assume the tumor with high accuracy result is a most prevalent issue in tumor detection and segmentation clustering techniques are trendy used for image segmentation. Centroid of clusters provides the various segmentation results. We analyze figure that has some similarities using clustering algorithms. Mostly used clustering techniques are K-Means and fuzzy-c-Means approaches. It is used to dividing an image or data into a group of clusters and get the result.

II. LITERATURE SURVEY

T. Logeswani [5], proposed that the process of Segmentation that indicates part of an image into various regions. To detect Brain tumor from MRI is a meaningful task, but it absorbs more time in performing any operation. There are various methods used for it: Thresholding, character analysis, pattern matching, and region- growing methods. The explosion in an image will degrade the size of growing the regions and may give the fault edges. To abstract complicated information from magnetic resonance imaging used segmentation mechanism. Image segmentation mechanism is done by using thresholding, clustering, region – growing methods or vector continuation. Vector continuation with two ways: firstly, it trains the data according to the anticipation of input data and then encryption of data. SOM is one time of a clustering tool. It shows the two-stage approach of segmentation. In the First stage, it chooses the MRI image from the database. In this state it removes the tissues

amount and explosion. In the second stage, it detects the tissue architecture by using fuzzy based segmentation approach. It developed a fuzzy segmentation procedure to identify a brain tumor. The performance of the procedure depends on the vector, execution time and the pixels that are detected in the process. Composite approach enlarges the accuracy of related clubbed data and irrelated dataset for the clustering process. Y. Zhang [6], proposed a different approach that use of the categorized input MR image is ordinary or extraordinary. This approach implemented at three levels. In the first level, it is done with abstract component using wavelet transform pursue through principal component analysis (PCA). Here, the wavelet transform is used for abstract useful information from the image or dataset and principal component analysis used to decrease commotion from the image. A different stage analysis, decision on an image possible with the help of wavelet transforms. Then train with the help of Kernel support vector machine and express the output of an image. Classifier is used for calculating more accurate result from trained data set, but it's not used on liberated dataset. After applying of KSVM method on various kernels and calculate the accuracy of these kernels. By merging cross confirmation approach in it, we reduce the repletion of data. It compares their approach with other approaches and find the best results by making a combination of the discrete wavelet transform, principal component analysis, and kernel support vector machine. It will be used for doctors to detection of either the person is cancerous or non-cancerous. Swapnil R. Telrandhe [**7**] proposed that single MR image are not capable to detect the lump area. K-mean clustering method are worn for reprocessing of an image. Smoothing are used to decrease the intensity value of an image. Unsupervised learning with support vector machine can control and build the structure with flexible system. This is also used for discovering the characteristics of prepared SVM. The goal of this paper is to recognize the cancer area and its feature of the tumor. Thresholding also worn for tumor detection, but it's not able to give the exact location of the tumor in MR images. Hence, they used k-mean clustering approach pursues through the object mark. And reprocessing state is used to identify the lump in the brain. Reprocessing is done by applying smoothing, sharpening, alter and extract explosion of the images. This system includes four steps. In the first step it will perform reprocessing of an image, then it executes segmentation method. Use k-means clustering approach for part of an image. Thirdly, it will use item labeling and discover the elegant decision for identifying the cancer. In the final step it uses supervised learning method named support vector machine (SVM). It is established on idea of conclusion level and acquire the participation of different class. Training and testing process are done with the help of SVM. This method determines the segmented disease by applying MR images. It also examines the efficiency of detecting lumps. Identification of lump is done by applying angled, non-angled masks. The projected method is worn for segmentation and identification of tumor. Also discover the category of cancer. C.hemasundara [4] proposed that field of medical image processing is very demanding. By using the data of T1 and FLAIR MRI images build a more flexible segmentation. To integrate data of T1 and FLAIR MRI image they are worn conditional random field (CRF). Benefit of adopting CRF is complicated designs efficiently and examine the intensity function. Detection of cancer and achieve the approximate and significant inquiry are useful in medical care. Medical care of the patient is based on size of the tumor and time passed. This approach has three stages: primary segmentation, efficiency function of design and optimum intensity function. Fuzzy c-means method of energy characteristics is used by primary labeling (segmentation). It divides the image into pre-defined number of clusters (K). Then it describes the intensity function using primary segmentation. The energy function is shown as:

$$E(x,y) = \sum_{i} \phi_i(x_i) + \sum_{i,j \in \Omega} \phi_{i,j}(x_i, x_j, y)$$

