BRAIN TUMOR DETECTION USING HELP OF SUPPORT VECTOR MACHINE CLASSIFIER

[1] MEERA MOHANDAS, [2] ANILA JOSE

[1]Msc Scholar, [2]Assistant Professor

[1,2]Department of Computer Science

[1,2]St.Joseph's College (Autonomous), Irinjalakuda, Thrissur, India

ABSTRACT: Brain is one of our body's most essential part. Brain tumors are caused by the abnormal growth of cells in our brain. Cancer arises whenever the body's normal control mechanism starts to fail. Brain damage is harmful to our body. Tumor is a disease that harmful to humans. Some of brain tumor grow fast while others grow slowly. The tumor can be removed quickly in first stage using machine learning methods. Machine Learning is type of the artificial intelligence it allows software applications to perform more accurate for predicting the outcomes without being explicitly programmed to do so. this paper give an overview for SVM classifier approaches for detecting the brain tumor. The detection of brain tumor allows localizing a mass of abnormal cells in a slice of Magnetic Resonance (MRI) using SVM Classifier and segmentation of the excrescence cells to know about the size of the excrescence present in that segmented area. The extracted uprooted features of the segmented portion will be trained using artificial neural network to display the type of the tumor. These features will used for comparing the accuracy of the different classifiers in Classification learner app. The scope of this project is helpful in post processing of the extracted region like the brain tumor segmentation.

KEYWORDS: Brain tumor, SVM classifier, segmentation, artificial neural network, MRI, Classification learner app, KNN.

INTRODUCTION: In India, the cancer cases is rise day by day.at the same time the mortality rate is increasing. brain tumor can result various major complications. Tumors in the brain have significant impact on patient quality of life. The brain controls the body's activities such as walking and taking. Things that the brain does without thinking such as breathing, are controlled by the brain, as well as visual and auditory memory. brain tumor contains a feature that is in some people shows symptoms, but in others it shows no symptoms at all. Symptoms of brain tumor include headache, epilepsy, or loss of consciousness, changes in personality and behavior, and problems with your eye. in the USA, there are presently 70,000 individuals living with primary tumors 58% of CNS tumor are found in women and 42% in men. Cancerous and non-cancerous brain tumor can exist. tumors, whether begins or malignant can rise pressure inside your brain as they grow. This can affect brain damage even death.
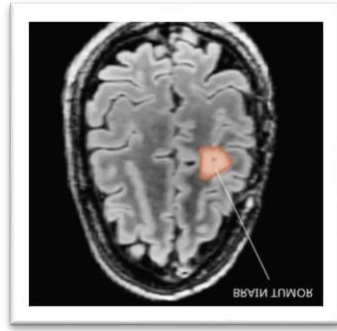
Fig.1. brain tumor

Types of brain tumor are secondary and primary:

Primary Brain Tumor: primary brain tumor starts from the brain. Tumors can start in any part of the brain or in the spinal cord. In adults, brain tumor originates from the cerebrum which is part of the brain. Tumor can start from the following areas and they are given below:

- The layers of tissue that guard the brain.
- Pineal glands
- Spinal cord

Secondary Brain Tumor: Cancers that spread from other parts of the body to the brain are called secondary brain tumor. Secondary brain cancers are made up of the same cells as the primary cancer, so if your cancer started in the lungs, the cancerous parts of the brain are made up of the lung cancer cells. Any type of cancer can spread to the brain but these are most common types:

- Lung Cancer
- Breast Cancer
- Kidney Cancer

The most common tumors in brain and spinal cord in children are Medulloblastoma, Gliomas which include Astrocytoma's, Brain stem gliomas, Ependymomas, Optic nerve gliomas. Brain tumors are more likely to affect teenagers and young adults which contains Pituitary tumors Gliomas, Medulloblastoma,Germ cell tumors. Although brain tumor can occur in people of any age, they are more common in children and adults.

Based on the malignancy, it is classified as: -

Benign tumor: tumor cells are noncancerous that are normal in size and growth. They don't generally spread the other parts of the body.

