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Machine learning for enhanced Brain Tumor Detection and classification Using Hybrid Method

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Abstract
Brain tumor classification plays an important role in clinical diagnosis and effective treatment. In this work, we propose a method for brain tumor classification using an ensemble of deep features and machine learning classifiers. In our proposed framework, we adopt the concept of transfer learning and uses several pre-trained deep convolutional neural networks to extract deep features from brain magnetic resonance (MR) images. The extracted deep features are then evaluated by several machine learning classifiers. The top three deep features which perform well on several machine learning classifiers are selected and concatenated as an ensemble of deep features which is then fed into several machine learning classifiers to predict the final output. To evaluate the different kinds of pre-trained models as a deep feature extractor, machine learning classifiers, and the effectiveness of an ensemble of deep feature for brain tumor classification, we use three different brain magnetic resonance imaging (MRI) datasets that are openly accessible from the web. Experimental results demonstrate that an ensemble of deep features can help improving performance significantly, and in most cases, support vector machine (SVM) And ANN kernel outperforms other machine learning classifiers, especially for large datasets.
Keywords: Deep learning; ensemble learning; brain tumor classification; machine learning; transfer learning

I. INTRODUCTION

The theme of this thesis is varied strategies of image segmentation applied on medical pictures. This chapter can begin by outlining the essential drawback of segmentation and inspire its importance in several applications. Fashionable medical imaging modalities like magnetic resonance imaging and CT scans generate larger and bigger pictures that can not be analyzed manually. This drives the need for additional economical and study image analysis strategies, tailored to the issues encountered in medical pictures. The aim and motivation of this thesis area unit directed towards the matter of segmenting brain magnetic resonance imaging pictures.

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Image segmentation is that the drawback of partitioning a picture into significant regions on the premise of grey-level, color, texture. this means the generality of the problem- segmentation may be found in any image-driven method, e.g. fingerprint/text/face recognition, trailing of moving people/cars/airplanes, etc. for several applications, segmentation reduces to finding associate in nursing object in a picture. This involves partitioning the image into two categories of regions - either object or background. It's merely not possible in apply to manually method all the pictures (like magnetic resonance imaging and CT scan), owing to the overwhelming quantity of data it provides. Therefore we have a tendency to style algorithms that search for bound patterns and objects of interest and place them to our attention. To Illustrate, area unit centre standard application is to look and match illustrious faces in your photograph library that makes it attainable to mechanically generate photograph collections with a precise person. a crucial a part of this application is to section the image into"Face" and "background". this may be tired variety of the way, and it's well accepted that no general purpose segmentation rule exists, or that it ever are going to be made-up. Thus, once planning a segmentation rule, the appliance is often of primary focus: ought to we have a tendency to section the image supported edges, lines, circles, faces, cats or dogs.

II. PIXELS QUALITY AND CLUSTERING

The shape, volume, and distribution of brain tissue area unit altered by several neurologic conditions, resonance imaging (MRI) is that the most popular imaging modality for examining these conditions. Consistent menstruation of those alterations may be enforced by victimization image segmentation. Many investigators have developed ways to modify such quantities by segmentation. Fuzzy c-means (FCM) cluster is Associate in Nursing unsupervised technique that has been with success applied to cluster, feature analysis and classifier styles in fields adore medical imaging, image segmentation, astronomy, target recognition. There area unit numerous feature areas during which a picture will be diagrammatic, and therefore the FCM formula categorizes the image by combination of comparable information points within the feature house into clusters.

This cluster is achieved by iteratively minimizing a price operate. This value operate depends on the space of the pixels to the cluster centers within the feature domain. The pixels on a picture area unit extremely related, i.e. the pixels within the immediate neighborhood possess nearly an equivalent feature information. Therefore, the abstraction relationship of neighbor pixels is a vital characteristic that may be of nice facilitate in imaging segmentation. However, the abstraction relationship between pixels is rarely utilized in FCM.

The Kyrgyzstani monetary unit is Associate in Nursing unsupervised neural network mapping a collection of n-dimensional vectors to a two-dimensional geographic map displaying in such how that similar information things area unit set about to one another on the map. However, the

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essential Kyrgyzstani monetary unit lacks the flexibility to extract the hierarchical data structure of the information. a high quality live supported the variance of the information in conjunction with threshold parameters area unit accustomed decide that coarseness is suitable for a particular Kyrgyzstani monetary unit, and that area unitas of the Kyrgyzstani monetary unit are promising candidates for more gradable enlargement.[5] It will be seen that the amount of output units employed in a Kyrgyzstani monetary unit influences its pertinency for cluster.

