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Fuzzy-Transform based Early Detection of Brain Tumour

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Abstract: Early detection of brain tumor is intricate job as well as tumor segmentation studies based on MRI imaging are attracting more and more attention in recent years. For detection of unusual growth of tissues and block of blood in nervous system can be seen in an MRI image. The first step of detection of brain tumor is to check symmetric and asymmetric shape of human brain which will define the abnormality. After this step next step is segmentation based on two techniques. 1) Fuzzy transform 2) Morphological operations. These operations are performed to delineating brain tumor boundaries and calculate the area of tumor. The F-Transform is a professional intelligent method to handle uncertain information and to extract salient edges.

Keywords: Image segmentation, brain tumor, fuzzy transform, morphological operation.

I. INTRODUCTION

Medical image processing is that the greatest challenging and developing field. Now a day's processing of MRI images is one among the parts of this field. The measureable analysis of MRI brain tumour allows obtaining valuable key indicators of disease progression. Brain tumours are defined because the unusual growth of the tissues. Brain tumours are often either primary or secondary. Primary tumours are composed of cells a bit like people who belong to the organ or tissue where they begin . Tumours can disturb any a part of the brain and subject on what parts of the brain it distresses can muscle movement. Brain tumours are classified into Gliomas, Medulloblastoma, Ependymomas, CNS Lymphoma and Oligodendroglioma. Gliomas are the foremost frequent primary brain tumours in adults and account for 70% of adult malignant primary brain tumours.

II. RELEVANCE

Brain tumours are the leading explanation for childhood cancer deaths. Detection of brain tumour at an early stage might permit life-saving intervention. Clinical and preclinical diagnosis and evaluation of Brain cancers involve several imaging technologies including resonance imaging (MRI), Positron emission tomography (PET), and computerized tomography (CT), Ultrasound (US). brain tumour might influence a person at any age, and its impact on the body might not be an equivalent for each individual. brain tumour can affect individuals at any age. The impact on every individual might not be same. thanks to such a posh structure of human brain, a diagnosis of tumour area in brain is challenging task.

III. LITERATURE REVIEW

A. Automated Segmentation and Detection of brain tumour from MRI: In this paper [1], author proposed method used for segmentation of brain tumours in MRI images supported convolutional neural networks. For cancer diagnosis the brain tumours segmentation is completed manually, from MRI images having great deal of knowledge generated in clinical routine which ends up in time task. It suggests using convolution neural networks (CNN) method for segmentation of brain tumours in MRI images.

In the diagnosis of brain tumour , determination of the precise location is a crucial task which helps to seek out out the form & size of tumour. In brain tumour detection techniques, image segmentation plays a energetic role. so as to extract tumour from MRI images of brain different image segmentation techniques are used For the rationale that segmentation of MRI provides the detailed information about the soft brain tissues like grey matter (GM), substantial alba (WM), cerebral cerebrospinal fluid (CSF) etc.[9]. There are two sorts of segmentation includes a manual segmentation and automatic segmentation.

B. MRI brain tumour Detection using cuckoo Search Support Vector Machines and Particle Swarm Optimization Based Feature Selection: In this paper [2], author proposed system for automated diagnosis, on basis of classification of resonance Imaging (MRI) human brain images. Wavelet Transform is employed for feature extraction. For feature selection Particle Swarm Optimization (PSO) is applied to decrease features size. To optimize support vector machine (SVM) parameters author utilize Cuckoo Search and Support Vector Machine (CS-SVM) model. SVM is applied to make the classifier.

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C. Detection and classification of HGG and LGG brain tumour using Machine Learning The proposed system [3] is meant for the precise detection and classification of normal and abnormal brain MRI's then the classification of the abnormal MRI's into HGG or LGG glioma tumour. Brain MRI is read by the system, then Otsu binarization is applied to convert the image into a binary image. then k-means clustering is applied for segmentation. Later, DWT and PCA are applied. Finally, SVM [4] is employed for classification. In stage 1, the pictures are classified into normal or abnormal MRI's. In stage 2, the abnormal MRI images are classified into HGG or LGG glioma tumour MRI.the image into a binary image.

D. Application of ANN and ANFIS for detection of brain tumour using DWT and GLCM texture analysis: In this work author combine different methodologies so as to develop algorithms for Computer-Aided Diagnosis (CAD) for brain tumors from the axial plane. All methods utilize texture analysis by extracting features from data , without post-processing, supported different techniques, like Gray Level Co-Occurrence Matrix (GLCM), or Discrete Wavelet Transform (DWT) and different classification methods, supported ANN or ANFIS. All of proposed methodologies are developed, validated and verified on various sub data including 65% non-healthy MRIS. the entire used database consists of 202 MRIs from non-healthy patients and 18 from healthy, segmented visually by an experienced neurosurgeon. Combining different subsets of features, our greatest results are by using 4 GLCM features for a input and two hidden layers ANN, giving sensitivity 100%, specificity 77.8% accuracy 94.3%. it's proved that the input file to coach such a CAD are considered to be unbiased if the ratio between healthy/un-healthy tissue MRIs is about 35%/65%, respectively.