Malignant tumor: tumor cells are cancerous cells that are abnormal in size and growth. They tend to invade the neighboring healthy cells. Based on the appearance, the tumor cells are graded. During the period of treatment, this grade measurement gives the information about the rate of growth of tumor cells.

Grade	Appearance	Growth rate
1	Nearly normal	Slow
2	Slightly abnormal	Slow
3	Abnormal	Active growth
4	Most abnormal	Quick growth

TABLE.1. Grades of brain tumor

A benign brain tumor can come nasty latterly and a low-grade tumor can turn into an advanced grade tumor. therefore, the knowledge about the exact grade or stage of the tumor is necessary for the proper treatment. The brain tumor can be achieved through several images similar as CT (Computed Tomography), ultrasound, PET(Positron Emission Tomography), MRI, Spectroscopy, Fusion, etc. Among all the Imaging ways, MRI is preferred as it effectively detects the following given conditions like growth, tumor, bleeding, swelling or infections. One of the main problems in medical analysis is the segmentation of obtained image where the boundaries of objects similar as abnormal region or organs are linked in the images. Results attained from the segmentation process is useful in carrying features of segmented tumor region similar as area, curiosity, bounding box, orientation. The image segmentation substantially relies on the threshold, edge, pixels, cluster, and neural network. Processing of image grounded on shapes is called morphology. Structuring element is applied to the preprocessed input image which creates affair image of the same size. Every pixel of the input image is compared with all the neighboring pixels and the compared result is the values of the matching affair pixel. Dilation and corrosion are the introductory operations of morphology. Pixels are added to the boundaries of the objects in dilation operation while they're removed in the corrosion operation depending on the size and shape of the structuring rudiments. During the comparing process, dilation operation returns the loftiest value of the girding near pixels to the affair whereas the corrosion operation returns the smallest value of the girding near pixels to the affair. There are different types of clustering that includes mountain, K- means, fuzzy C-means and subtractive clustering system. The k- means clustering is the common clustering fashion that's used. It's a simple, straightforward and quicker than the hierarchical clustering that can work for large number of variables. The image segmentation substantially relies on the encourages threshold, edge, pixels, cluster, and neural network. Processing of image grounded on shapes is called morphology. Structuring element is applied to the preprocessed input image which creates affair image of the same size. Every pixel of the input image is compared with all the neighboring pixels and the compared result is the values of the matching affair pixel. Dilation and corrosion are the introductory operations of morphology. Pixels are added to the boundaries of the objects in dilation operation while they're removed in the corrosion operation depending on the size and shape of the structuring rudiments. During the comparing process, dilation operation returns the loftiest value of the girding near pixels to the affair whereas the corrosion operation returns the smallest value of the girding near pixels to the affair. There are different types of clustering that includes mountain, K- means, fuzzy C-means and subtractive clustering system. The k- means clustering is the common clustering fashion that's used. It's a simple, straightforward and quicker than the hierarchical clustering that can work for large number of variables. The process of separating an image into colorful corridor or regions is called image segmentation. The major thing is to simplify or change the representation of the image into commodity additional which is easier and further meaningful to Dissect. It's used to detect objects and boundaries in images. Every pixel in an image is assigned a marker similar that the pixels having the same marker share certain characteristics in common. One of the classical problems in image processing is image Bracket. The major thing of image bracket is to prognosticate the input image orders by using the features. There are colorful classifiers similar as ANN(Artificial Neural Network), SVM(Support Vector Machine), Random Forest, Decision Timber k-NN(k Nearest Neighbor), Adaptive boost (Ada boosted) etc. One of the best method for classifying any image or pattern is SVM. SVM is used to resolve a set of images into two various of classes. The classification done by chancing the hyper-plane that separate the two classes in fig. 1.
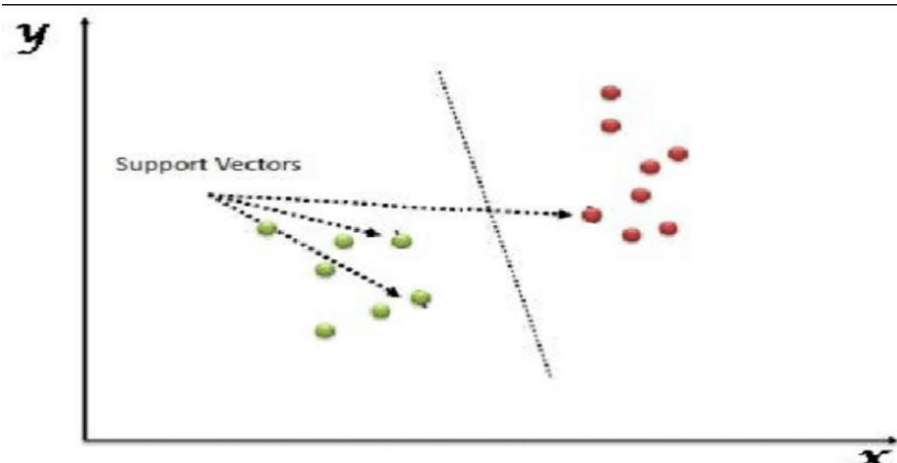
Fig.1 Classification Using SVM