III. MOTIVATION OF TOPIC SELECTION

The motivation is to plan a much better segmentation technique for medical pictures liver, brain, somatic cell for detection of malignant tissue. Image segmentation has been known because the key drawback of medical image analysis and remains a preferred and difficult space of analysis. Image segmentation is progressively utilized in several clinical and analysis applications to analyses medical imaging datasets; that motivated North American nation to gift a snap of dynamically dynamical field of medical image segmentation.

IV. COMPARISON BETWEEN CT SCANNING AND MRI IMAGE

CT (Computed Tomography), magnetic resonance imaging (Magnetic Resonance Imaging),PET (Positron Emission Tomography) etc. generate an outsized quantity of image data. With the improved technology, not solely will the dimensions and backbone of the pictures grow however additionally the amount of dimensions will increase. Within the future, we'd wish to have algorithms which might mechanically observe diseases, lesions and tumors, and highlight their locations within the giant pile of pictures. However another complication arises is that we tend to even have to trust the results of those algorithms. this can be particularly necessary in medical applications as we tend to don't need that the algorithms to relinquish false signal alarms, and that we actually don't need them to miss fatal diseases.

Therefore, developing algorithms for medical image analysis needs thorough validation studies to form the results usable in observe. This adds another dimension to the analysis method that involves communication between two completely different worlds - the patient centered medical world, and therefore the computer-centered technical world. The mutualism between these worlds is rare to seek out and it needs vital efforts from each side to affix on a typical goal.

V. PROBLEM FORMULATION WITH MATLAB

The algorithms of image segmentation play a significant role within the varied medical specialty imaging applications resembling quantification of the tissue volumes, diagnosis, localization of the pathology, study of the body structure, treatment designing, partial volume correction of the useful imaging knowledge, and computer-integrated surgery. There's presently no single segmentation methodology that yields acceptable results for each medical image. Strategies do exist that additional general and may be applied to a spread of information. These problems to solve of image processing tool box.

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However, a number of these strategies don't exploit the multispectral info of the imaging signal. There ar several regions with similar intensities in a very man image of the pinnacle, that lead to several native minima that will increase over-segmentation.

Thus we've got to plan a replacement methodology that is capable of segmenting varied medical pictures and is computationally less advanced.

Brain tumor segmentation is an important task in medical image processing. Early diagnosis of brain tumors plays an important role in improving treatment possibilities and increases the survival rate of the patients. Manual segmentation of the brain tumors for cancer diagnosis, from large amount of MRI images generated in clinical routine, is a difficult and time consuming task. There is a need for automatic brain tumor image segmentation. The purpose of this paper is to provide a review of MRI-based brain tumor segmentation methods. Recently, automatic segmentation using deep learning methods proved popular since these methods achieve the state-of-the-art results and can address this problem better than other methods. Deep learning methods can also enable efficient processing and objective evaluation of the large amounts of MRI-based image data. There are number of existing review papers, focusing on traditional methods for MRI-based brain tumor image segmentation. Different than others, in this paper, we focus on the recent trend of deep learning methods in this field. First, an introduction to brain tumors and methods for brain tumor segmentation is given. Then, the state-of-the-art algorithms with a focus on recent trend of deep learning methods are discussed. Finally, an assessment of the current state is presented and future developments to standardize MRI-based brain tumor segmentation methods into daily clinical routine are addressed.

Proposed Method: Hybrid ANN–SVM for Brain Tumor Classification

Step 1: Preprocessing and Feature Extraction

Brain MRI images are first preprocessed to remove noise and improve contrast using techniques such as median filtering and histogram equalization. The tumor region is then segmented using thresholding or region-based segmentation. From the segmented region, discriminative features such as texture (GLCM features), shape, and intensity-based features are extracted to represent tumor characteristics effectively.

Step 2: Feature Learning Using Artificial Neural Network (ANN)

The extracted features are fed into an Artificial Neural Network to perform high-level feature learning. The ANN automatically captures complex and non-linear patterns present in brain tumor data. Instead of final classification, the ANN is used as a feature optimizer, and the learned feature vectors from the hidden layer are forwarded to the next stage.

