IJSRCSEIT
International Journal of Scientific Research in Computer Science, Engineering and Information Technology
 | Volume 2 | Issue 1 | ISSN : 2456-3307

Automatic Classification and Detection of Brain Tumor with Fuzzy Logic and MFHWT

Navjot Jyoti
Assistant Professor, Department of Computer Science & Engineering, Northwest Group of Institutions, Dhudike, Moga, Punjab, India

ABSTRACT

Brain tumor is connecting abnormal mass of tissue within human brain. The Accurate and early detection of tumor is very necessary for doctors to prevent permanent damage to brain. The main task of the doctors is to detect brain tumor which is time consuming for which they feel burden. So Automatic brain tumor detection is boom to doctors for aiding to diagnose malignant in brain. In the current paper we are going to present the automatic technique by using MFHWT and Fuzzy to detect Tumor. The algorithm present in this paper reduces extraction steps through enhancement the contrast in tumor image by processing the mathematical morphology. The segmentation and the localisation of suspicious regions are performed by applying the region growing marking then feature extraction with MFHWT Finally Fuzzy algorithm is implemented to extract the tumor.

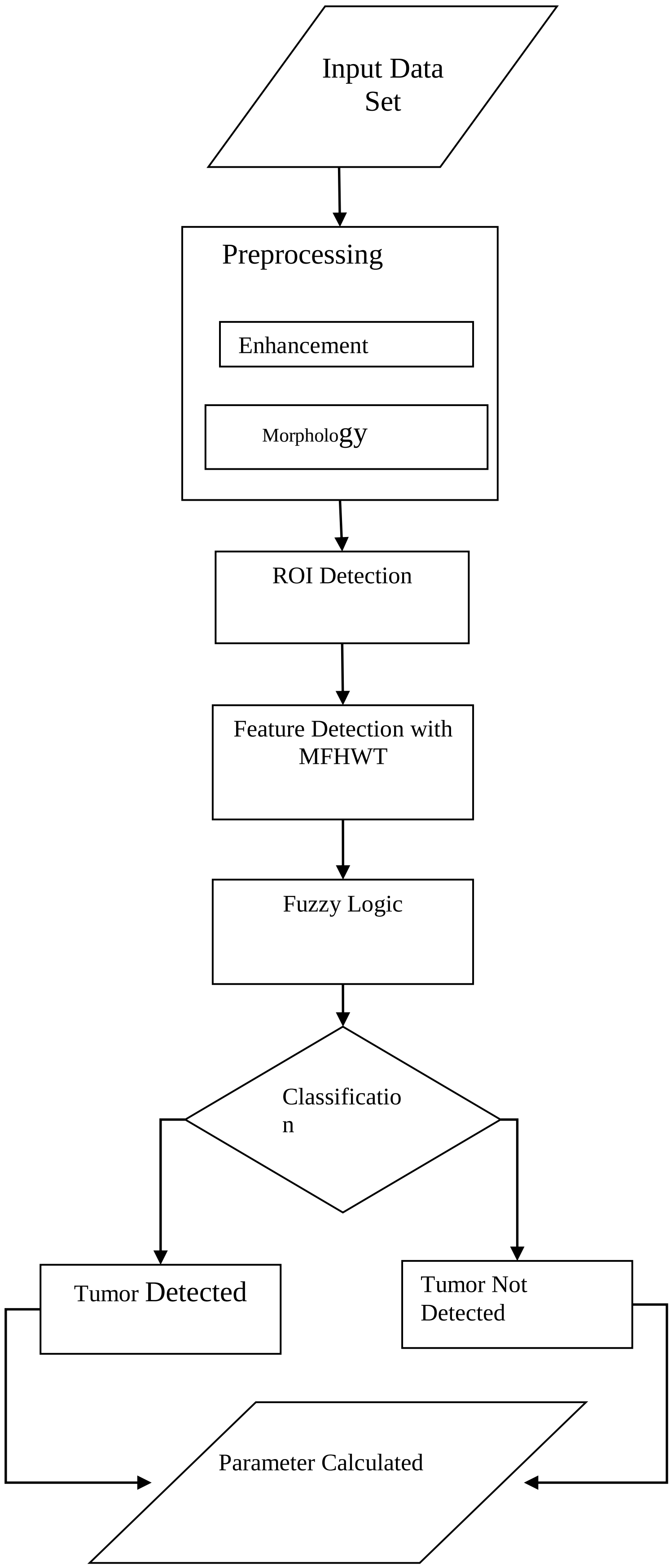
Keywords : Brain Tumor, Detection, Classification, Fuzzy, Harrwave, Segmentation, Mathematical Morphology

