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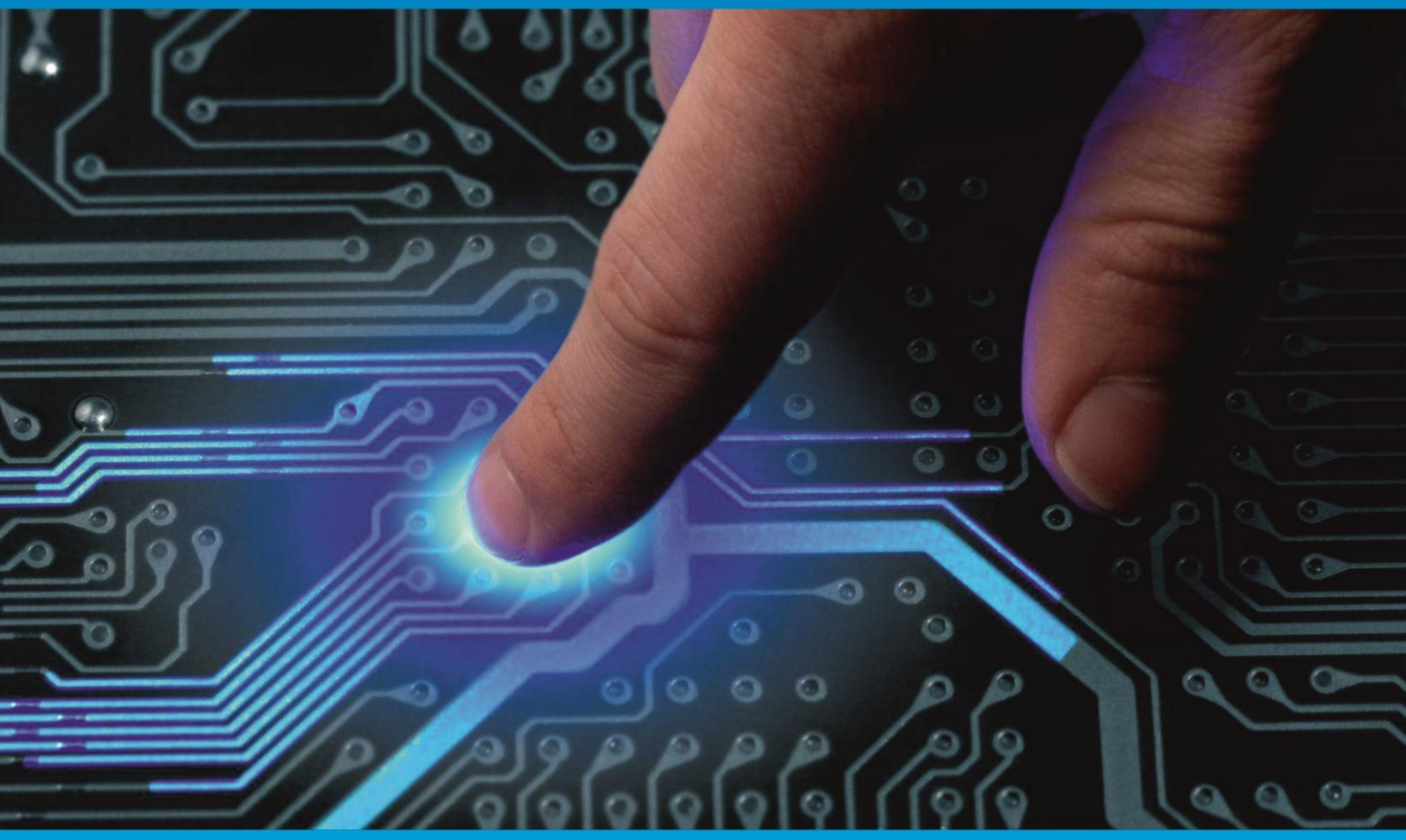

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Brain Tumor Detection Using MATLAB

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ABSTRACT: Tumour is the undesired mass in the body. Brain tumour is the significant growth of brain cells. Manual method of classifying is time consuming and can be done at selective diagnostic centers only. Brain tumour classification is crucial task to do since treatment is based on different location and size of it. Magnetic Resonance Imaging (MRI) is most suitable way to do so. Hence there is a need to build such system which will automatically classify the brain tumour type based on input MR images only. The objective of the proposed system is to classify the brain tumour images into three sub-types: Meningioma, Glioma and Pituitary using convolution neural network (CNN) and Support vector machine (SVM). Images from the dataset are downsized to reduce computation and some salt noise is added to make model robust and increase the dataset. The performance comparison is done on Google Co lab and tensor flow platform in python language.