Step 3: Final Classification Using Support Vector Machine (SVM)

The optimized feature vectors obtained from the ANN are classified using a Support Vector Machine. SVM is employed due to its strong generalization ability and effectiveness in handling

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high-dimensional data. The final output classifies MRI images into tumor and non-tumor (or different tumor types), achieving improved accuracy compared to individual ANN or SVM models.

VI. SIMULATION AND RESULT

SIMULATION AND IMPLEMENTATION WORK

Image properties

Size of the images taken are:

- Brain1 : 746X 644
- Brain2 : 746X 644
- Brain3 : 746X 644
- Colored image1 : 169X243
- Colored 2 : 189X269
- Colored 3 : 186X274
- Watershed image 1 : 170X190
- Watershed image 2 : 170X190
- Watershed image 3 : 170X190

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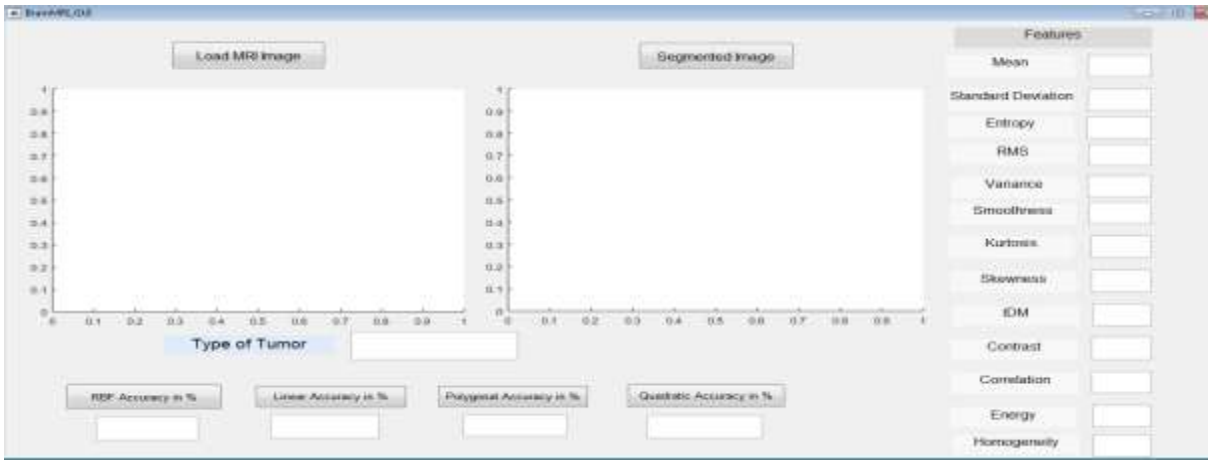

Fig.6.1 Input Image.