I. INTRODUCTION

Brain tumor is connecting abnormal mass of tissue within human brain. In case of tumor some cells grow and reproduce uncontrollably, apparently unregulated by the mechanisms that manages and control normal cells of brain. The expansion of a growth takes up area inside the bone and interferes with all normal brain activities. That's way detection of the tumor is very necessary in earlier stages for doctors to prevent serious damage. Number of techniques was developed for detection of tumor in brain. A brain tumor is associate intracranial solid growth. Many university centers are focused on the issue because of the fact that cerebral cancer is spreading among the world population. For example in the US, nearly 3000 children are diagnosed with brain tumors. Almost half will die within five years, making it the most fatal cancer among children [1]. They're created by associate abnormal and uncontrolled organic process, typically within the brain itself, however conjointly in lymphoid tissue, in blood vessels, within the bone nerves, within the brain envelopes. Due to its negative effects on affected people, the cancer diseases constitutes a high burden on national economy and a source of suffering for the family as well as the society [2].To identify tumor and accurate data regarding the size, position and type of a tumor, a patient will endure many medical tests like Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). All this obtained knowledge is very useful to doctors for proper diagnosis and treatment of this cruel decease. From all above mention medical images technique, Magnetic resonance imaging (MRI) is the main imaging technique for evaluation of the brain tumor growth before and after surgery. Detecting brain tumors in MRI images is an important yet time consuming task performed by medical experts. Automating this process is really a very difficult task due to the often high degree of textural similarity between healthy brain tissue and tumor area. Main aim of this paper is to present the automatic technique for tumor detection which more accurate and less time consuming than any other manual method.

II. PROPOSED METHOD FOR TUMOR DETECTION

A brain tumor is an abnormal and uncontrollable growth of tissues in the human brain.A brain tumour is a localized intracranial lesion which occupies space with the skull and tends to cause a rise in intracranial pressure. Depending on their behaviour, brain tumour can be classified into two main categories as either benign or malignant. A benign brain tumor grows slowly, has distinct boundaries, and rarely spreads. On the other hand a malignant brain tumor grows quickly, has irregular boundaries, and spreads to nearby brain areas. The early diagnosis and proper treatment of brain tumors are essential to prevent permanent damage to the brain or even patient death. Accurate data regarding the position of the tumor and its size are essential for effective treatment. Hence, an entirely computerized automatic system to provide accurate tumor data is really compulsory for physicians. The primary task of the neurosurgeon is to detect brain tumor which is time consuming process by which they feel burden. To overcome this situation Automatic brain tumor detection has become boon to doctors for aiding to diagnose malignant in brain. Numbers of methods are given to get correct results. The seed method somewhat achieve its goal but if seed marking is not proper then it may give wrong results and hence wrong diagnoses of selected area may come out. Thus this method needs further improvement with other classifiers and fuzzy rule set. In Fig1 represent work flow of proposed method



2.1. Pre Processing

In this proposed detection system, pre-processing is performed to remove noises from the MRI brain images. The algorithm reduces extraction steps through enhancement the contrast in tumor image by processing the mathematical morphology. It uses following steps for image Enhancement:

a) Gaussian
b) Median
c) Contrast adjustment

Fusion of all enhanced images to get single image.