I. INTRODUCTION

Brain, the most important part has the most complex structure in the body. The presence of the skull around the brain hinders the study of its functions and also increases the complexity of diagnosing the diseases [1]. The brain isnot prone to any particular diseases like the other parts of the body but can be triggeredby the abnormal growth of cells in which tumor types, thus the utilization of intrusive strategies. 4 Henceforth, MRI is a more obliging image philosophy than X-ray Computed Tomography for inspecting delicate tissues and organs. 5A potential utilization of MRI in clinical practice is brain tissue classification or division for ordinary and over the top tissues.4 The segment of the cells and their centers from the straggling leftovers of the image content is one of the crucial issues looked by most by far of the medical imagery analysis structures.6 The normal brain cells are damaged by tumors with the help of generating tenderness; it exerts pressure on parts of brain and raising pressure inside the skull. The most essential preferred standpoint of MR imaging is that it is a non-obtrusive procedure. The utilization of PC innovation in medical choice help is presently far reaching and inescapable over an extensive variety of medical regions, eg, malignancy inquire about gastroenterology, heart ailments, and brain tumors.7,8 The tumor is visible with beta, x rays, or gamma rays. The segmentation of brain tumor and tissue has become an actively researched area [2]. The major issue in the segmentation of images is the clustering of feature vectors which are similar. Thus, extraction of acceptable features is the primary requirement for successfully segmenting the images. The useful feature extraction of images is a difficult task due to the intricacies in the structures of the various tissues in the brain [3]. The image segmentation is a significant change in its behavior and structure.Brain tumors can be cancerous (malignant) or non-cancerous (benign).

II. LITERATURE REVIEW

There are many classification methods available in the literature to detect and identify brain tumor. Support Vector Machine (SVM) is notably considered a good one for a two class classification purpose. It provides better results for noisy data. It is a supervised learning method which makes the analysis less complicated and is used for data analysis and pattern recognition. SVM can perform data analysis by either classification or regression. This work is based on considering image segmentation as a classification problem. The lesion in the brain is classified as benign or malignant using SVM in this project.

1.HariBabuNandpuru in 2015“Classification techniques based on SVM to classify the brain MR image” in three kernel functions – linear, quadratic and polynomial were employed with SVM. The SVM achieved the highest accuracy with quadratic kernel, about 84%.

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2.Vijay Wasule et in 2001 "to classify the brain MR image into malignant or benign". GLCM technique was used for feature extraction and stored as feature vectors. Entropy, energy, homogeneity, correlation and other features are calculated. The accuracy was about 87% and 86% for SVM respectively.

3.Xia, Y., Bettenger, K., Shen, L., Reis, A , in 2007 "Automatic segmentation of caudate nucleus from human brain MR images". In the purpose of Segmenting the images from the nucleus of the brain.

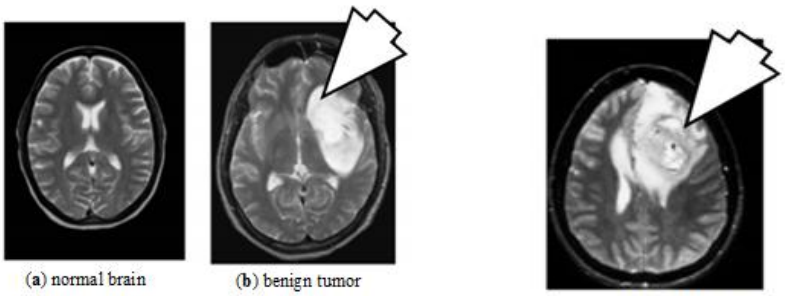
4.E. Hassan and A. Aboshgifa in 2008 "Detecting Brain Tumors from MRI Image using MATLAB GLCM Program". Detection of the brain tumor using GLCM with accuracy of 78%.

