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Brain tumor identification and tracking using image processing technique

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***Abstract*---**Abnormal growth of mass or cell in the brain is considered as a brain tumor. The proper functioning of the brain is affected by the growth of any tissue or cell abnormally. Knowing about the abnormalities in a specific area, an effective technology-based system is required which can provide accurate and meaningful information about the disorders. Now a day's image processing plays an important role in medical science as well as the field is also developing in many ways. Various methods in image processing help doctors to get maximum information about the disease with minimum possible errors. Some of these techniques are CT scans (Computed Tomography Scan), Magnetic resonance imaging (MRI), X-rays. These advanced technologies are capable of detecting all the biggest to smallest defects in the body. All these computerized techniques are equipped with high resolution and better quality image readers. This research investigates brain tumor identification and tracking using an image processing technique. For this research 40, sample images were examined using image processing techniques using classification methods with brain tumor problem and without brain tumor problems investigated. The present work represents 92.5% accuracy for the detection of patients with brain tumors during analysis.

***Keywords*---**brain tumor, classification, image processing, CT scan image, affects, tracking.

Introduction

The growth of abnormal tissues or mass in the brain is considered as brain-spinal cord tumor. It affects mainly the functioning of the brain. Brain tumors are divided into two kinds either malignant that is harmful or benign which is non-

harmful [1]. Out of these two categories, malignant tumors are more aggressive compare to benign tumors.

In benign tumors mass of abnormal cells does not contain cancer cells, mass grows slowly and does not spread from its original site [2]. According to a survey conducted by the American Brain Tumor Association (ABTA), around two-thirds of all the new brain tumor cases are of this kind compare to the malignant tumor [3]. In malignant tumor mass of abnormal cells grow very fast, it contains cancer cells and spread quickly around the site makes them more dangerous. Depending on the site from which the abnormal cells grow categorized the brain tumor into two subcategories primary brain tumor and secondary brain tumor [4]. In Primary, tumor originates in the brain, and in secondary or metastatic, the tumor began in another part of the body and spread to the brain. World Health Organization are officially reclassify all types of brain and spinal cord tumor based on a range of different characters and subtypes [5]. More than 120 types of tumors affect the different types of cells in the human body. May month is the month of comfort, revival, hope, and rebirth. The month of May is dedicated to the awareness of brain tumors wearing ribbons of grey color symbolizes brain cancer [6]. The awareness brings greatness into an action. A month gives the authority to speak about the disease, inform about the facts related to a brain tumor, organizing events that give awareness to brain tumor turns into action [7]. Victims of brain tumors need awareness that will lead to action and stepping towards a cure. Abnormal growth of mass or cell in the brain is considered as a brain tumor. Symptoms due to the location and tumor's type of symptoms of brain tumors vary. Common symptoms include headaches, nausea, general drowsiness, vomiting, problems with vision, speech problems, issues with short term memory, personality changes, and coordination issues [8]-[9]. These symptoms occur slowly and gradually worsen. Sometimes there is no symptom at all. According to the medical survey by ACS, half of the brain tumor patients have persistent headaches and some experience a seizure at some point [10].

Diagnosis process

Neurological examination is conducted on the diagnosis of brain tumors. The test of the neural system such as hearing, vision, coordination, reflexes, balance, and strength are getting tested.