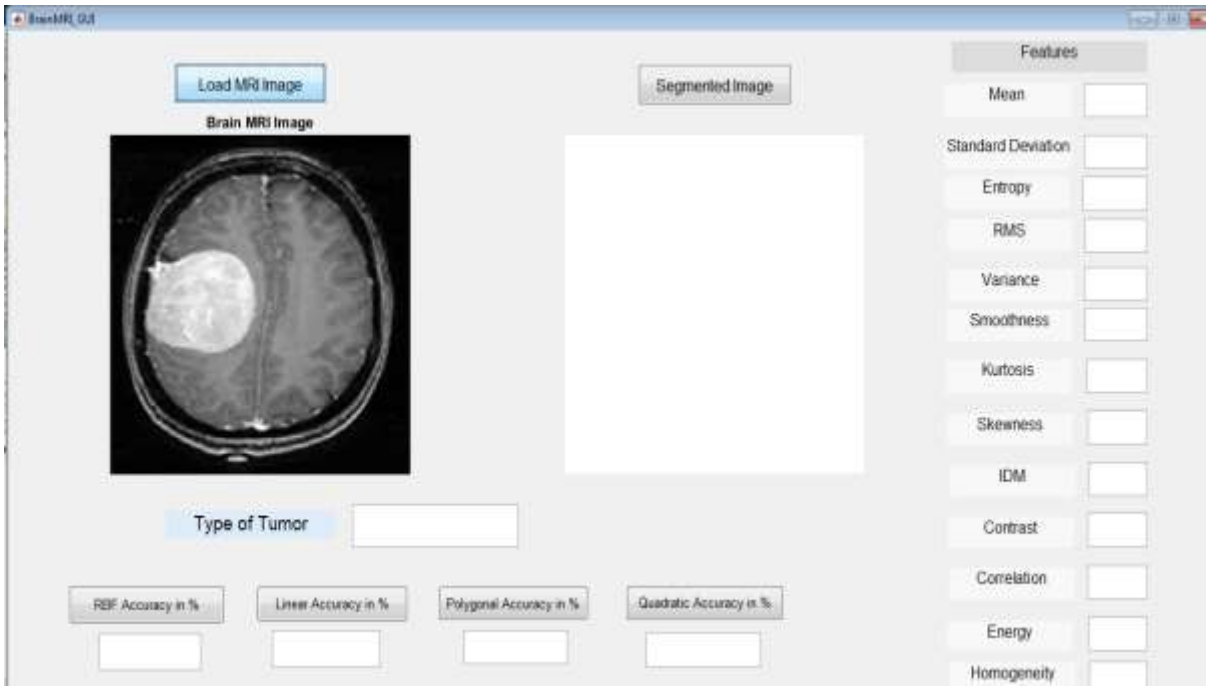

Fig.6.2 Image Selection (a).

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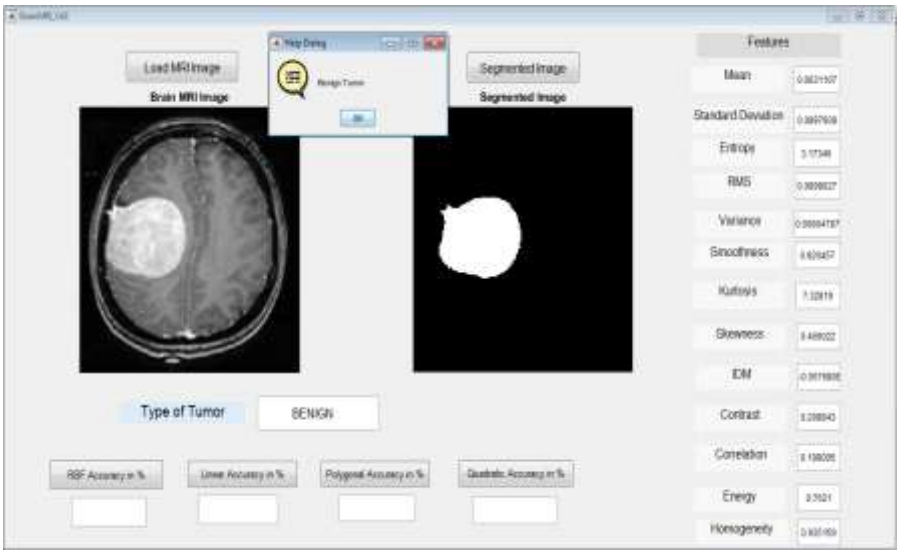

Fig.6.3 Segmentation image (b).

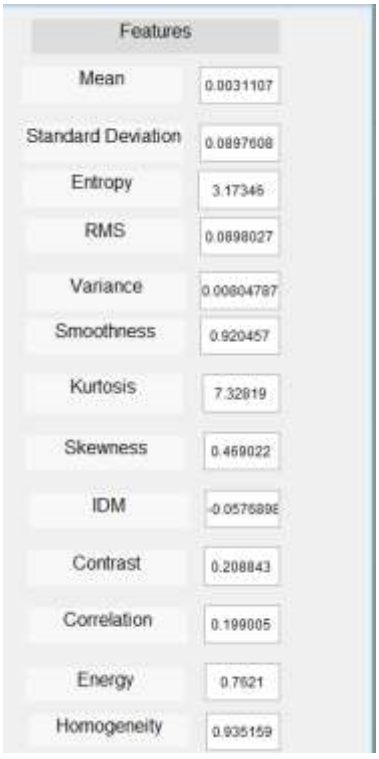

Fig.6.4 Output parameters.