5. P. Jain, H. Didwania, and S. Chaturvedi in 2011 "Brain Tumour extraction from MRI Images using Matlab". Extracting of the brain tumor using matlab using the SVM with 67% of accuracy.

6. Abd-Ellah, Mahmoud Khaled, "Design and implementation of a Computer Aided Diagnosis System for Brain Tumor Classification". Identification of the brain tumor by designing and implementing of computed aided diagnosis system of brain tumor the accuracy is low.

III. EXISTING SYSTEM

Support Vector Machine (SVM) is notably considered a good one for a two class classification purpose. It provides better results for noisy data. It is a supervised learning method which makes the analysis less complicated and is used for data analysis and pattern recognition. SVM can perform data analysis by either classification or regression.This work is based on considering image segmentation as a classification problem. The lesion in the brain is classified as benign or malignant using SVMA brain tumor occurs when abnormal cells from within the brain. In diagnosis of the disease medical imaging has many advantages. Many people suffer from brain tumor; it is a serious and dangerous disease.



(a) normal brain (b) benign tumor (c) malignant tumor

A proper diagnosis of brain tumor is provided by the medical imaging. The detection and classification of tumor from brain is an important and difficult task in the medical field. The brain tumor detection technique in the MRI images is very significant in many symptomatic and cures applications. Tumor detection and classification are very hard because of high quantity of data in MRI images. One essential part in detecting the tumor is image segmentation. The segmentation provides an automatic brain tumor detection technique in order to increase the precision, yields with decrease in the diagnosis time.

BRAIN TUMOR DETECTION APPROACHES

Brain tumor detection incorporates four main stages namely Preprocessing, Segmentation, Feature Extraction and Classification.

In medical field it is essential to get precise images for accurate observations of disease. Quality of medical images depend upon the sources of artifact acquisition such as MRI,PET,CT etc.MRI scans may contain a lot of unwanted and irrelevant parts in its actual images.MRI are influenced by Rician noise.[33] Rician noise is signal dependent and it is challenging to remove it. Image preprocessing techniques like filtering, contrast enhancement, skull stripping are used to retain original image properties.

is used to extract Region of Interest (ROI) from digital images. It ais crucial to separate out tumor region from brain MRI vector machine).Hence the accuracy of the result is higher.

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And the speed of the detection is alsoDifferent supervised and unsupervised techniques like threshold, soft computing, atlas based, clustering, neural network etc. exist for segmentation. Threshold includes adaptive, global, Otsu's, histogram based threshold methods. Unsupervised clustering techniques include K-means, Fuzzy C means. It gives effective segmentation of brain MRI into Gray Matter (GM), White Matter (WM),Cerebrospinal Fluid(CSF).Segmentation is also performed using bio inspired algorithms like Particle Swarm Optimization (PSO)[6],Genetic Algorithm(GA)[14].Advances in segmentation shows that deep learning architectures like CNN, Mask-RNN, Unit give better performance over traditional methods In feature extraction various features like shape, texture, wavelet, Gabor features are extracted from MRI. Gray-Level-Co-occurrence Matrix (GLCM) is used by most of the researchers. It is second order statistical method which can give texture features like energy, correlation, contrast etc.[5].Wavelet features are extracted using Discrete Wavelet Transform(DWT).It is applied to raw image, approximation coefficients are extracted and selected as feature vector. Brain tumors are mainly classified as benign and malignant tumors. Malignant tumors are further divided into types Glomma, Meningioma and Pituitary.