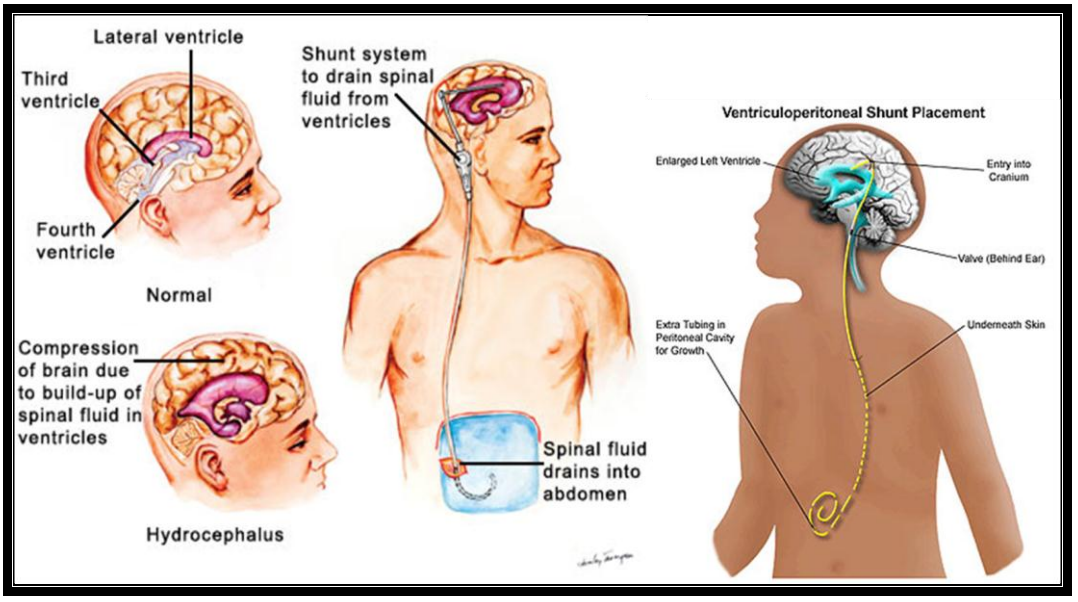
Imaging Test- For diagnosing brain tumor MRI images are commonly used for the examination process. Various MRI scan components such as functional MRI, perfusion MRI, and Magnetic resonance spectroscopy are used for evaluating the tumor. Another imaging test such as Computerized Tomography, Positron Emission Tomography is used for brain imaging. CT and PET scan test is used to find cancer in other parts of the body.

*Magnetic Resonance Imaging-*An MRI uses magnetic fields which gives detailed images of the abnormal part of the body. MRI measures the tumor's size. For getting the clear picture a special dye called a contrast medium is injected into the patient's vein or given liquid or a pill to swallow. MRI is considered the most preferred way to diagnose a brain tumor. It involves various types like IV gadolinium, diffusion-weighted imaging, spinal MRI, functional MRI, and MRS.

CT scan: It gives pictures of the body from different angles using x rays. A computer combines these pictures into a detailed three-dimensional image that shows tumors or any abnormalities. Bleeding and enlargement of ventricles in the brain can be seen from CT scans.

PET scan: It gives more about abnormal cells or tumors while the patient is receiving treatment. It may also be used if the tumor comes back after the treatment.

Biopsy or tissue sampling: In the brain, tumor biopsy is the part of the operation where a stereotactic needle biopsy is done for brain tumors. A thin needle is inserted in the small hole drilled into the skull by a neurosurgeon. With the help of guidance by CT and MRI scanning tissue is removed using the needle. Laboratory test on the tissue gives a clear idea about the treatment options.