Here, $\emptyset i(xi)$ is unitary potential, and $\emptyset i,j(xi,xj,y)$ is praise potential, and Ω is nearby pixel of i. Praise potential uses the 8-jointed neighboring pixels. When the higher potential value of the pixels, then we design the reverse of correspondence tween of neighboring pixels.

$$\phi_{i,j}(x_i, x_j, y) \propto \frac{1}{dist(x_i, x_j, y)}$$

Here, dist. define the normalized Euclidean distance. Compose graph depends on given below intensity function.

$$\phi_{i,j}(x_i, x_j, y) = \frac{1}{1 + exp(-(ln(dist(P_{FLAIR}, P_{T1}))) + w_0)}$$

We divide the graph in two sections for calculating the minimum intensity value. According to this projected approach it neither get any previous imagination of structure nor the volume of cancer area. It combines both the data exist in the T1 weighted, it will help to get better edges and thus increase its performance. Asra Aslam [8] projected that, image segmentation is used in various fields like medical, remote satellites, security reasons, sports etc. Segmentation of image further divides an image into small parts. Researchers developed new approach for edge detection approach in brain tumor MRI images. The edge identification technique is established on Sobel edge detection. This approach combines thresholding method and Sobel edge to discover the domains using closed contour method. The edge detection approach is flexible, so we can also use it for object detection.

The method has four steps:

1. Discover slope using Sobel operator.
2. Determine image threshold.
3. Then, implement closed contour algorithm on it.
4. Finally, object portion depends on pixels anxiety and closed contour.

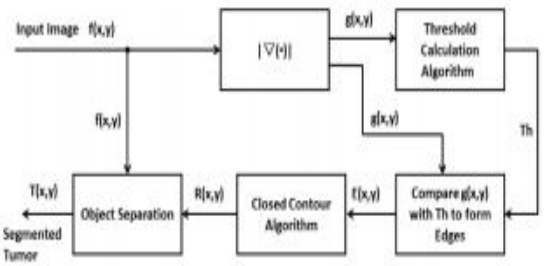

Figure.2. Description of proposed algorithm.

This proposed algorithm gives the less faulty edges and closed contours. It will give better results of abstracted tumor, then, the

Sobel edge operator. We used the closed contour approach to gain the region field and reduce the thickness of the border.

III. PROPOSED METHOD

Our proposed method consists three steps:

1. Preprocessing (includes feature extraction and feature reduction)
2. Training the kernel svm.
3. Submit the new MRI brains to the trained kernel svm and predict the output.

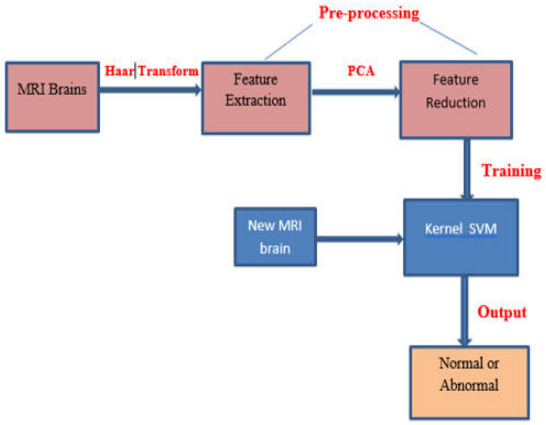

Figure.2. Methodology of our proposed approach.

pre-processing

Pre-processing includes two levels. First it will extract the features using the haar transform followed by gray-level co occurrence matrix. Then apply principal component analysis for remove the redundant data. Feature abstraction is a process that is used for extract meaningful information from the given input data and present extracted information in well manner. For feature abstraction from MR brain images wavelet transform is an effective tool. Haar – transformation have multi scale property for check out the images on various levels. [9] By applying the haar transform we get the more accurate boundaries of blob or tumor. Feature extraction will consume the performance time and storage space. PCA is used to decrease the dimension of the data set which consist enormous number of relevant variables efficiently, PCA is used. According to their importance order the new transformed data set is achieved.