It builds a hyper plane grounded on a kernel function (K). As shown in Figue.1, point vectors on left side of hyper plane belong to class-1 and the point vectors on the right side of hyper plane belong to class 1. In neural network, the dataset of MRI images are trained by replication system. Thus, when a new image is given to the neural network, it's trained by neural network by comparing the replication value of the preliminarily trained image. After the training is complete, if any changes need to be made to the training process, the network architecture, or the data sets can be determined using the network performance.
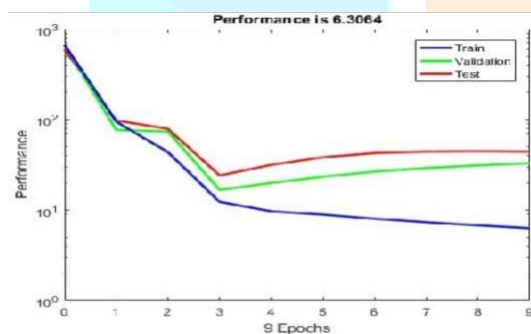
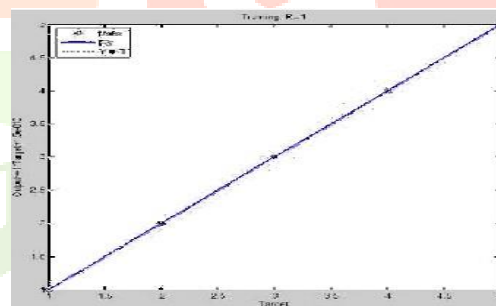Fig.2 performance of training process.   Fig.3.Regerssion Plot

The Fig 2 shows that the test curves and validation curves are very similar. If the test curve gets increased significantly ahead the confirmation wind is increased, also it's apparent that an over befitting   might have passed. The relationship between the targets and the performing affair of the network can be compared by conniving the retrogression plot (6). If the training was perfect, the network affair and the target would be equal as shown in fig. 3.

Classification Learner app is used to train the database for classifying the obtained data by supervised ML. The tasks involved includes:

- Uploading the data
- Selecting the features
- Training the database
- Obtaining the results

Types of classification includes SVM, K-nearest neighbors, decision tree. This app performs model of assessment and comparisons using confusion matrix and scattering plot. Two type of the classifier training are :

- Manual classifier training
- Parallel classifier training

Manual classifier training It's used to explore individual model types or if we formerly know what type of classifier we need. Therefore, Manual classifier training classifies one at a time or a group of the same type. Parallel classifier training Using parallel computing tool box and we can train classifiers. Therefore this app starts a parallel pool of workshop automatically until and unless we turn off the dereliction parallel preference. Therefore, parallel classifier can train multiple classifiers at formerly.

In this design we're using parallel classifier training.