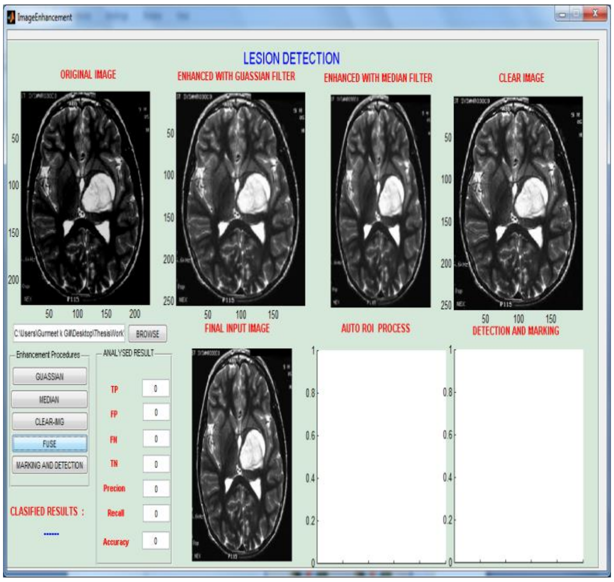


Fig.2. Pre processing of input image using enhancement method

2.2. Segmentation

Region growing segmentation is used for segmentation in this process. It is simple region-based image segmentation and it is also classified as a pixel-based image segmentation method since it involves the selection of initial seed points. This approach to segmentation examines neighboring pixels of initial seed points and determines whether the pixel neighbors should be added to the region

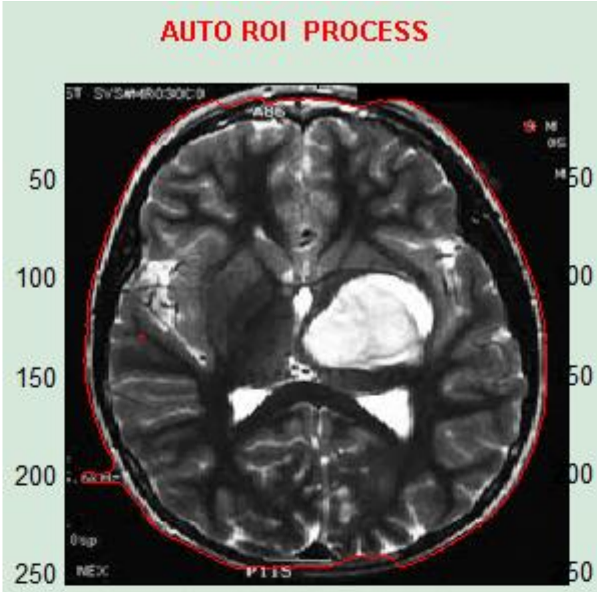


Fig.3. Shows Region growing Marking

2.3. Features Extraction

In this system, Mathematical morphology and MFHWT is to be used to extract features from MRI images. Morphology is basically study regarding shapes. It mainly deals with the mathematical theory of describing about shapes using changed sets. In image processing, mathematical morphology is used to investigate the interaction between an image and a certain chosen structuring element using the basic operations of erosion and dilation. The Haar transform is one of the simplest and basic transformations from the space/time domain to a local frequency domain, which reveals the space/time-variant spectrum. The attracting features of the Haar transform, including fast for implementation and able to analyse the local feature, make it a potential candidate in modern electrical and computer engineering applications, such as signal and image compression.

2.4 Various Parameters in Tumor Detection:

The tumor's detection results are evaluated based on various parameters, including Sensitivity or True Positive rate (TPR), True Negative rate or specificity (SPC), Positive predictive value or precision(PPV),Fall-out or False Positive Rate (FPR), False negative rate (FNR), Accuracy(ACC). These metrics are based on the consideration that a test point always falls into one of the above four mention categories. Sensitivity and specificity are statistical measures of the performance of a binary classification test, also known in statistics as classification function.

The evaluation metrics of sensitivity, specificity and accuracy can be stated in the terms of TP, FP, FN and TN.

2.4.1 Sensitivity: - Sensitivity refers to the test's ability to correctly detect patients who do have the condition. Consider the example of a medical test used to identify a disease. The sensitivity of the test is the proportion of people who test positive for the disease among those who have the disease. A negative result in a test with high sensitivity is useful for ruling out disease. A high sensitivity test is reliable when its result is negative, since it rarely misdiagnoses those who have the disease. A test with 100% sensitivity will recognize all patients with the disease by testing positive. A negative test result would definitively *rule out* presence of the disease in a patient. A positive result in a test with high sensitivity is not useful for ruling in disease. Suppose a 'bogus' test kit is designed to show only one reading, positive. When used on diseased patients, all patients test positive, giving the test 100% sensitivity. However, sensitivity by definition does not take into account false positives. The bogus test also returns positive on all healthy patients, giving it a false positive rate of 100%, rendering it useless for detecting or "ruling in" the disease.