Training

For train part we used the kernel support vector machine (KSVM). Kernel svm is the extended version of support vector machine. Support vector machine is type of supervised classification technique. Kernel are the functions that we used with svm as a dot product. Here, we implement linear kernel, polygonal kernel, RBF kernel and quadratic kernel. With the help of SVM have advantage of high accuracy. To avoid the overfitting of data, we used K-fold cross validation. It doesn't increase the classification accuracy, but it makes the decisive classification and it will conclude the liberated dataset. For training we used 500 images that were included 300 abnormal images and 200 normal brain images.

Testing

After the successful training process, we test the 30 images that that include 17 malignant tumors and 13 images was benign type. And calculate the average accuracy of four different kernels that was used in our project.

Proposed Algorithm

Step 1: Input image.
Step 2: Then convert RGB to grayscale.
Step 3: Apply Otsu binarization for Segmentation.
Step 4: Extract feature using Haar Transform.
Step 5: PCA used for reducing feature vector dimension.
Step 6: Then apply Train data on KSVM for classification.
Step 7: And get output as Benign or malignant.

IV. RESULT

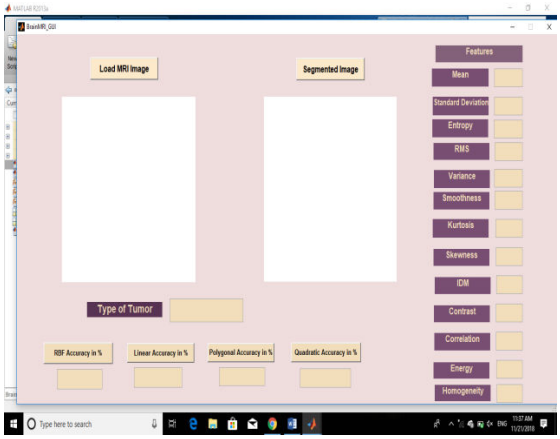

Figure.3. Gui of project work

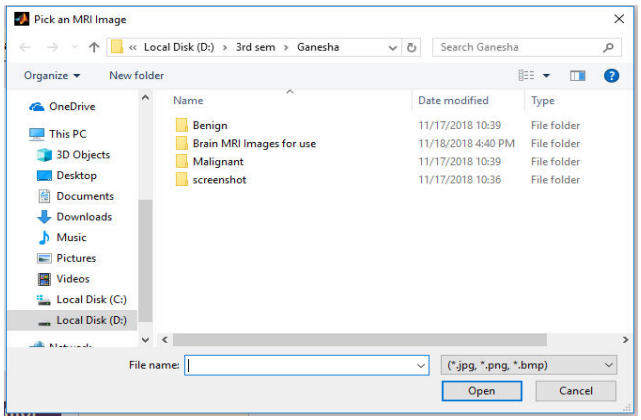

Figure.4. Open dialog box on click on the load mri image button.

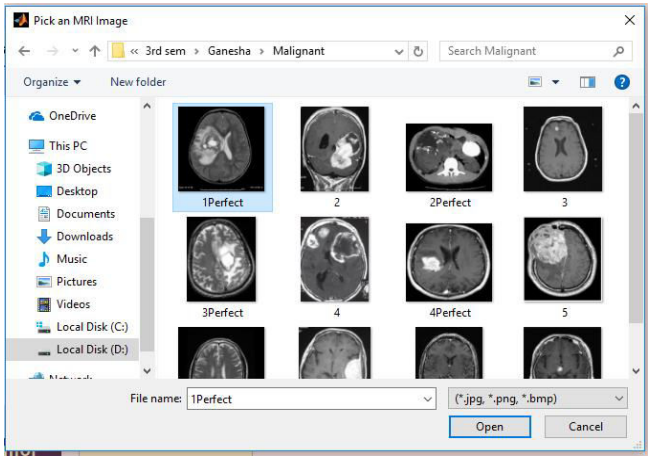

Figure.5. Select an input image.