PROPOSED SYSTEM :-

The flowchart of various steps involved in the proposed system is in fig.4 A.

A) Acquisition of input image :

The dataset of MRI Images are acquired from intimately available sources similar as hospitals, laboratories and medical institutions and sodalities which is saved in. jpg format.

B) Convolution filtering:

The MRI Images acquired from colorful sources contain noises due to arbitrary movement of case during scanning and external noise, etc. The below mentioned noises should be removed and the image perceptual quality have to be enhanced for effective brain excrescence discovery Various steps of pre-processing is as follows:

1) RGB to Gray-level conversion: The image is converted to gray scale image from the RGB model.

2) Edge Detection: The edges present in the grey scale image are detected using canny system. The Canny edge sensor smoothens the Argentine scale image by convoluting it with a Gaussian sludge. Both the x and y direction derivations are reckoned grounded on the performing smoothed image. The gradient magnitude of the image is reckoned with these derivations. If they do not constitute a original outside, also the pixels of the image are suppressed. The final step is performed by using the hysteresis, where the pixels are marked as either edges, non-edges or between the edges and non- edges, grounded upon the threshold values. If the in-between pixels are connected with the edged pixels, they're also considered as edge pixels. A double image is Attained as the result, where the white pixels nearly approximate the true edge of the original image.

3)Image resizing: The gray scale image is resized to a size 200□ 200.

4)2D complication masking in this step, the value of the pixel is given in matrix format (substantially 3x3 matrix) and a masking matrix is created as below

$$hN = [0\ 1\ 0;\ 0\ -1\ 0;\ 0\ 0\ 0] \hspace{3cm} (1)$$

 This masking matrix and the matrix form of image is convoluted as shown below.

$$nablaN = imfilter(diff\_im,\ hN,'conv') \hspace{2cm} (2)$$

Perona- Malik Diffusion equation and PDE direct method is used for filtering of image.

Perona-Malik Formula:

$$G=1/(1+(x/k)^2) .*a \hspace{4cm} (3)$$

$$G=\exp(-(x/k)/2).{*}a \tag{4}$$

PDE Direct Method:

$$Img= Img + dt{*}(CN.{*}GN + Cs.{*}Gs + Ce.{*}Ge + Cw.{*}Gw) \tag{5}$$

The 'Result 1' and 'Result 2' in Fig. 4 independently relate to the type of the brain tumor and the comparison result of classifiers.
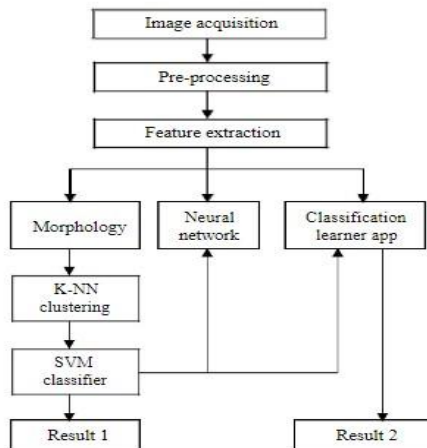

Fig. 4 Flow chart of the proposed System

C) Neural Training:

After the pre-process operation on the image, the dataset of the image along with its uprooted features are trained using the neural network. The performance of the training operation is validated and is colluded in a graph with mean square error in y-axis and replication values in x-axis.

D) Morphology:

The morphology operation is performed on the preprocessed image using the 'fragment' structuring element. The image is first unrestricted and the small object boundary is colluded around the area of tumor is colluded around the area of tumor.

E) Clustering:

KNN is a simple classification technique. In this type of classifier, the testing feature vector is classified by finding the k nearest training neighbor vector. The distance between the training and testing vector is calculated using different distance metric measurement technique similar as Euclidean distance, city block, Chebyshev, Murkowski, Mahala Nobis, cosine, correlation, Spearman, hamming, Jaccord etc. In this method, Euclidean, city block, cosine, correlation distances are considered between training and testing data vector.