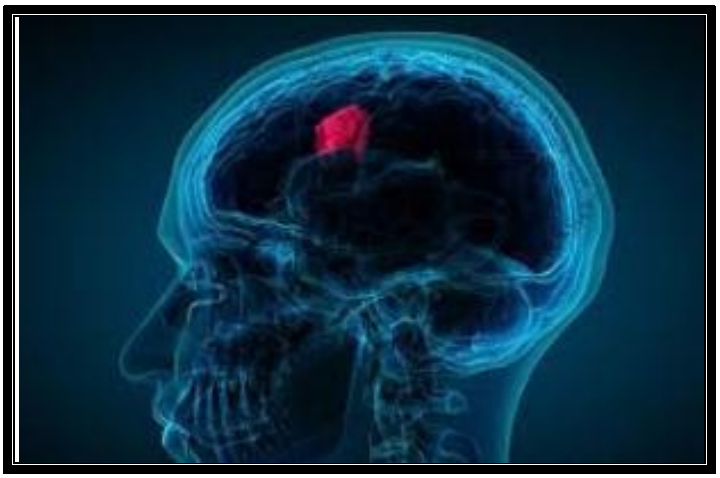


Figure 1. Brain Tumor

Methodology

Research Investigates on preprocessing, segmentation with clustering, and classifications method using image processing techniques. For research 40 sample images were examined using classification methods without brain tumor patients and with brain tumor patients for investigations. For this research, a CT scan image is considered for analysis. It gives pictures of the body from different angles using x rays. A computer combines these pictures into a detailed image that shows tumors or any abnormalities. Bleeding and enlargement of ventricles in the brain can be seen from CT scans.

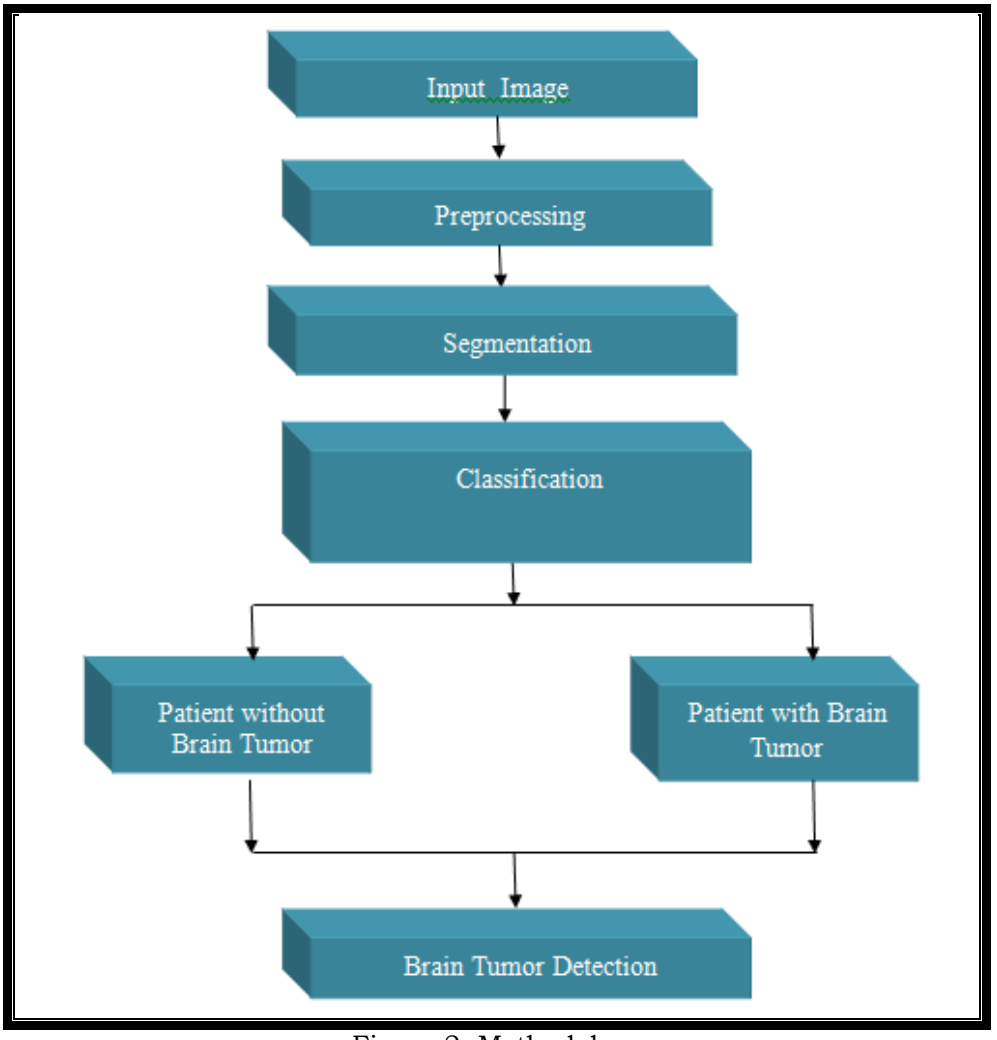


Figure 2. Methodology

The above figure 2 represents the methodology for the present research work, initially preprocessing methods is consider for avoiding background noise and cleaning of images, then segmentation method is applied, after segmentation method classification technique used for detecting of with patient without brain tumor image and with Brain tumor patients. Dataset of 40 images has been collected for investigation and analysis.