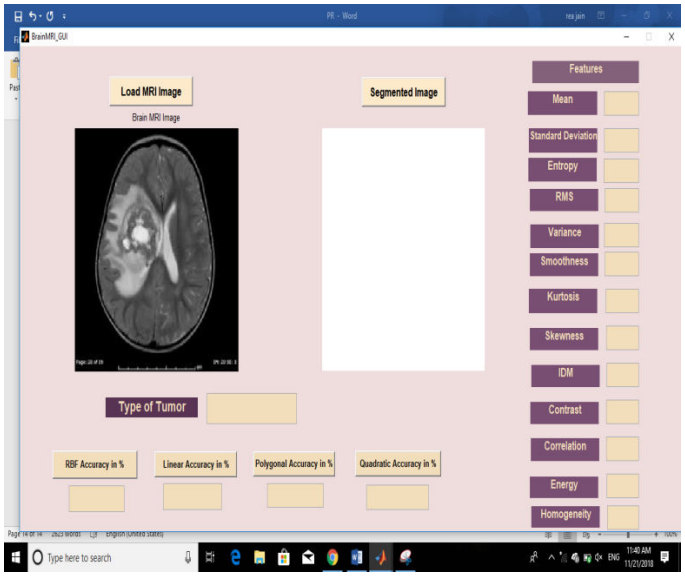

Figure.6. Load selected input image.

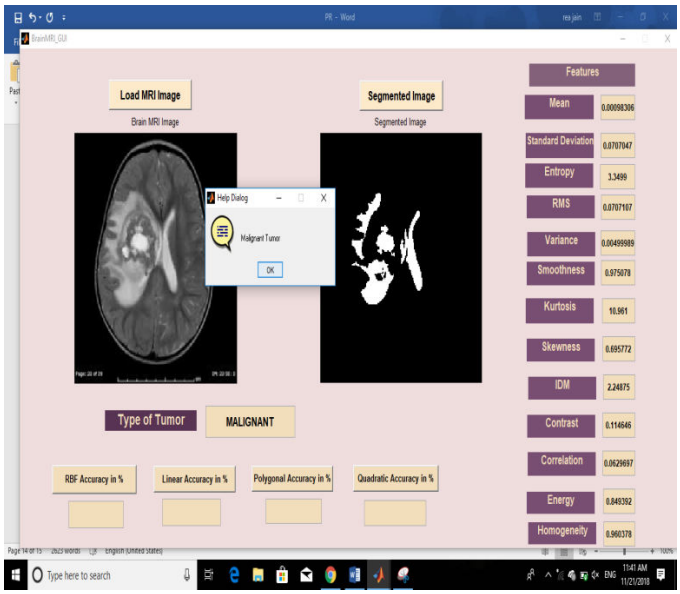

Figure.7. Result after click on segmented image button.

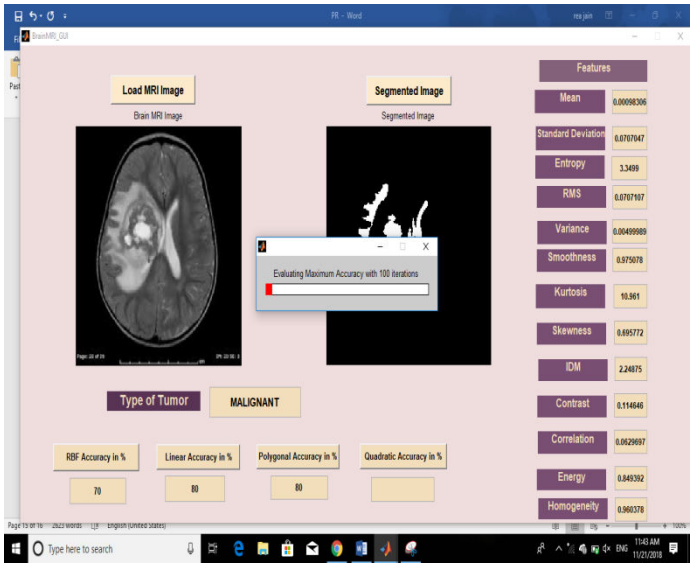

Figure.8.calculating accuracy of quadratic kernel.