The morphed image is also clustered using the same 'fragment' structuring element. The clustering includes the process of dilation and corrosion followed by 'open' operation. After all these operations, the connected factors set up on the image are returned. Segmentation A inked distance chart (SDF) is created for masking purpose. Interior and surface points of the mask are set up and using these points, their mean values are calculated. The kappa value is also calculated by setting a threshold point and the image are returned.

F) Segmentation: A signed distance map (SDF) is designed for encryption purposes. Internal and external points of the mask are obtained and using these points, their intermediate values are calculated. The value of kappa is then calculated by setting the threshold point. The 4 boundaries are tested in the neighborhood subscriptions and the directions to the eight neighbors are found in the central derivative. the derivatives of SDF a x, y are :

$$\pi\_xx = \pi(a)-2*\pi(e)+\pi(b);\quad (8)$$

$$\pi\_yy = \pi(c)-2*\pi(e)+\pi(d);\quad (9)$$

$$\pi\_xy = -0.25*\pi(f)-0.25*\pi(g)\ldots \qquad +0.25*\pi(h)+0.25*\pi(i);\quad (10)$$

$$\pi X2= \pi\_x.^2;\qquad (11)$$

$$\pi\_y2=\pi\_y.^2;\qquad (12)$$

The kappa value is calculated using central derivatives as follows

$$Kappa=((\pi\_x2.*\pi\_yy+\pi\_y2.*\pi\_xx-.*\pi\_x.*\pi\_y.*\pi\_xy)./..$$

$$(\pi\_x2+\pi\_y2+eps).^(3/2).*(\pi\_x2+\pi\_y2).^(1/2);\qquad (13)$$

G) Classification learner app: classification learner app is used. While training each classifier, both the correct and misclassified results are plotted in the scattering plot. Similarly, confusion matrix displays the result in matrix format. By the above process, efficiency of the classifiers is found and it's compared with another The options are named in order. On opting the option "TESTING INPUT", the input image can be chosen from any number of images. The input image is displayed as in Fig. 6.

On opting the option "NEURAL NETWORK AND PROCESSING", the unknown input image is preprocessed when it's simultaneously added as a dataset to the neural network The neural network training dialog box opens and the iterations starts and shown in Fig. 7
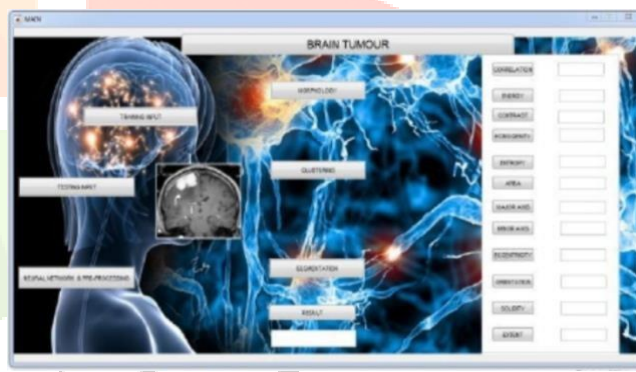