IV. PROPOSED SYSTEM

The work is initiated by obtaining the MRI scans of the patients for classification and analysis purpose. All the images are divided into training and testing sets. The training set is analyzed first by extracting first and second order features. These features are then used by the classifier to generate the required file. These features from the test images are then used to identify and classify the tumor as benign or malignant. An interface is prepared based on this algorithm. Here we are using GUI(GRAPHICAL USER INTERFACE) along with the SVM(support classifying the MRI images into timorous or non-tumors.

higher .To make the whole procedure easy and fast .The proposed system is to detect and classify the brain tumor, which involves pre-processing, demising, segmentation, feature extraction and classification stages. The software and device that are used for implementing this proposed system is MATLAB R2017b with Intel core i5 processor and 16GB RAM capability. Specimen images were collected from PSGIMS&R, PSG Hospitals, Coimbatore which is used for training and testing the proposed system. The MRI image dataset that is obtained from PSGIMS&R consists of 10 different cases in which a few sample cases are taken as the input for detection and classification. After consultation with the radiologist, the axial T2 FLAIR weighted, digitized in 512´512, 12 bit per pixel images from the MR Avanto 1.5 T MRI scanner was selected as the input data. The first stage classifies a normal and abnormal image into two classes. Two metrics were calculated to evaluate the classification efficiency: (a) the training performance (i.e. the proportion of cases properly classified in the training process) and (b) the test performance (i.e. the proportion of cases properly classified in the testing process). Initially the MRI image is taken as the input and it is preprocessed using wiener filter. The wiener filter would remove the noise present in the image, and it would blur the image. The pre-processing stage is followed by Demising, where Edge Adaptive Total Variation technique is used. The main objective of the demising is to eliminate the unwanted signal present in the input image. The demised image is further taken to the Segmentation process in which Mean Shift Clustering is used to cluster the pixel that are of similar properties. Finally, the clustered output is used for extracting the features which is done in feature extraction phase and the extracted features are used for classification of tumor. In the

ADVANTAGES OF PROPOSED SYSTEM

This research paper presents a method based on image characteristics and automatic detection of abnormalities to automatically classify medical images in two classes Normal and Abnormal. Statistical texture functionality is derived from normal and abnormal pictures.

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V. (BLOCK DIAGRAM)

FLOW CHART:

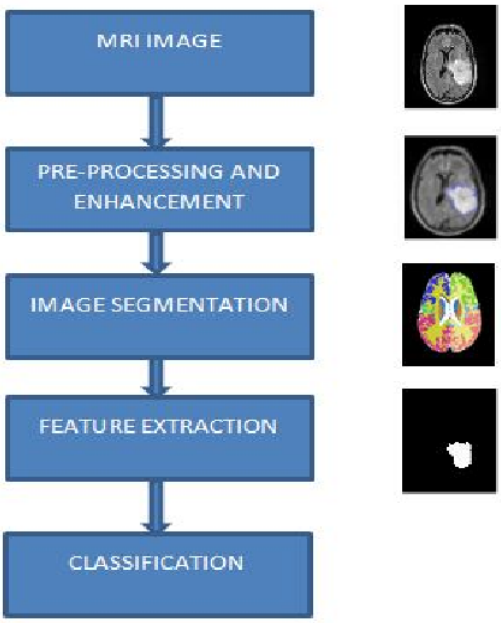
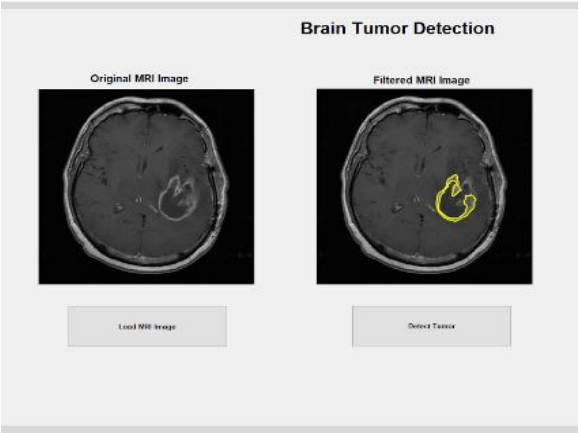


Figure 1.Steps for image processing

Brain tumor detection incorporates four main stages namely Preprocessing, Segmentation, Feature Extraction and Classification.

A.Input MRI image Imaging techniques help doctors, medical practitioners and researchers view inside the human body and analyze internal activities without lot of unwanted and irrelevant parts in its actual images.MRI are influenced by Rician noise.[33]



Input MRI image

different treatments. The brain imaging techniques can be categorized into two types: Structural imaging consists of different measures related to brain structure, tumor location, injuries and other brain disorders. The functional imaging techniques detect metabolic changes, lesions on a finer scale and visualizebrain activities. This activity visualization is possible due to metabolic changes in a certain part of the brain which are reflected in the scans. CT and MRI are used for brain tumor analysis and are able to capture different cross-sections of the body without surgery.