E. Hybrid Approach for detection and segmentation using artificial BEE colony Optimization with FCM: In this paper , author proposed a system to acknowledge the tumour within the favourable stage. The clearness - Hence, the Fuzzy-C-Means (FCM) bunching is consolidated alongside Ant Colony Optimization, the FCM which aggregate the pixels of the tumor district into gatherings/groups. Arrangement is finished utilizing the development method therefore the time calculation is lessened.

IV. PROPOSED WORK

This work "F-Transform based early detection of brain tumour "proposes an algorithm for the early detection of brain tumour. This system provides an efficient way for diagnosis of the brain tumour. Proposed system consists of multiple phases.

A. Objectives

Objectives of proposed work are as follows:

1) This work is proposed to enhance the accuracy and reduce computational problems in already proposed algorithms.
2) The main purpose using F-transform is to control the amount of details appears in edge image and suppresses noise
3) It enhances the efficiency of system.

B. Scope

The brain tumour segmentation studies supported MRI are attracting more and more attention in recent years thanks to non-invasive imaging and good soft tissue contrast. Also it describes the proposed approach for detection and extraction brain tumour from MRI scan images of brain.

The overview of proposed system is shown in Flow Dia.

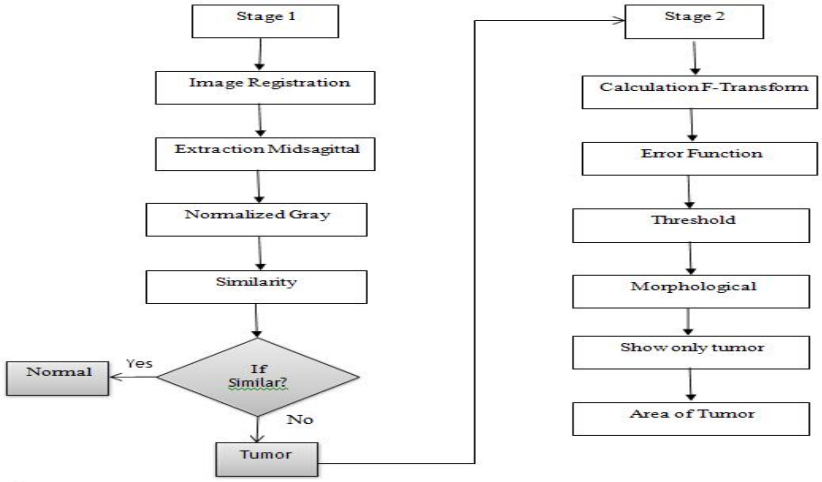


Fig 1. Flow Diagram of proposed work

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C. Methodology

Selecting an appropriate, proven methodology is vital step in any research endeavour. to guage the performance of proposed work we'll design a simulation model. the planning steps in simulation model are as below:

1) *Stage-I*

a) *Image Registration:* To insure that brain image within the middle. If not then image alignment operation performed to urge brain image in middle.

b) *Extraction Midsagittal:* This system wont to separate brain into left and right hemispheres. By this system human brain is split into two equal left and right parts.

c) *Normalized Gray:* during this the normalized gray level histograms of left and right hemispheres is calculated.

d) *Similarity Measures:* By using five symmetry measures i.e. 2-D correlation, Root Mean Square Error (RMSE), Average Gradient (AV), Entropy, Variance Distance the similarity between two parts is calculated. After analysing above five parameters, judge the info as normal or with suspicious tumours consistent with quantified similarity value of every symmetry measure. The degree of asymmetry is going to be carefully considered as indication of pathology.

2) *Stage-II*

a) *Calculation of F-transform:* Calculate F[u] the direct F-transform of image and Calculate unn – the inverse F-transform using the components F[u].

b) *Error Function:* Calculate the error function Rescale and around the values of e.

c) Compute the edge value of segmentation purpose.

d) *Morphology:* After applying threshold we've to use morphology to urge tumour area.

e) Show only tumour area by square and take away all other components.

f) Area of tumour is calculated by using horizontal dimension and vertical dimension

3) *Stage-III*

Performance Evaluation Parameters

a) *Accuracy:* To calculate accuracy we'd like to look at algorithm on a minimum of ten images then collectively claim the accuracy.

b) *Precision:* Same thing about precision we'd like to look at quite ten images to calculate precision.