Sensitivity is not the same as the precision or positive predictive value (ratio of true positives to combined true and false positives), which is as much a statement about the proportion of actual positives in the population being tested as it is about the test.

The calculation of sensitivity does not take into account indeterminate test results. If a test cannot be repeated, indeterminate samples either should be excluded from the analysis (the number of exclusions should be stated when quoting sensitivity) or can be treated as false negatives (which gives the worst-case value for sensitivity and may therefore underestimate it).

A test with high sensitivity has a low type II error rate. In non-medical contexts, sensitivity is sometimes called recall. Mathematically it can be expressed as:-

Sensitivity = TP/(TP + FN)

2.4.2 Specificity

Specificity relates to the test's ability to correctly detect patients without a condition. Consider the example of a medical test for diagnosing a disease. Specificity of a test is the proportion of healthy patients known not to have the disease, who will test negative for it. A positive result in a test with high specificity is useful for ruling in disease. The test rarely gives positive results in healthy patients. A test with 100% specificity will read negative, and accurately exclude disease from all healthy patients. A positive result signifies a high probability of the presence of disease. A negative result in a test with high specificity is not useful for ruling out disease. Assume a 'bogus' test is designed to read only negative. This is administered to healthy patients, and reads negative on all of them. This will give the test a specificity of 100%. Specificity by definition does not take into account false negatives. The same test will also read negative on diseased patients; therefore it has a false negative rate of 100%, and will be useless for ruling out disease. Mathematically it can be expressed as:-

Specificity= TN/(TN+ FP)

2.4.3 Accuracy

Accuracy is the ratio of true results, either true positive or true negative, in a population. It evaluates the degree of veracity of a diagnostic exam on a shape.

Accuracy = (TN + TP)/(TN + TP + FN + FP)

III. RESULTS AND DISCUSSIONS

Medical imaging is the technique and process of creating visual representations of the interior of a body for clinical analysis and medical intervention, as well as visual representation of the function of some organs or tissues (physiology). Medical imaging seeks to reveal internal structures hidden by the skin and bones, as well as to diagnose and treat diseases. A brain tumor is an abnormal and uncontrollable growth of tissues in the human brain.A brain tumour is a localized intracranial lesion which occupies space with the skull and tends to cause a rise in intracranial pressure. The early diagnosis and proper treatment of brain tumors are essential to prevent permanent damage to the brain or even patient death. Accurate data regarding the position of the tumor and its size are essential for effective treatment. Hence, an entirely computerized automatic system to provide accurate tumor data is really compulsory for physicians. The inserting methodology makes a automatic brain tumor detection system based on Harr wave based fuzzy rule base system. Numbers of methods are given to get correct results. The seed method somewhat achieve its goal but if seed marking is not proper then it may give wrong results and hence wrong diagnoses of selected area may come out. Thus this method needs further improvement with other classifiers and fuzzy rule set. In this research, an efficient detection of brain tumor has been introduced. It's based on mathematical morphology, segmentation. The algorithm reduces extraction steps through enhancement the contrast in tumor image by processing the mathematical morphology. The segmentation and the localisation of suspicious regions are performed by applying the region growing marking then feature extraction with MFHWT Finally Fuzzy algorithm is implemented to extract the tumor. Results are presented, using a real image of brain tumor as illustrative example, which indicate significant concordance. Although the performances of proposed algorithm has been demonstrated. The conclusion from all is this brain tumor segmentation and detection can be done technically using MATLAB Software.