Digital image preprocessing

Preprocessing methods are used to remove noise and smoothing of images. For this research work, a median filter is used during the investigation of image classification for a brain tumor. During filtering process neighborhood nearer pixel are selected and remaining pixels which are not similar are rejected from the process by smoothening of the images

3x3 Masks-with-Matrix $\begin{bmatrix} 2 & 2 & 10 \\ 3 & 7 & 8 \\ 9 & 9 & 11 \end{bmatrix}$

Initially arrange the values in ascending order form

2	2	3	7	8	9	9	10	11

Now compute the median value according to pixel

2	2	3	7	**8**	9	9	10	11

Median filter matrix is calculated with original image pixel

$\begin{bmatrix} 2 & 2 & 10 \\ 3 & 7 & 8 \\ 9 & 9 & 11 \end{bmatrix}$ → $\begin{bmatrix} 2 & 2 & 10 \\ 3 & 8 & 8 \\ 9 & 9 & 11 \end{bmatrix}$

Image (Original) Resulted Median filter

Segmentation

The segmentation method works through thresholding techniques. The thresholding technique produces segments with similar intensity values. Thresholding is useful in developing boundaries in images. An adaptive thresholding method is used because to check the background noise whether it is constant or not. The clustering method is used for this present research. Clustering methods represent the relationship between the input data pattern and clustered value. Initially, it clusters n objects according to attribute into 'c' partition where c<n. Then measure the similarity between numbers of observations, to achieve similar observation it is necessary to calculate Euclidean distance. Euclidean distance is a measure of the distance between observations.

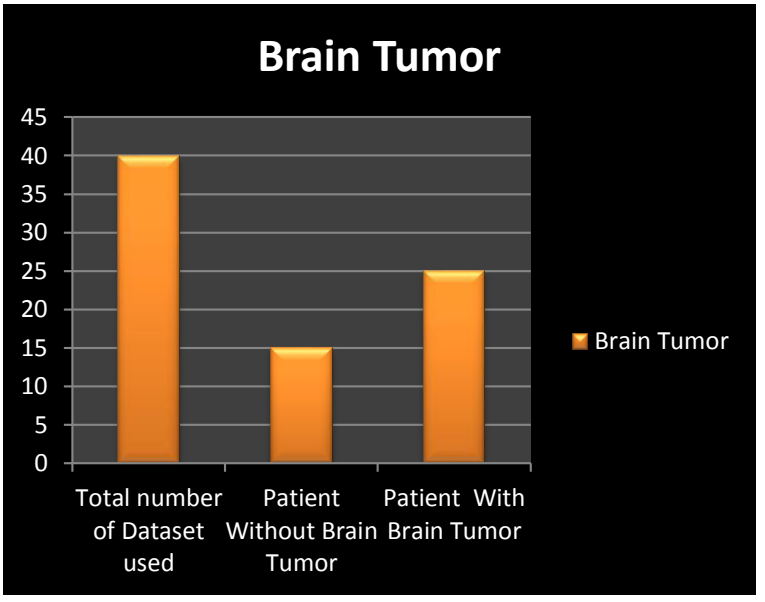
$$d_{pq} = \sqrt{(p_1 - q_1)^2 + (p_2 - q_2)^2 + (p_3 - q_3)^2 + \cdots \ldots (p_z - q_z)^2}$$

$$d_{pq} = |p_1 - q| + |p_2 - q_2| + |p_3 - q_3| + \cdots \ldots |p_p - q_p|$$

Now randomly select the cluster center, it is denoted with c, then calculate fuzzy center then update the cluster center. For updating the cluster center a centroid needs to be calculated for each cluster. To calculate centroid it is important to find the average of all x-axis and y-axis. To re-compute the new cluster center, it is necessary to take the mean of all points in each cluster.