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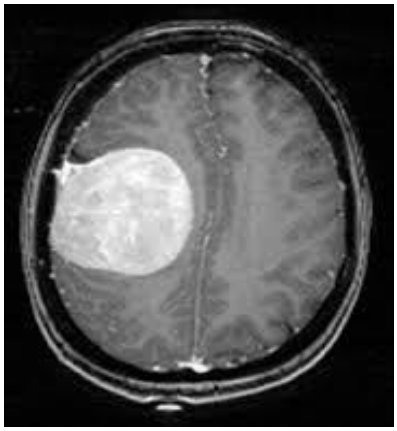
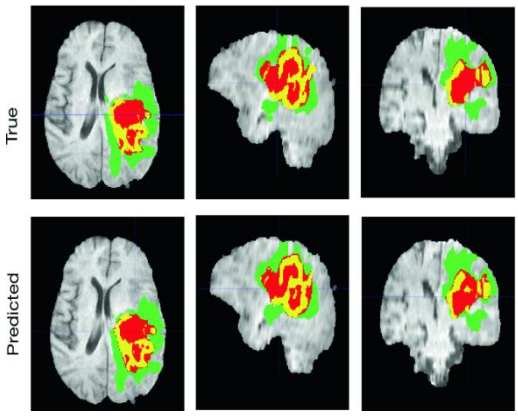
B. Preprocessing



Preprocessing image

In medical field it is essential to get precise images for accurate observations of disease. Quality of medical images depend upon the sources of artifact acquisition such asRician noise is signal dependent and it is challenging to remove it. Image preprocessing techniques like filtering, contrast enhancement, skull stripping are used to retain original image properties.

C. Segmentation



Segmented Image

It is used to extract Region of Interest (ROI) from digital images. It is crucial to separate out tumor region from brain MRI. Different supervised and unsupervised techniques like threshold, soft computing, atlas based, clustering, neural network etc. exist for segmentation. Threshold includes adaptive, global, Otsu's, histogram based threshold methods. Unsupervised clustering techniques include K-means, Fuzzy C means. It gives effective segmentation of brain MRI into Gray Matter (GM), White Matter (WM),CerebrospinalFluid(CSF).Segmentation is also performed using bio inspired algorithms like Particle Swarm Optimization (PSO)[6],GeneticAlgorithm(GA)[14].Advances in segmentation shows that deep learning architectures like CNN, Mask-RNN, Unit .

D. Feature Extraction

In feature extraction various features like shape, texture, wavelet, Gabor features are extracted from MRI. Gray-Level-Co-occurrence Matrix (GLCM) is used by most of the researchers. It is second order statistical method which can give texture features like energy, correlation, contrast etc.[5].Wavelet features are extracted using Discrete Wavelet Transform(DWT).It is

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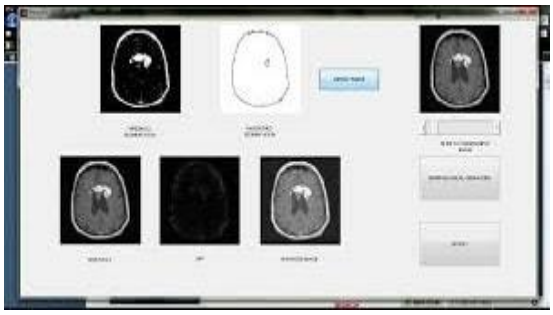

Extracted Image

Applied raw image, approximation coefficient extract & selected feature vector.