To check out the performance of method for detecting tumors, the figures obtained using the proposed Methodology is compared with its corresponding image data sets. The proposed technique is analyzed using Parameter like TPR, FPR, FNR, TNR, Precision, Recall, and Accuracy to evaluate its performance. In this, results of all the intermediate steps of the proposed methods are highlighted. Implementation is done on MATLAB. Experimental results of intermediate steps show the efficiency of the proposed approach. Results includes following steps: Step 1: Figure 3.1 Run the application to show GUI

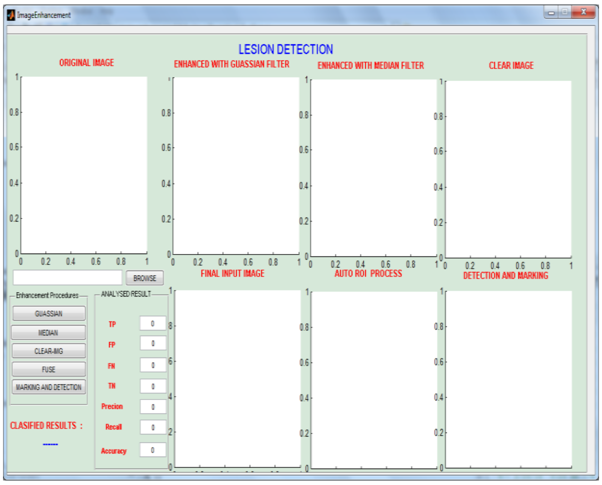
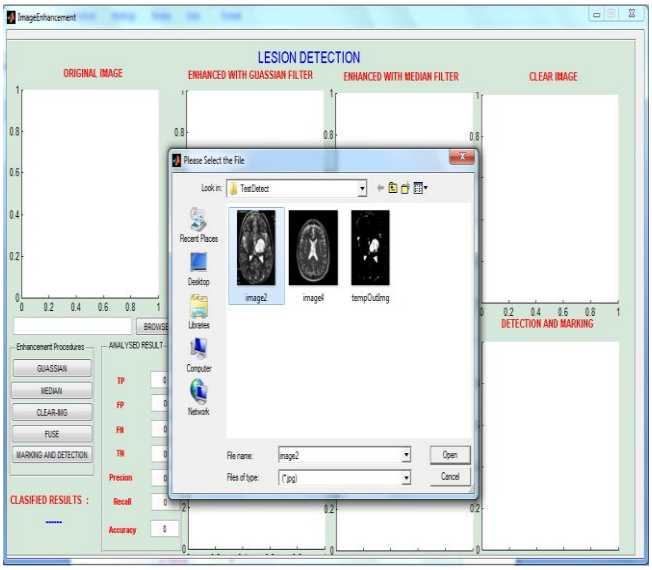
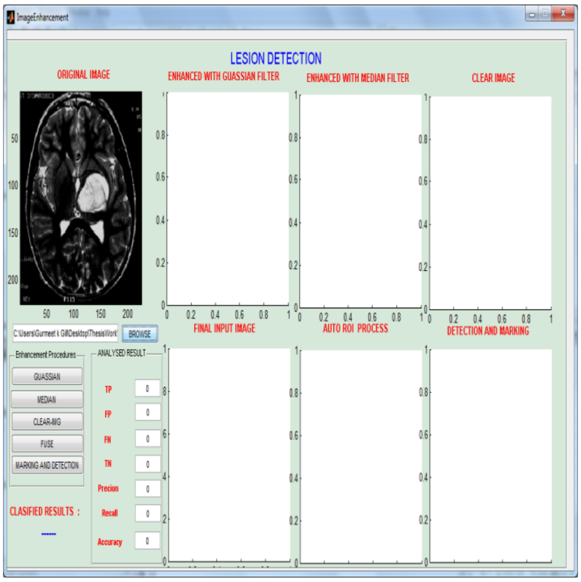


Fig 3.1 GUI of the proposed work

Step 2: load a MRI image which is used to detect lesion with the help of "Browse" button. In figure 3.2 input brain MRI image has been loaded



(a)



(b)

Figure 3.2(a) Browsing input image.

(b) Input image is loaded.