Classification

In the classification method, the present research measures the accuracy of the image with patients facing brain tumors and patients without a brain tumor. The total number of samples analyzed is 40 CT Scan images collected for analysis. In which 15 images are considered and selected without brain tumor patients and 25 images with brain tumor patients.



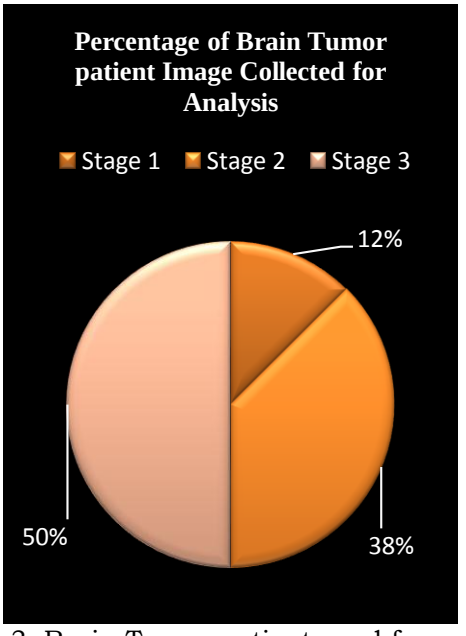


Figure 3. Brain Tumor patient used for analysis

Figure 3 represents the total number of samples analyzed is 40 patient images. In which 15 images are selected for without brain tumor and 25 images with brain tumor images using a graphical representation. For this research, a CT scan image is considered for analysis. It gives pictures of the body from different angles using x rays. A computer combines these pictures into a detailed image that shows tumors or any abnormalities. Bleeding and enlargement of ventricles in the brain can be seen from CT scans. The graph shows pictorial representation and

the total number of patients accessed in investigation with brain tumors with stages.

Result and Discussions

The present study investigates digital image preprocessing, segmentation with clustering, and classifications method using image processing techniques. For this research 40, sample images were examined using image processing techniques using classification methods with brain tumor problem and without brain tumor problems investigated.