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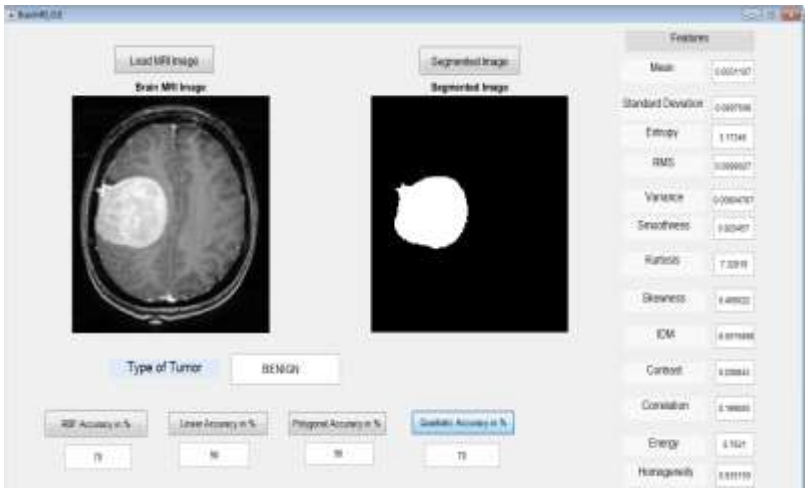

Fig.6.5 Test Image 1.

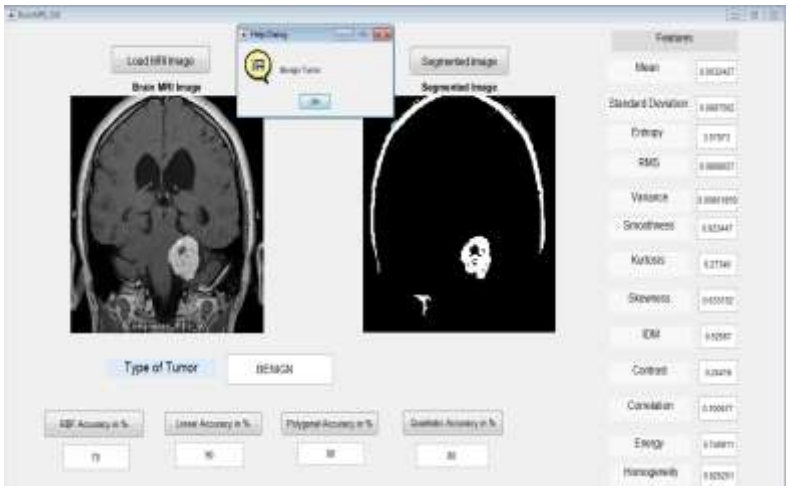

Fig.6.6 Test Image 2.

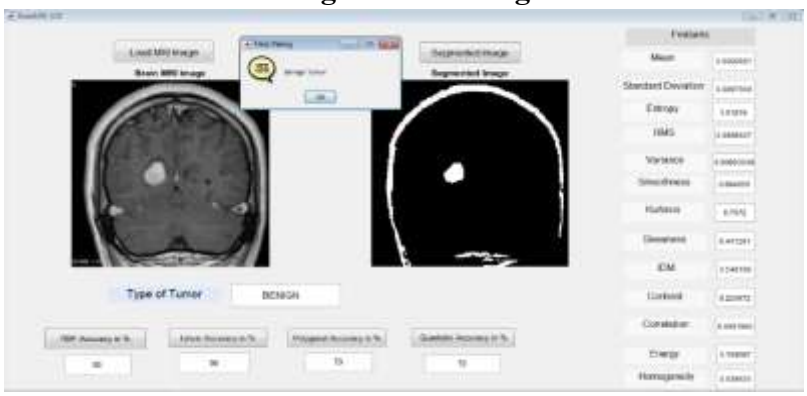

Fig.6.7 Test Image 3.

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Fig.6.8 Test Image 4.