Step3 Image enhancement with following steps :

a) Gaussian
b) Median
c) Contrast adjustment

Fusion of all enhanced images to get single image

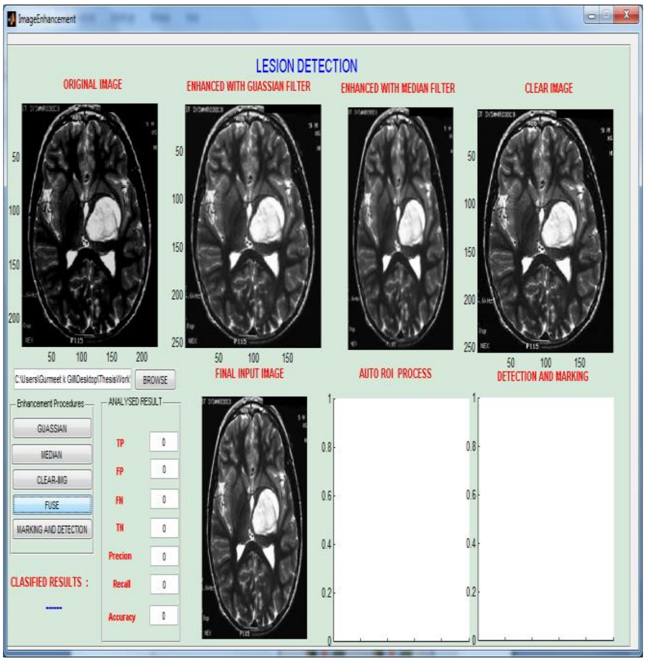


Figure 3.3: Image Enhancement

Step 4: Region marking, Mathematical morphology,

Feature detection and Classification.

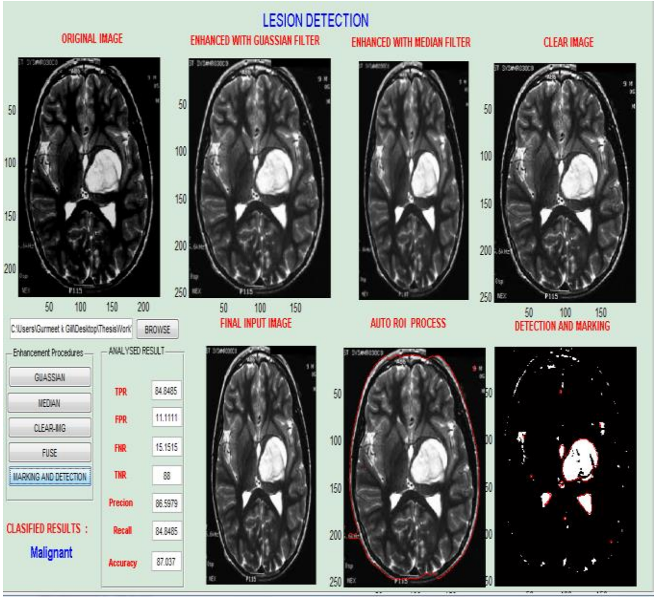


Fig.3.4. Type Malignant tumor detected and representing resulting parameters.

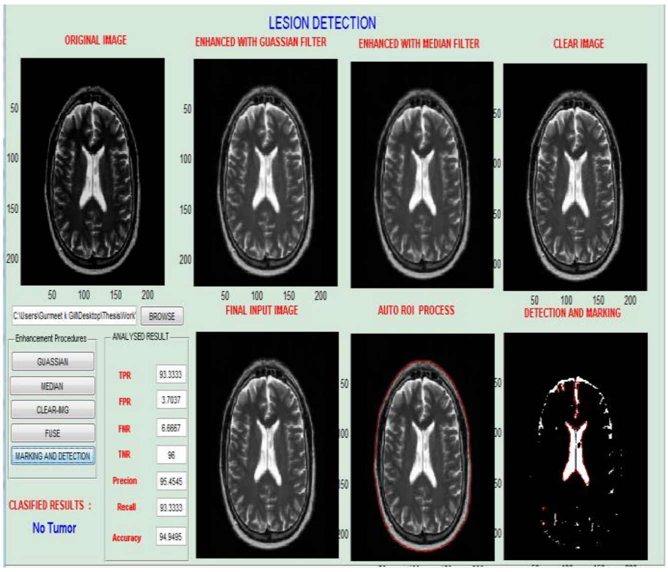


Fig.3.5. No tumor detected and resulting parameters.