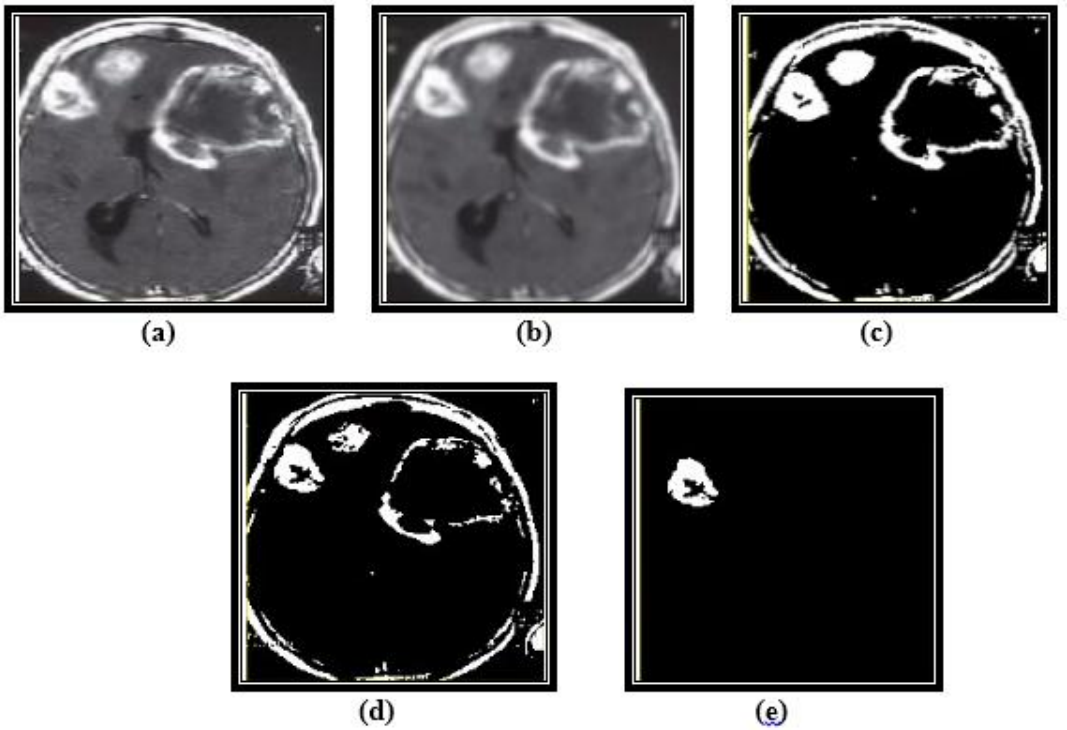


Figure 4. Brain Tumor Detection

Figure 4 represents a) Grayscale image, b) Preprocessed image, c) Threshold image, d) segmentation image, e) Detection of the tumor.

Table 1
Result and Analysis of Patient Record without Brain Tumor

Registered Patient	Information	Output
	Patient without Brain Tumor	Output results of Patients without Brain Tumor
ID_401	No Tumor	Yes
ID_402	No Tumor	Yes
ID_403	No Tumor	Yes

ID_404	No Tumor	Yes
ID_405	No Tumor	Yes
ID_406	Minor case	No
ID_407	No Tumor	Yes
ID_408	No Tumor	Yes
ID_409	No Tumor	Yes
ID_410	No Tumor	Yes
ID_411	No Tumor	Yes
ID_412	No Tumor	Yes
ID_413	No Tumor	Yes
ID_414	No Tumor	Yes
ID_415	No Tumor	Yes

Table 1- represents the number of the patient image without a brain tumor in which the total test image is 15. The table is divided into three groups, patient ID, a patient without a brain tumor, and classification results with the condition. The table represents all with true values that denote image without brain tumor except patient ID_406 which represents 'No' because of Minor stage case with the patient.

Table 2
Result and Analysis of Patient Record with Brain Tumor

Registered Patient	Information	Output
	Patient with Brain Tumor	Output results of Patients with Brain Tumor
ID_416	Tumor Detected	YES
ID_417	Tumor Detected	YES
ID_418	Tumor Detected	YES
ID_419	Tumor Detected	YES
ID_420	Tumor Detected	YES
ID_421	Tumor Detected	YES
ID_422	Tumor Detected	YES
ID_423	Tumor Detected	YES
ID_424	Tumor Detected	YES
ID_425	Tumor Detected	YES
ID_426	Tumor Detected	YES
ID_427	Tumor Detected	YES
ID_428	Tumor Detected	YES
ID_429	Tumor Detected	YES
ID_430	Tumor Detected	YES
ID_431	Tumor Detected	YES
ID_432	Tumor Detected	YES
ID_433	Tumor Detected	YES
ID_434	Minor Tumor	NO
ID_435	Minor Tumor	NO
ID_436	Tumor Detected	YES

ID_437	Tumor Detected	YES
ID_438	Tumor Detected	YES
ID_439	Tumor Detected	YES
ID_440	Tumor Detected	YES

Table 2- represents the number of images with a brain tumor in which the total test image is 40. The table is divided into three groups, patient ID, patient with brain tumor image, and classification results with logical two outputs yes/ no. This research clustering method is used. Clustering methods represent the relationship between the input data pattern and clustered value. Initially, it clusters n objects according to attribute into 'c' partition where c<n. Then measure the similarity between numbers of observations, to achieve similar observation it is necessary to calculate Euclidean distance. Euclidean distance is a measure of the distance between observations. Now randomly select the cluster center, it is denoted with c, then calculate fuzzy center then update the cluster center. For updating the cluster center a centroid needs to be calculated for each cluster. To calculate centroid it is important to find the average of all 'x-axis and y-axis'. To re-compute the new cluster center, it is necessary to take the mean of all points in each cluster center.