E. Classification

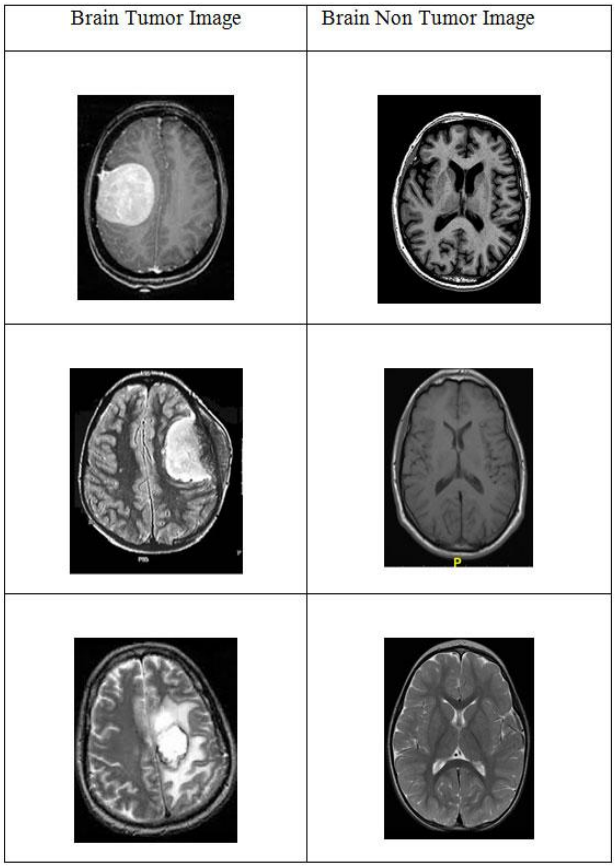

Figure 2: CNN based classified results

Classification of brain Image

Brain tumors are mainly classified as benign and malignant tumors. Malignant tumors are further divided into types Glomma, Meningioma and Pituitary.

VI. FUTURE SCOPE

In future this technique can be developed to classify images for ovarian breast, lung, skin tumors. Instead of rectangular boxes can work with general boundaries level set based frame work.

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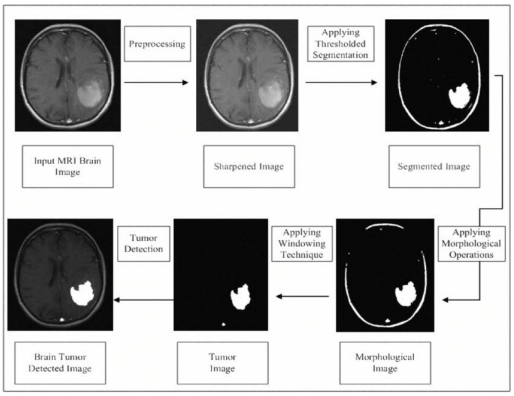
VII. RESULT

Different Angle of brain Image



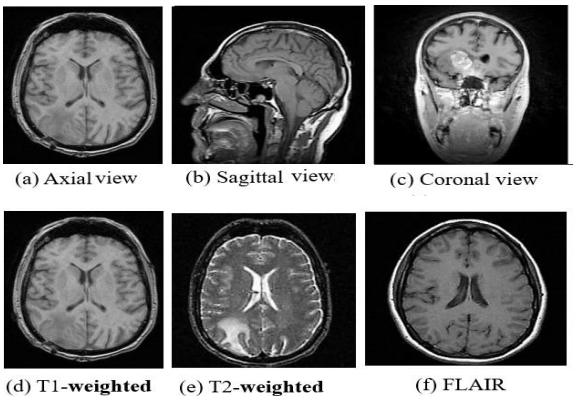
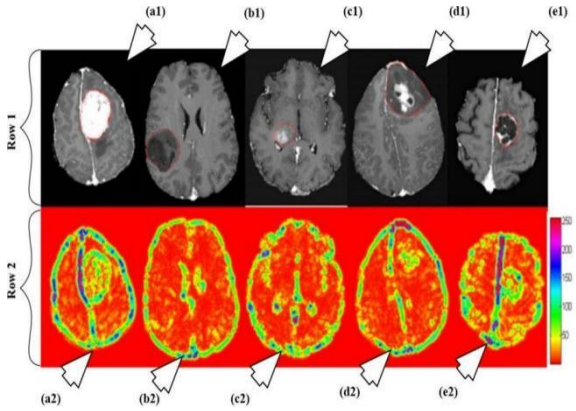
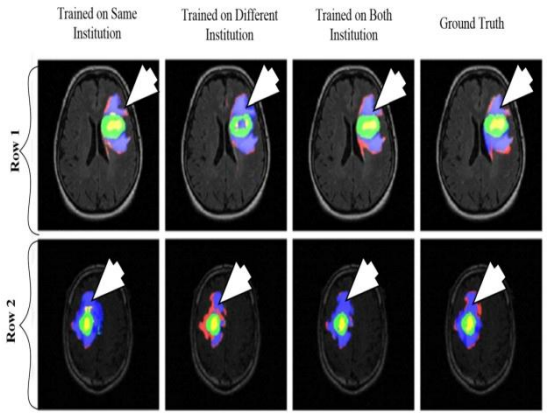