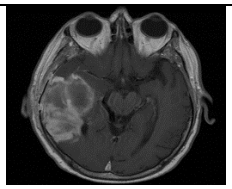
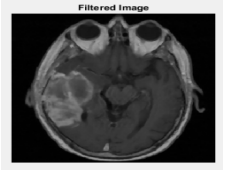
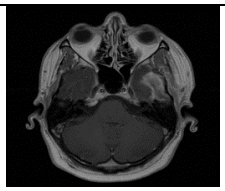
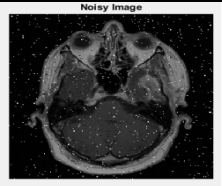
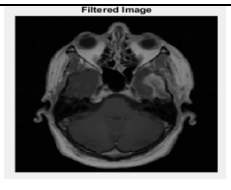
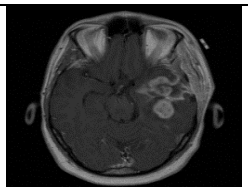
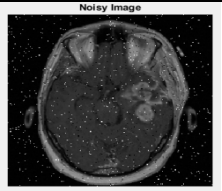
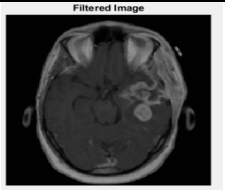
4) *Stage-IV*

a) Performance of proposed work is validated with real time images.

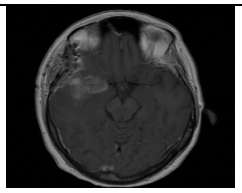
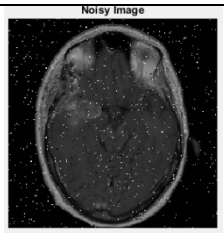
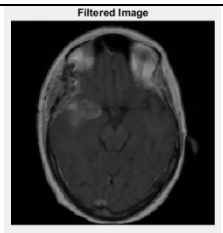
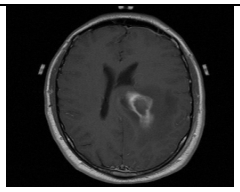
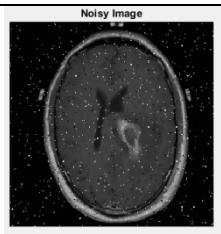
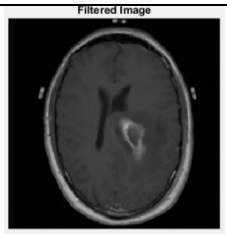
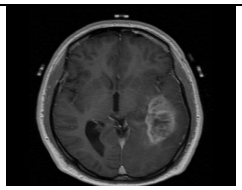
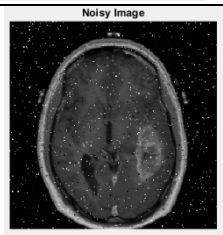
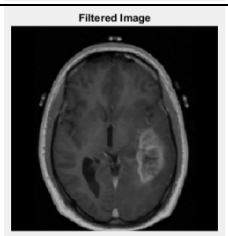
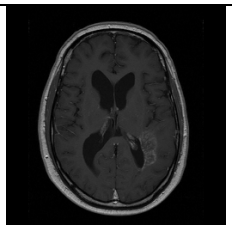
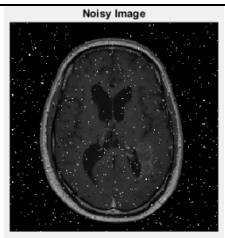
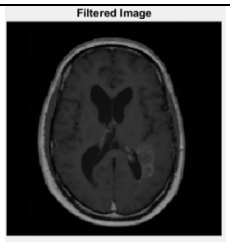
V. EXPERIMENTAL RESULTS

A. Pre-processing of Image

Pre-processing is a common name for operations with images. The aim of pre-processing is an improvement of image data that suppresses unwanted distortions or enhances some image features important for further processing.

Input image	Noisy Image	Filtered Image
		
		
		

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Input image	Noisy Image	Filtered Image
		
		
		
		