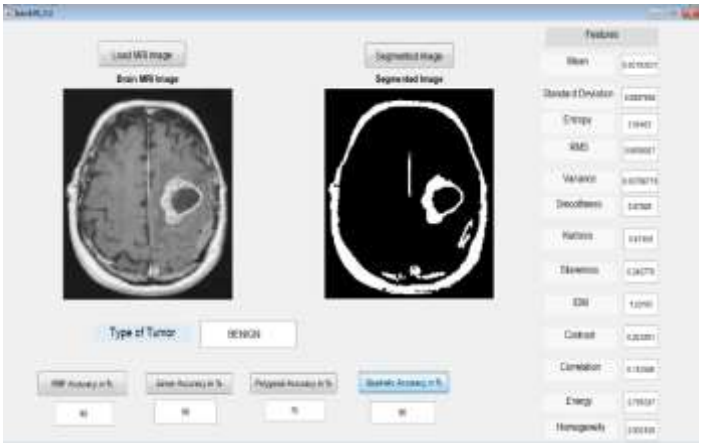

Fig.6.9 Test Image 5.

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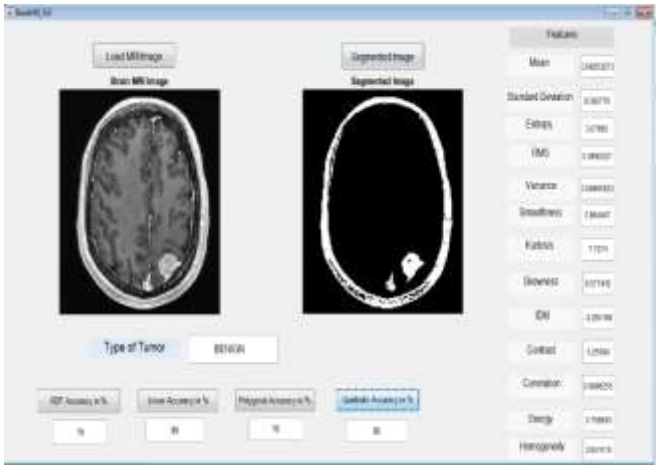

Fig.6.10 Test Image 6.

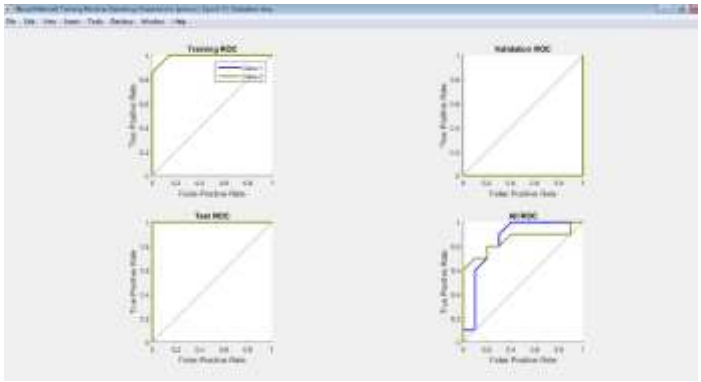

Fig.6.11 ROC curve.

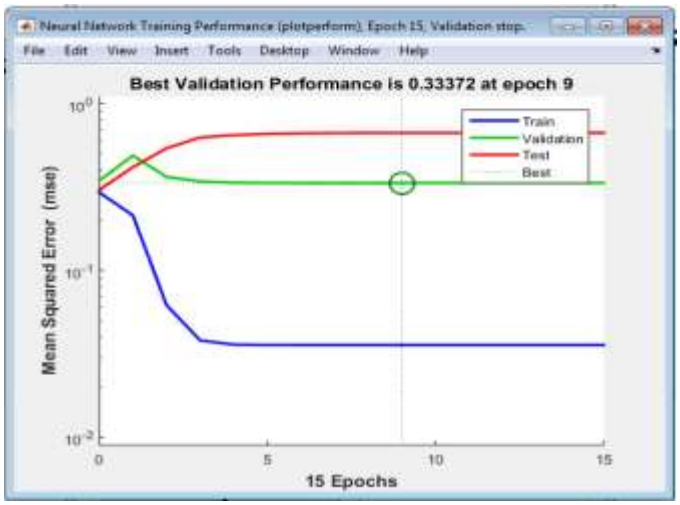

Fig.6.12 Performance curve.

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VII. CONCLUSION

This research concludes that machine learning–based approaches provide an effective and reliable solution for automated brain tumor classification and prediction using MRI images. The implemented framework, which integrates feature extraction with Support Vector Machine (SVM) and Artificial Neural Network (ANN) classifiers, demonstrates strong capability in distinguishing tumor-affected and normal brain tissues. The extracted feature set successfully captures the critical characteristics of brain tumors, thereby enhancing the overall classification performance.

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