Illustration of different types



Segmentation Results from Two Different Patients



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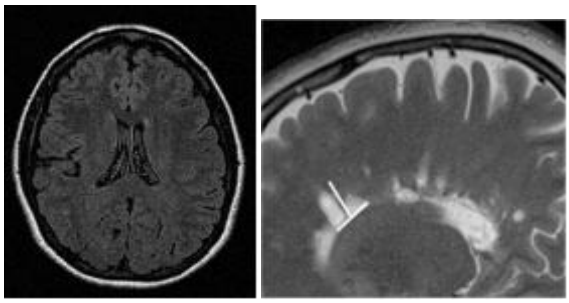
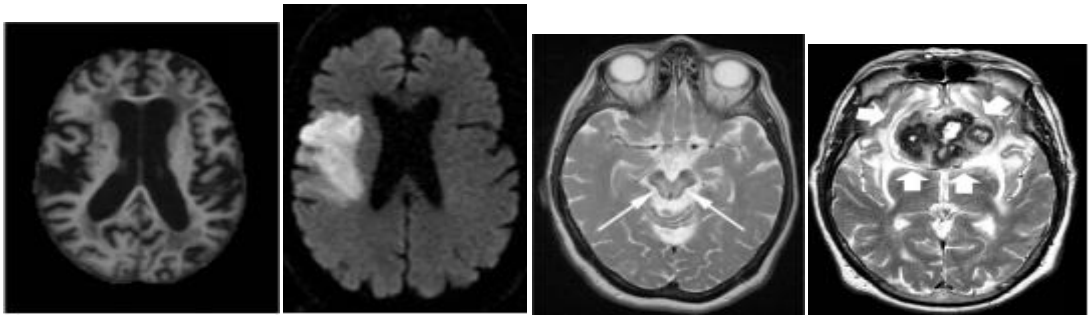
Different brain disorders



Normal brain multiple sclerosis



S t r o k e P a r k i s

Output Image

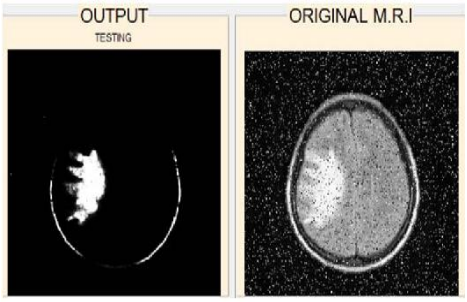


Fig. 10. Segmentation after Median filter.

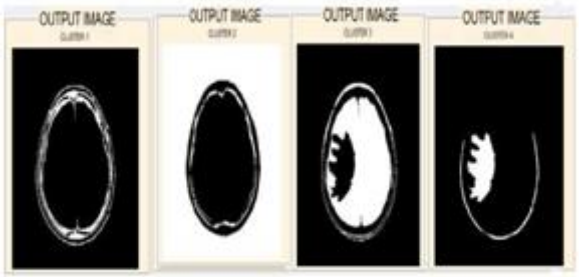


Fig. 13. The output of k-means clustering algorithm.

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VIII. CONCLUSION

The In summary, we propose a CNN-based method for segmentation of brain tumors in MRI images. There are several existing of techniques are available for brain tumor segmentation and classification to detect the brain tumor. There are many techniques available presents a study of existing techniques for brain tumor detection and their advantages and limitations. To overcome these limitations, propose a Convolution Neural Network (CNN) based classifier. CNN based classifier used to compare the trained and test data, from this get the best result.

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