Fig.5.GUI menu

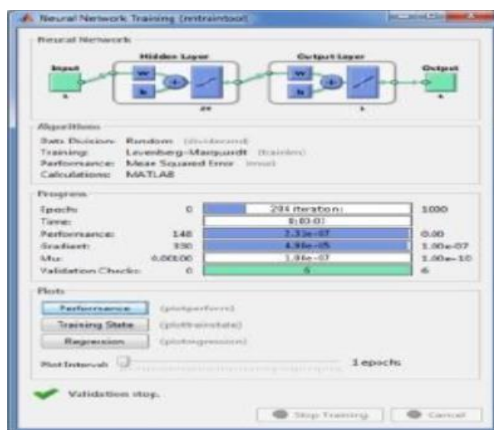
Fig.6 Image acquisition

Fig.7 Neural Network Training

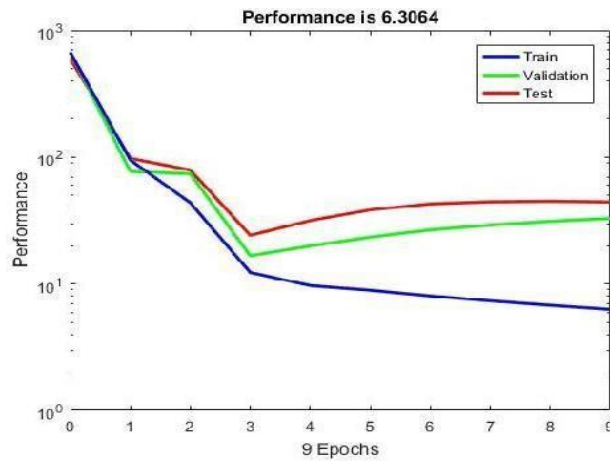The performance of the validation can be viewed in the form of graph as in Fig.8.

Fig.8 Performance Validation

After the process of morphology and clustering, the tumor part is alone segmented and is displayed along with its properties as in Figure.7. Also, on selecting the option "RESULT", the result of the tumor either being normal, benign or malignant is displayed as in Fig. 9.
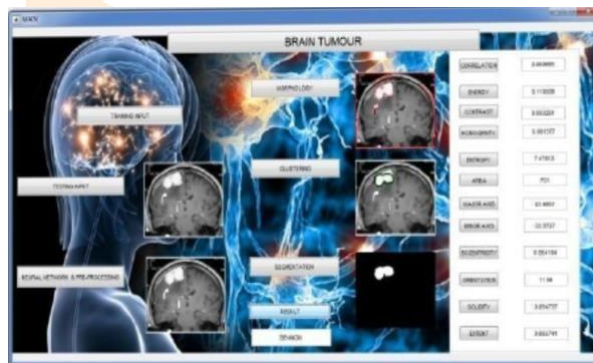

Fig.9 Final Segmentation Result

Then the classification learner app is opened and the data for the given input image is plotted as a graph as in Fig.10.
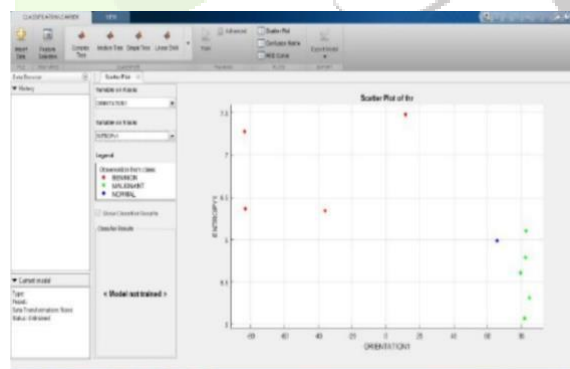

Fig.10 Scatter plot

The scatter plot and the confusion matrix of the image using Linear SVM classifier is shown in Fig. 11.a and Fig 11.b.
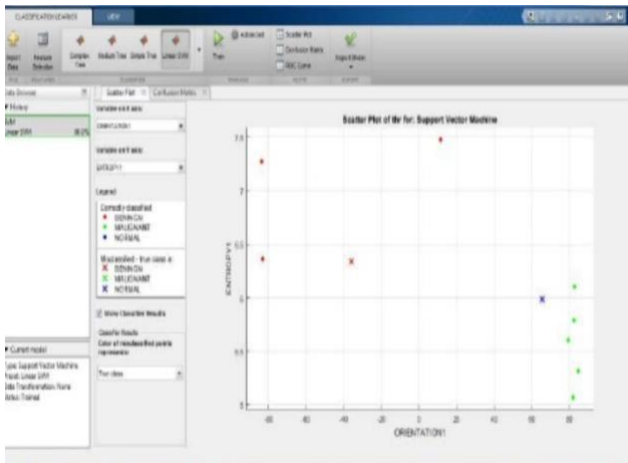
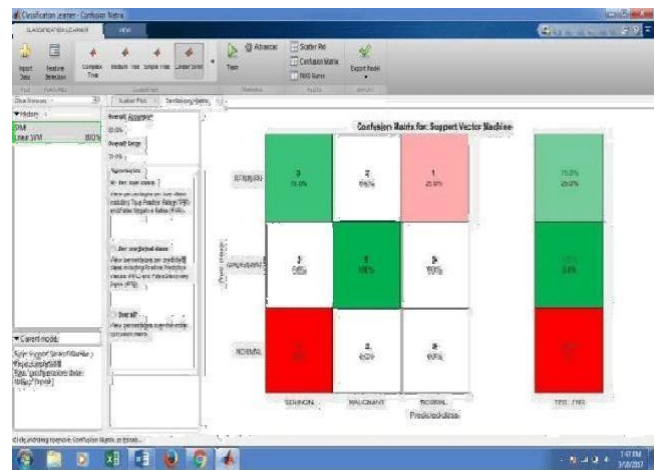Fig.11.a Scatter plot of Linear SVM classifier.