Table 3
Brain Tumor Detection Using Confusion Matrix

Result	VALUES (ACTUAL)	
	True Positive 23 cases	False Positive 1 case
	False Negative 2 cases	True Negative 14 cases
Table 1	(Correct_detection cases x 100) ÷ Total Number of Cases	Table 1 = (14 x 100) ÷15 = 93.3%
Table 2	(Correct_detection cases x 100) ÷ Total Number of Cases	Table 2 = (23 x100)÷ 25= 92 %
TPV	(True _Positive ÷ All Samples based on Positive values)	TPV= 23 ÷ (23 + 1) = 0.95 = 95%
FPV	False_Positive ÷ All Samples based on Negative values	FPV = 1 ÷ (2 + 14) = 0.06%
ACCURACY	True(Positive _Value) + True(Negative _Value) ÷ (Total No. of Samples)	Accuracy = (23+ 14) ÷ (40) = 37 ÷ 40 = 92.5%

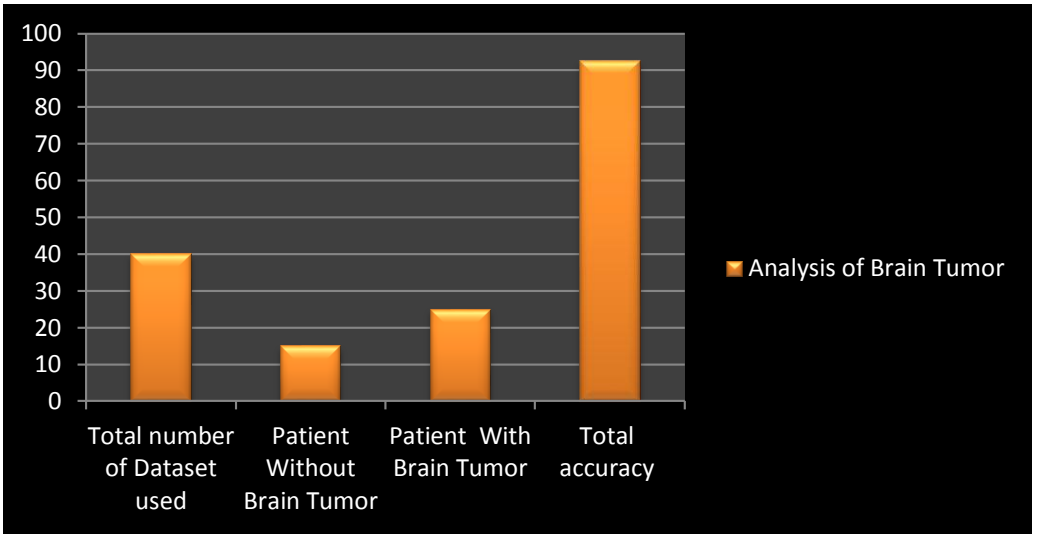


Figure 4. Analysis of Brain Tumor

Figure 4- represents an analytical view of brain tumor accuracy with the total number of datasets used without the patient having a brain tumor and patient with having brain tumor representation. The present research represents 92.5% accuracy for the detection of Brain Tumor.

Conclusion

Now a day's image processing plays an important role in medical science as well as the field is also developing in many ways. Various methods in image processing help doctors to get maximum information about the disease with minimum possible errors. Some of these techniques are CT scans (Computed Tomography Scan), Magnetic resonance imaging (MRI), X-rays. These advanced technologies are capable of detecting all the biggest to smallest defects in the body. All these computerized techniques are equipped with high resolution and better quality image readers. This research investigates brain tumor identification and tracking using an image processing technique. For this research 40, sample images were examined using image processing techniques using classification methods with brain tumor problem and without brain tumor problems investigated. The present work represents 92.5% accuracy for the detection of patients with brain tumors during analysis.

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