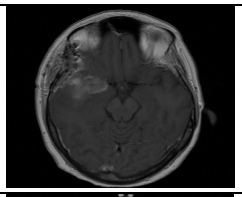
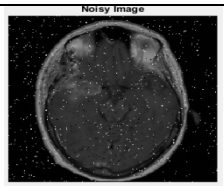
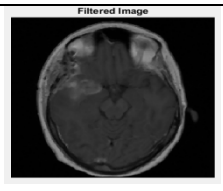
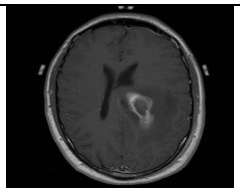
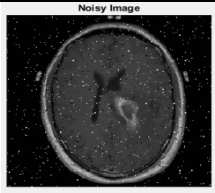
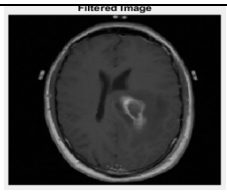
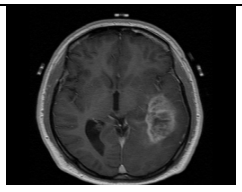
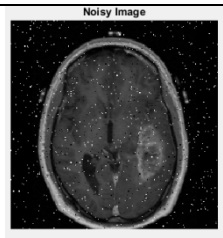
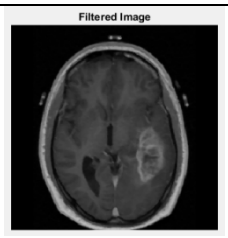
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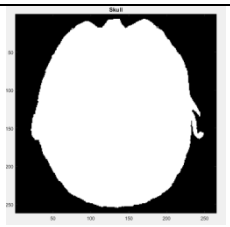
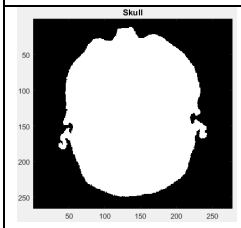
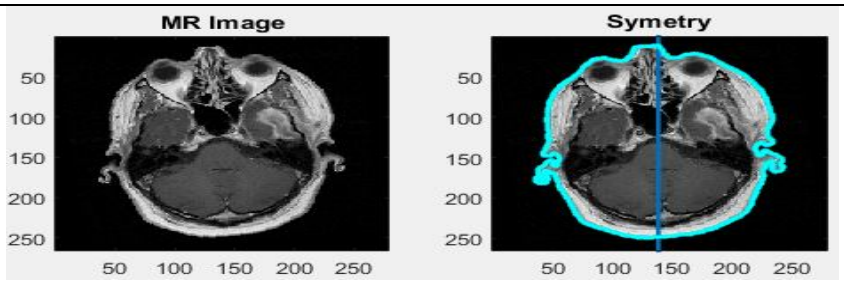
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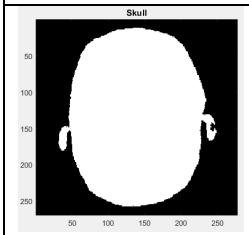
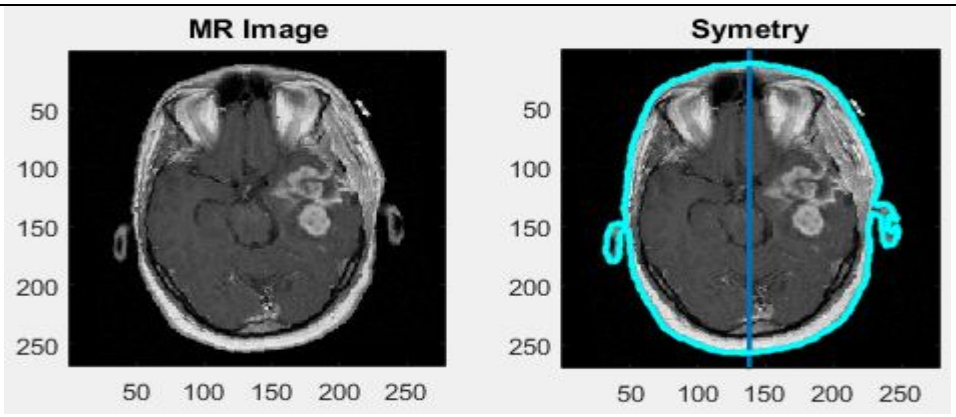
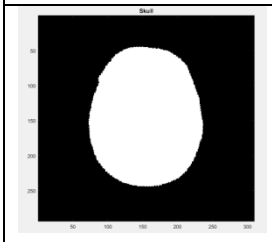
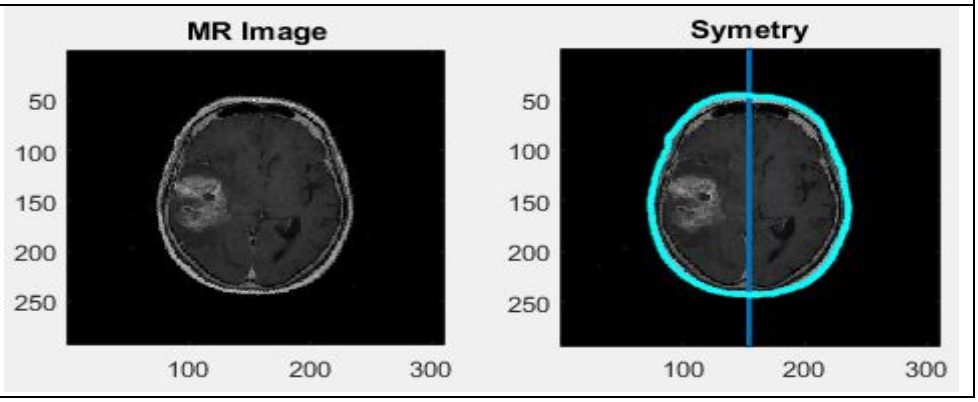
B. Extraction of Midsagittal Plane

Skull detection is an useful technique for segmenting the brain. The skull detect contains series of sequential steps including image enhancement to enhance performance, background removal, histogram based thresholding and morphological operation.