Fig.11.b Classification matrix of Linear SVM classifier
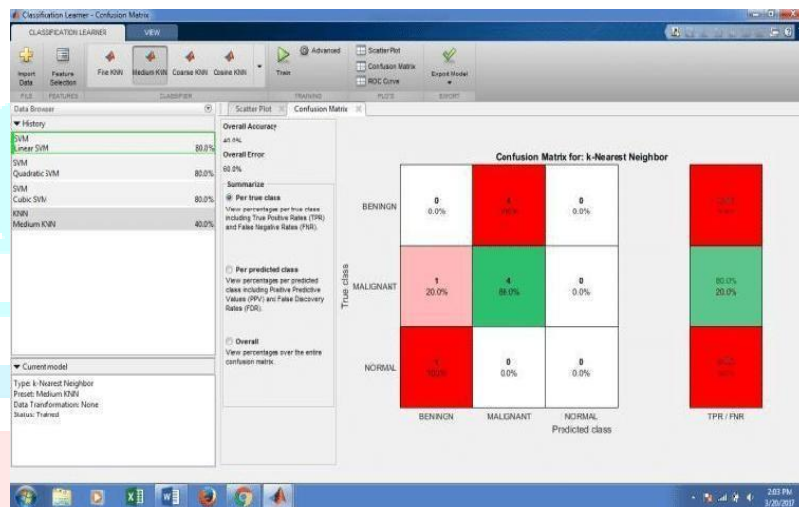

Fig.12 Confusion Matrix of Medium KNN Classifier

It is evident from the Fig.13 SVM classifier is more efficient than the other classifiers.
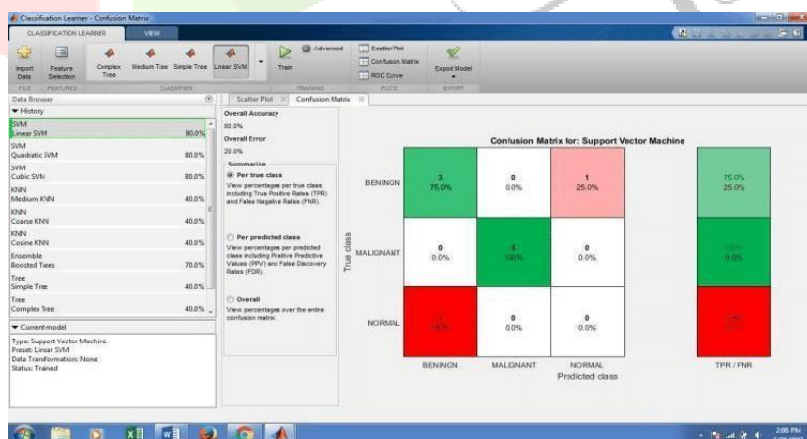

Fig.13 Confusion Matrix for: Support Vector Machine

CONCLUSION

Brain tumor is very sensitive problem, which is related to health, main focus of SVM is on Accuracy. Motivation behind in this paper is detect tumor and provide better treatment for the sufferings from the results of proposed system, it is concluded that the accuracy of the SVM classifier is obtained successfully. It is also found that as we increase the number of training images the performance of SVM classifier increases. The scope of this project is helpful in post processing of the extracted region like the tumor segmentation this paper give an overview for SVM classifier approaches for detecting the brain tumor.