IV. CONCLUSIONS & FUTURE WORK

It's based on mathematical morphology, segmentation. The algorithm reduces extraction steps through enhancement the contrast in tumor image by processing the mathematical morphology. The segmentation and the localisation of suspicious regions are performed by applying the region growing marking then feature extraction with MFHWT Finally Fuzzy algorithm is implemented to extract the tumor. Results are presented, using a real image of brain tumor as illustrative example, which indicate significant concordance. In future we will analyse larger size database with multiple patients so that it can be securitized properly.

V. REFERENCES

[1]. ABHIJEET ZAMRE, 2 TANVEER SHAH, et al, "Detection and Classification of Brain Tumor in MRI images" INTERNATIONAL JOURNAL OF SCIENCE, ENGINEERING AND TECHNOLOGY, VOL. 02, ISSUE 04, APRIL-MAY 2014.

[2]. Ashwini Gade et al "Segmentation of Tumor Region in MRI Images of Brain using Mathematical Morphology" International Journal of Image Processing (IJIP), VOL 8, Issue 3, 2014

[3]. Dilip Kumar Gandhi el al "Implementation of Classification System for Brain Cancer Using Artificial Neural Network and MRI" International Journal of Electronics Communication and Computer Engineering VOL. 3, Issue 5,

[4]. J.Z. Wang, J. Li, G. Wiederhold, "Simplicity: Semantics-sensitive integrated matching for picture libraries", IEEE Transactions on Pattern Analysis and Machine Intelligence, 23 (9), pp. 947–963, 2001.

[5]. R. Karuppathal and V. Palanisam, "FUZZY BASED AUTOMATIC DETECTION AND CLASSIFICATION APPROACH FOR MRI-BRAIN TUMOR", ARPN Journal of Engineering and Applied Sciences, VOL. 9, NO. 12, DECEMBER 2014.

[6]. Smitha P et L, "A Review of Medical Image Classification Techniques" International Conference on VLSI, Communication & Instrumentation (ICVCI) Proceedings published by International Journal of Computer Applications(IJCA) 2011.

[7]. "National Brain Tumor Society". April 1,2013 http://www.braintumor.org/patients-family-friends/about-brain tumors/brain-tumor-faq.html.

[8]. Punithavathy Mohan et al, "Intelligent Based Brain Tumor Detection Using ACO" International Journal of Innovative Research in Computer and Communication Engineering VOL 1, Issue 9, November 2013

[9]. Shanthakumar P, Ganeshkumar P. "Performance analysis of classifier for brain tumor detection and diagnosis"' Computer Electronics Engineering (2015), http://dx.doi.org/10.1016/j.compeleceng.2015.05.011

[10]. Ays¸e Demirhan, Mustafa T¨or¨u, and ˙Inan G¨uler, "Segmentation of Tumor and Edema Along With Healthy Tissues of Brain Using Wavelets and Neural Networks" IEEE JOURNAL OF BIOMEDICAL AND HEALTH INFORMATICS, VOL. 19, NO. 4, JULY 2015

[11]. Ed-Edily Mohd. Azhari1, Muhd. Mudzakkir Mohd. Hatta1, Zaw Zaw Htike1 and Shoon Lei Win2, "Brain Tumor Detection And Localization In Magnetic Resonance Imaging"International Journal of Information Technology Convergence and Services (IJITCS) Vol.4, No.1, February 2014

[12]. Charutha S., Charutha S.," An Efficient Brain Tumor Detection By Integrating Modified Texture Based Region Growing And Cellular Automata Edge Detection" 2014 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT)

[13]. S.U.ASWATHY, S.U.ASWATHY, Dr. S.S.KUMAR," A Survey on Detection of Brain Tumor from MRI Brain Images", 2014 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT)

[14]. R. J.Deshmukh, R.S Khulem" Brain Tumor Detection Using Artificial Neural Network Fuzzy Inference System (ANFIS)" International Journal of Computer Applications Technology and Research VOL. 3, Issue 3, 150 - 154, 2014