The brain is most complex organ in physical body which will split into two approximately symmetrical hemispheres employing a plane. This plane is understood as midsagittal plane.

It separate brain into left and right hemispheres. By this system human brain is split into two equal left and right parts.

Skull detect	MRI IMAGE
	
	

Skull detect	MRI IMAGE
	
	

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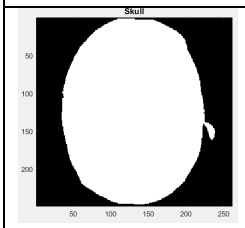
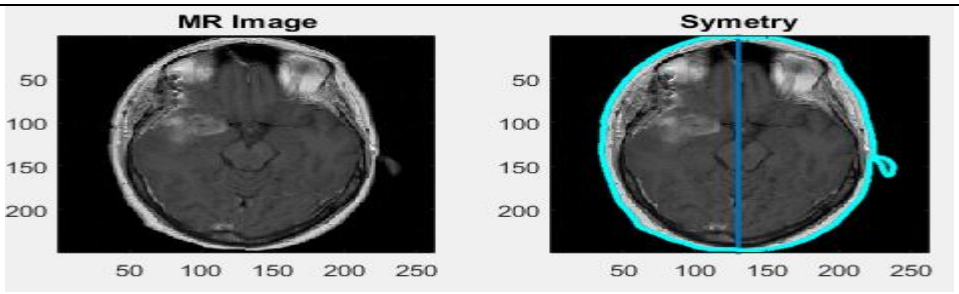
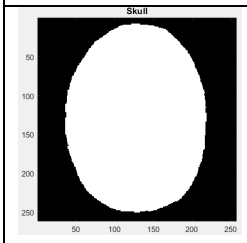
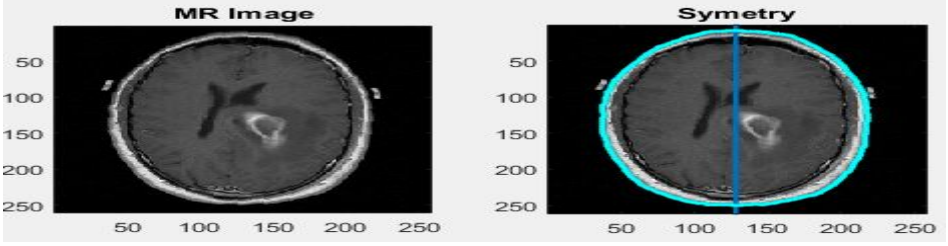
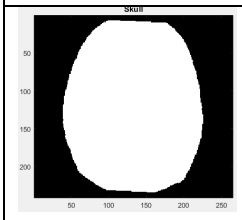
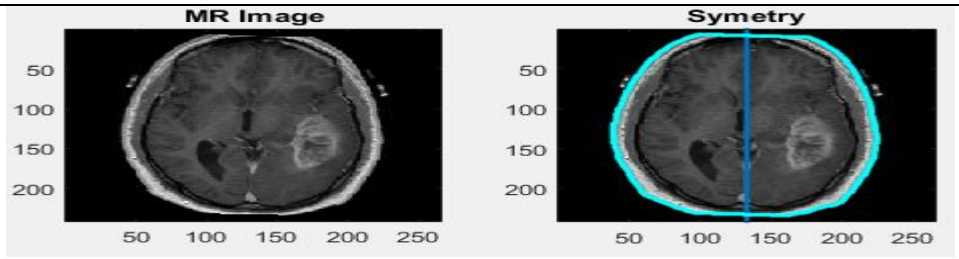
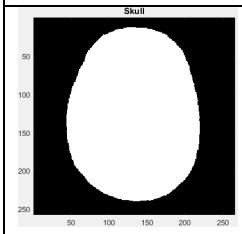
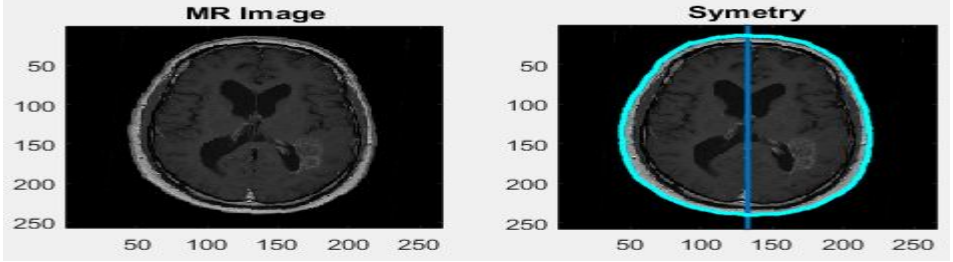
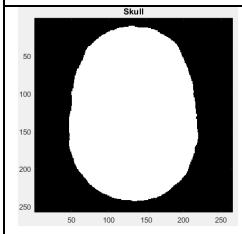
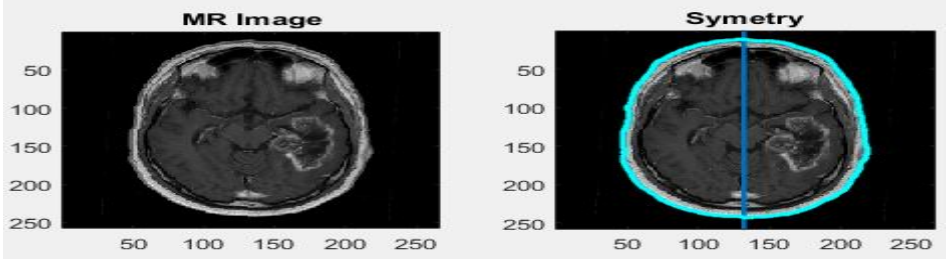
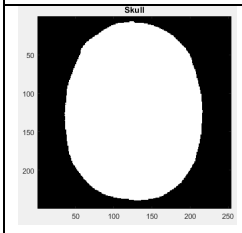
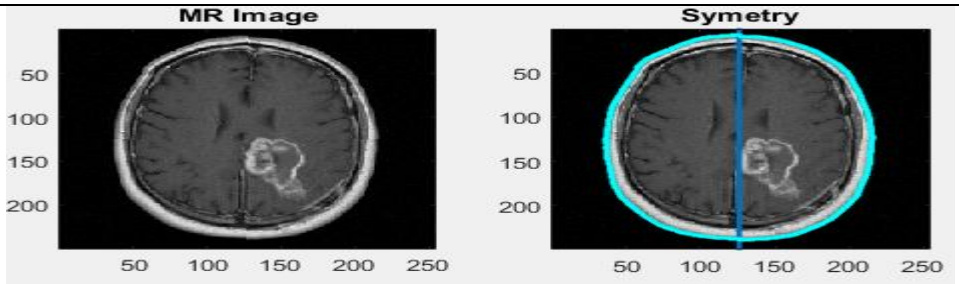
Skull detect	MRI IMAGE
	