REFERENCE

[1] Saptalakar. B. K, Rajeshwari. H, "Segmentation Based Detection of Brain Tumor" International Journal of computer and Electronics Research, Vol. 2, pp.20-23, February 2013

[2] Jayashree. M. J, Charutha. S, "An Efficient Brain Tumor Detection By Integrating Modified Texture Based Region Growing And Cellular Automata Edge Detection" .

[3]Ek Tsoon Tan, James V Miller, Anthony Bianchi, Albert Montillo- "Brain Tumor Segmentation With Symmetric Texture And symmetric Intensity- Based Decision Forests" GE Global Research, Niskayuna, NY, USA, University of California Riverside, Riverside, CA USA.

[4]Subhashini. J, Vijay. J, "An Efficient Brain Tumor Detection Methodology using k- means Clustering Algorithm", International conference on communication and Signal Processing, pg. 653– 657, April 2013.

[5]Albert Singh. N, Amsaveni. V, "Detection of Brain Tumor using Neural Network", in ICCCNT, pg, 15, July 2013.

[6]Nguyen ThanhThuy, Tran Son Hai, Le Hoang Thai, "Image Classification using Support Vector Machine and Artificial Neural Network", Vietnam .

[7] M.A. Balafar, A.R. Ramli, M.I. Saripan, S. Mashohor, Review of brain MRI image segmentation methods. Artif. Intell. Rev. 33(3), 261–274 (2010).

[8] R. Rana, H. S. Bhadauria, and A. Singh, "Study of various methods for brain tumor segmentation from MRI images", International Journal of Emerging Technology and Advanced Engineering, vol. 3, no. 2, pp.338-342, 2013.

[9]R. Ahmmed and M. F. Hossain, "Tumor stages detection in brain MRI image using Temper based Kmeans and Fuzzy C-means Clustering Algorithm", Proceeding of 11th Global Engineering, Science and Technology Conference, pp. 1-10, 18 – 19 December, 2015, BIAM Foundation, Dhaka.

[10]Nan Zhang, Su Ruan, Stephane Lebonvallet, Qingmin Liao and Yuemin Zhu. Kernel Feature Selection to Fuse Multi-spectral MRI Images for Brain Tumor Segmentation. Computer Vision and Image Understanding, 2011, 115(2):256-269.

[11]Khushboo Singh, SatyaVerma, "Detecting Brain Mri Anomalies By Using Svm Classification",International Journal of Engineering Research and Applications, ISSN: 2248-9622, Vol.2, Issue 4, June- July 2012 .

[12]Shweta Jain, "Brain Cancer Classification Using GLCM Based Feature Extraction in Artificial Neural Network", International Journal of Computer Science & Engineering Technology (IJCSET), ISSN : 22293345, Vol. 4 No. 07 Jul 2013.

[14]Dr. R. J. Ramteke, KhachaneMonali Y, "Automatic Medical Image Classification and Abnormality Detection Using KNearest Neighbour", International Journal of Advanced Computer Research (ISSN (print): 2249-7277 ISSN (online):2277-7970), Volume-2 Number-4 Issue-6 December-2012.

[15]Prakash Tunga P, Vipula Singh, " Extraction and Description of Tumour Region from the Brain MRI Image using Segmentation Techniques", IEEE International Conference On Recent Trends In Electronics Information Communication Technology, May 20-21,IEEE 2016,DOI:10.1109/RTEICT.2016.7808097,Pages:1571-1576.

[16]Nithyapriya.G1, Sasikumar.C2, March 2014, "Detection and Segmentation of Brain Tumors using AdaBoost SVM".

[17]Mrs. M.C. Hingane, Mr. Satish B. Matkar, Mr. Ashish B. Mane, Mr. Ambadas M. Shirsat, March 2015, "Classification of MRI Brain Image using SVM Classifier".