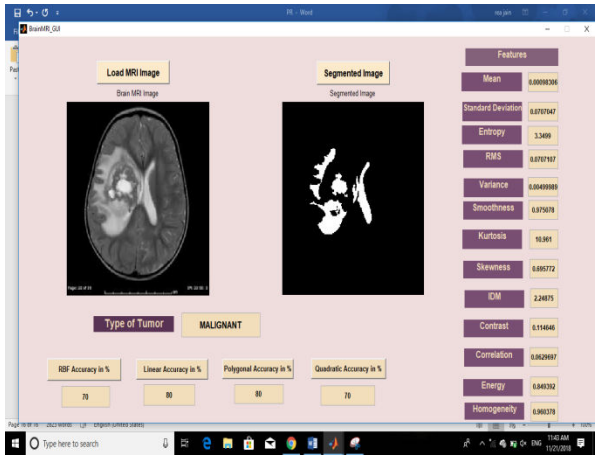

Figure.9. Result

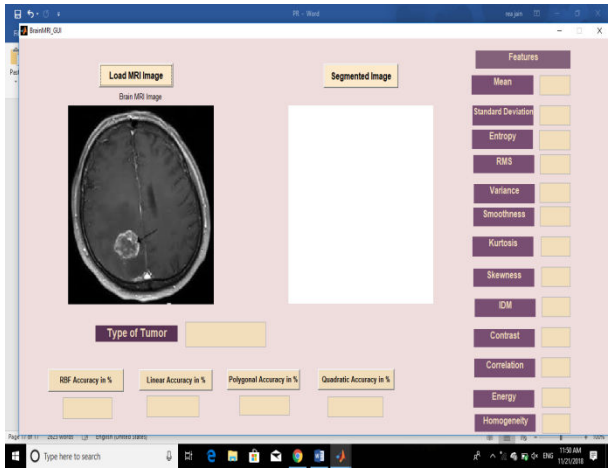

Figure.10. Load another mri image.

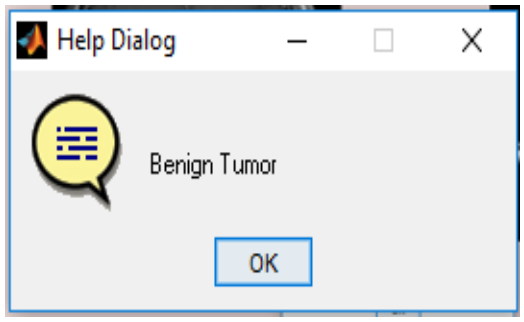

Figure.11. Dialog box showing tumor type.

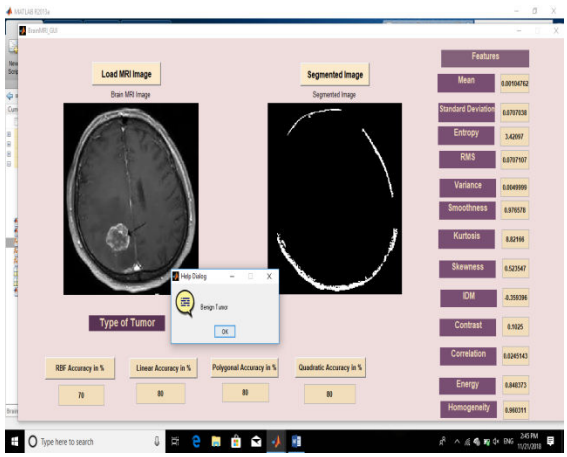

Figure.12. Result.

Tested Average accuracy of kernels

Table.1. average accuracy of various kernels.

RBF kernel	Linear kernel	Polygonal Kernel	Quadratic Kernel
80	90	75	80

IV. CONCLUSIONS AND DISCUSSIONS

Medical informatics is a leading part of medical image processing. Recently, instruments, disorders, healing applications that are based on imaging approaches and processing is an advanced area in medical image processing. The undisciplined rise of tissues is known as a tumor. Halt of giving attention to the normal tissues that overgrow. The growth of tumors has two levels, these are benign and malignant. We are proposing a novel method by using the combination of Haar, PCA and KSVM to distinguish between normal and abnormal MRIs of the brain. Haar wavelet is an effective tool for feature extraction from MRI brain images, because it allows the analysis of images at multi-scale. To remove the redundant data and increase the discriminative power, the principal component analysis is used. Linear kernel achieve the high classification accuracy. In future work we should focus on computation time could be accelerated by using advance wavelet transform such as the lift-up wavelet. Testing may be enhanced by using the T1-weighted images.

V. REFERENCES

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