	
	
Skull detect	MRI IMAGE
	
	
	

Table.2 Extraction of midsagittal plane

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C. Brain Tumour Detection

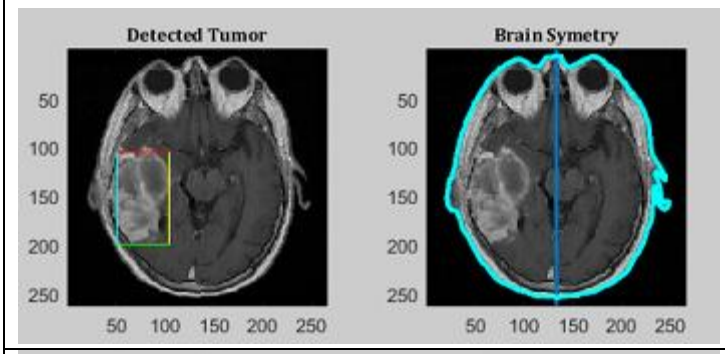
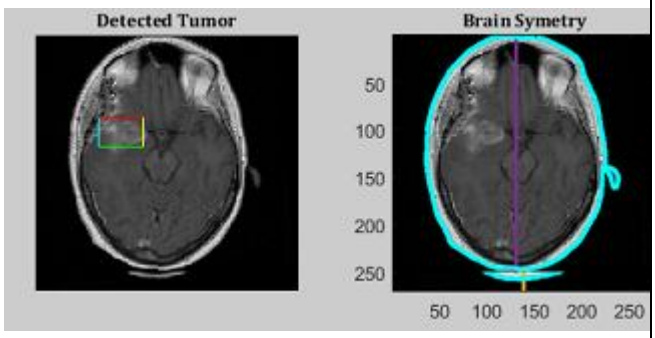
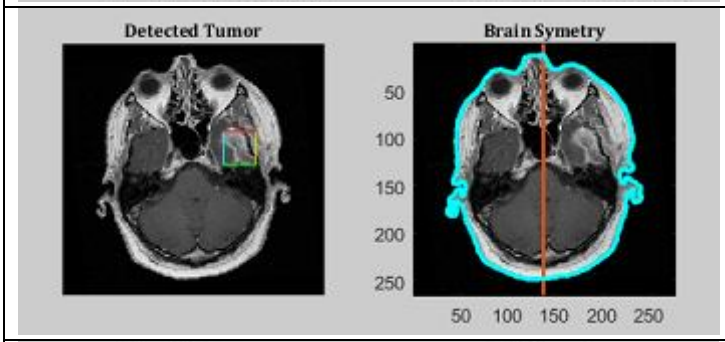
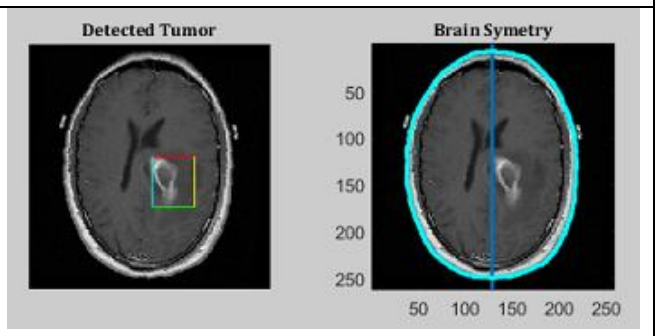
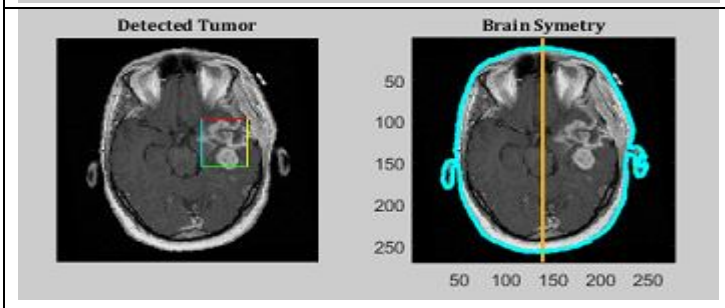
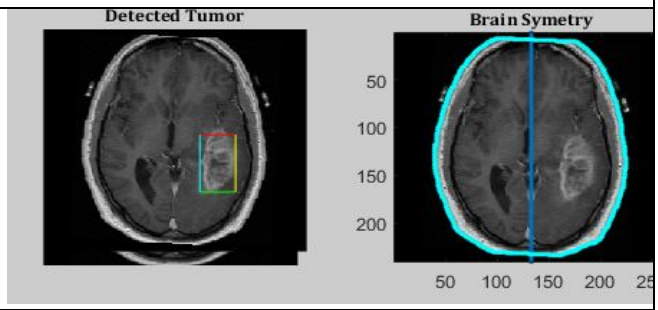
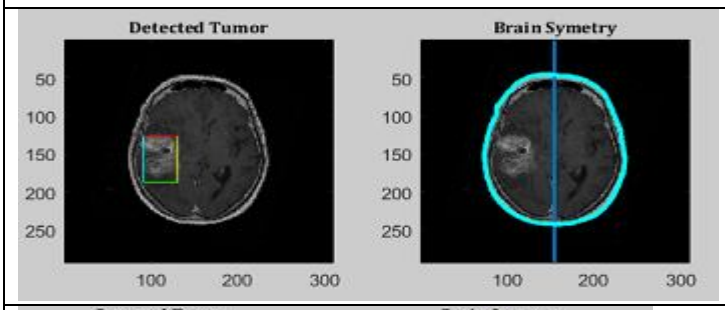
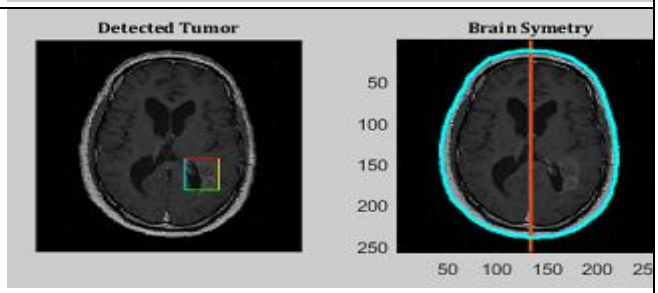
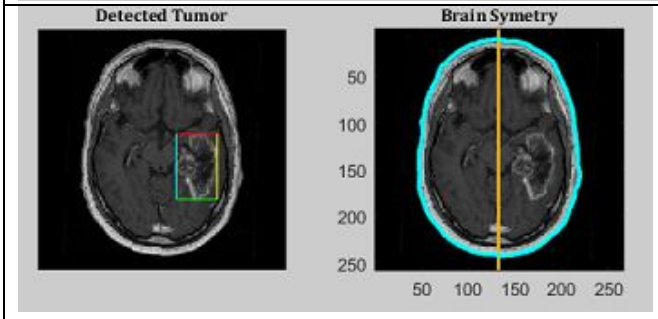
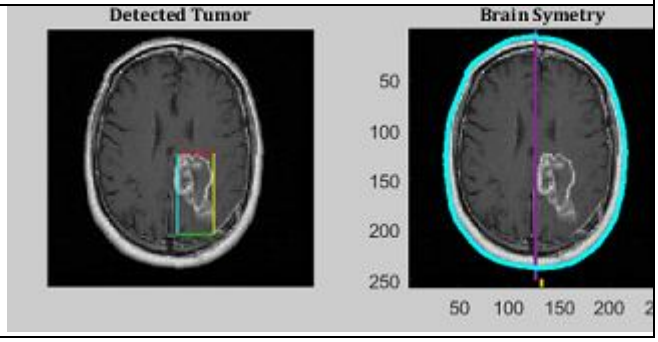
Detected Tumor	Brain Symmetry	Detected Tumor	Brain Symmetry
			
			
			
			
			

Table.3 Brain tumour detection

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VI. CONCLUSION AND FUTURE SCOPE

The speed of detection is improved after using asymmetry of brain. The developed brain tumour detection system is expected to provide valuable diagnosis techniques for the physicians.
After evaluating performance we can say that the proposed algorithm has been found to be performing well.

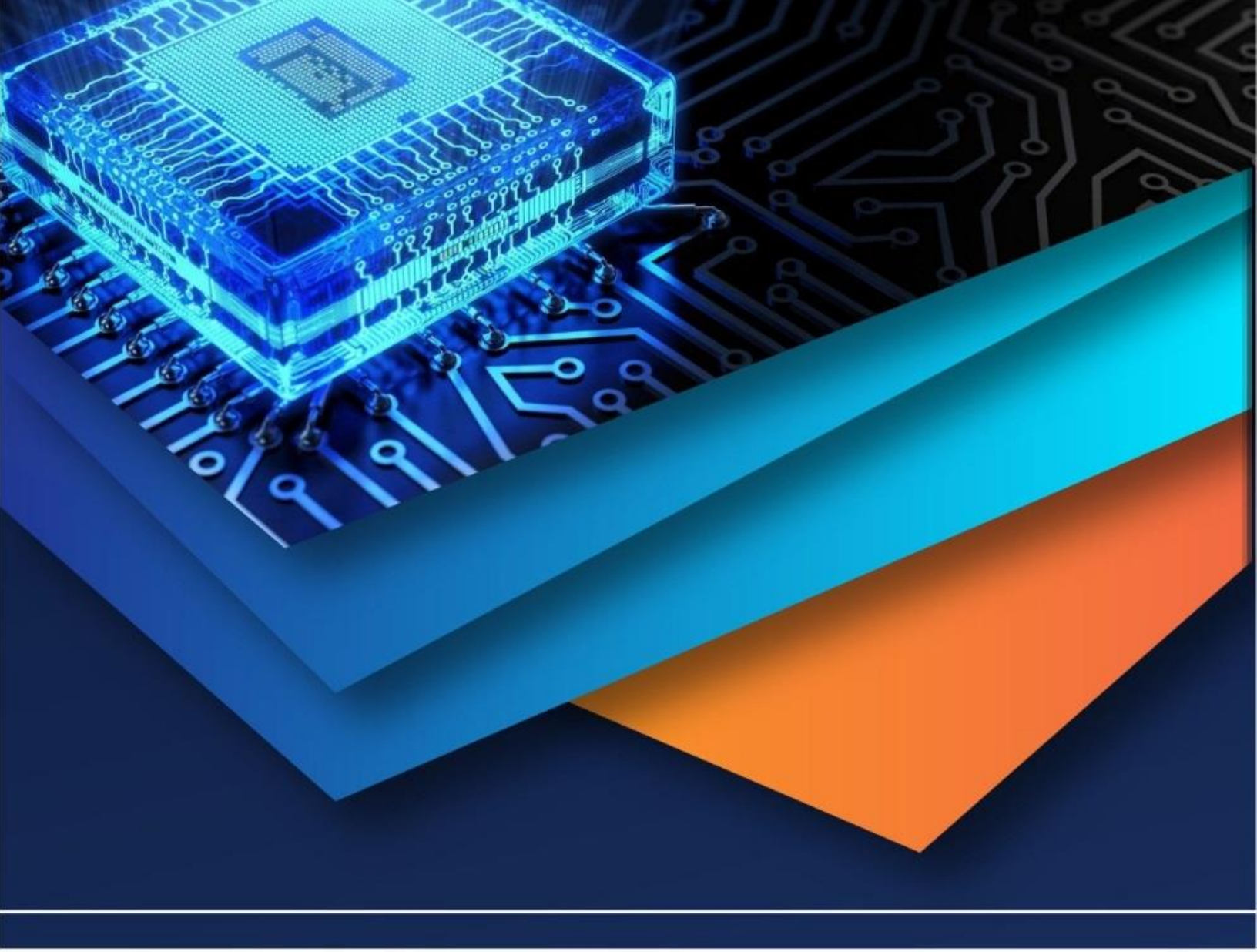
VII. ACKNOWLEDGEMENTS

We would like to express our gratitude towards all those who help us to complete this paper.

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