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K-MEANS, WATERSHED AND TEXTURE-BASED IMAGE SEGMENTATION

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Abstract— **Nowadays image processing is a highly challenging field in detecting the brain tumor from MRI Brain Scan.It has becomea popular in our research area. In this paper, MRI brain image is used to detect the brain tumor. This system includes conversion to gray, test the brain, whether it is benign or malignant, Threshold Segmentation is the simplest segmentation method, canny operator for edge detection and morphological Based de-noising used for removing the noise, clustering method combination of MRF and CRF, Watershed segmentation is the best method for grouping pixels of an image on the basis of intensity, by combining k-means with watershed Segmentation overcome the Over Segmentation and use texture Segmentation. The detailed procedure is implemented in MATLAB. By this, the brain tumor is detected accurately and also it is determined whether the patients can be cured by medicine or not.**

***Keywords*-K-means, watershed and Texture Segmentation, CannyOperator, MorphologicalBased denoising, MRF AND CRF.**

I. INTRODUCTION

A brain tumor is the cells which grow abnormally within the brain that effect the brain functions such as muscle contraction, breathing, heartbeat, sensation, memory and other normal body functions. There are two main types of brain tumors, primary and metastatic. The primary tumor starts and tends to stay in the brain, whereas metastatic brain tumor begins ascancer elsewhere in the body and spreads to the brain. There are two kinds of primary tumors Benign and Malignant (mal="bad",lgnis="fire"). A benign tumor does not contain cancer cells, whereas malignant tumors contain cancer cells. When compare to other cancers brain cancer increase the death aboutie.73%brain tumor cancers. In U.S, it is estimated 23,380 adults (12,820 Males and 10,560 females) will be diagnosed with primary cancerous tumors of the brain. It is also estimated that 14,320 adults (8,090 Men and 6,230 Women) will die from this brain tumor in the year 2014[1].About 22,850 malignant tumors of the brain(12,900 in males and 9,950 in females) will be diagnosed. In brain and spinal card tumor about 15,320 people (8,940 males and 6,380 females) will dies. Overall, the chance that a person will develop malignant tumor of the brain tumor in his or her lifetime is less than one percentage i.e., (about 1 in 140 for a man and 1 in 180 for a woman).in the year 2015.[2]This brain tumor is a notoriously difficult disease to diagnose. An MRI (Magnetic Resonance imaging) Scan is a radiology technique to produce the internal structure of the brain tumor.

II. LITERATURE REVIEW

Liu et al[3] proposed a method of a watershed transformation based on opening – closing operation and distance transform. It is a kind of iterative calculation of erosion and dilation. It reflects the location of the pixel in the image and overcomes the over-segmentation and detects the brain tumor.

Bala et al[4] has described the novel method of image segmentation. Here the Prewitt's operator to detect the edge instead of Sobel operator as in existing marker controlled watershed transform to control over-segmentation and detect the brain tumor.

Rahman et al[5]has discussed the novel method of image segmentation based on an adaptive threshold and masking operation with the watershed algorithm. Here the main aim is to overcome over segmentation and detect the brain tumor.

Shan et al[6]produce the improved watershed segmentation method. Here in the morphological operators reconstruction filter is applied to remove the noise and give full information about the object outline. The morphological gradient is

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calculated to overcome the shortcomings of traditional gradient operators and to produce a gradient map appropriate for the watershed segmentation

Acharya et al.[7] has described the novel based approach of the watershed algorithm used for distance transform is applied to Image segmentation. Here the (LOG) Laplacian of Gaussian edge detector is used to detect the edges and control the over-segmentation

Fernando C. Monteiro[8] introduces a new image segmentation method comprising of edge and region-based information with the help of spectral method and morphological algorithm of the watershed. Firstly, they reduce the noise from the image using a bilateral filter. Secondly, region merging is used to perform preliminary segmentation, region similarity is generated and then graph based region grouping is performed using Multi-class Normalized Cut method [9].The Berkley segmentation dataset is used as a dataset. They compare the technique with mean shift, multi-scale graph-based segmentation, and JSEG. It is found that the proposed technique has outperformed other methods and produce better results.

III. PROPOSED WORK

In the present work the implementation tool is MATLAB. It is used to improve the detection of brain tumor very accurately. Image Segmentation can be done by various techniques.The first MRI scan Images are taken andthe process can be done by the following steps. The first step is the image acquisition. Here the MRI brain images are converted to the grayscaleimages.In the pre-processing stage, the input MR images are tested to identify whether the MR image is normal or abnormal. Next step is the Threshold Method uses to separate the background and ROI (region of Interest) i.e...tumorportions. The tumor obtains doesn't have exact edges,sothe canny edge detection method is used. Further the noise can be removed by Morphological Based de-noising. In clustering Method combination of theMRF and CRF is used. Finally,the main goal of this work is the combination of K-Means and Watershed Segmentation is used to overcome Over Segmentation and texture Segmentation to detect the tumor portion of the input brain MR Image.

A. .*Image Acquisition:*

Brain tumor Images that are obtained by using the MRI scan images converting RGB to Gray level. InWeighted method give a gray color image by using the formula

$$(0.3*R)+ (0.59*G) + (0.11*B)$$

i.e. based on the intensities 30% of red,59% of green and 11% of blue will give the clear grayscale image

B. *Pre-Processing:*

On this Pre-Processing stage, the input MR images are tested to identify whether the MR image is Benign or Malignent. The grayscale images are displayed in two-dimensional matrix ranging from 0 to 255, where 0 shows the total black and 255 shows white thus we can separate the background and ROI and then the edges are detected using the Canny Operators. Noise is removed by Morphological-based denoising-gaussianfiltering[10], [11] is efficient and produces better results as compared to other filters. Next in the clustering methods the combination of MRF and CRF reduces both the problem of overlapping and noise with high accuracy.[12],[13]. A Markov Random Field is a countable set of random variables (RV) which is often used in the image access applications. It has the Markov property described as a unidirectional graph. It is similar to Bayesian networks. The differences between Bayesian networks are directed and acyclic, whereas Markov networks are undirected and may be acyclic. Thus, a Markov network can represent cyclic dependencies that a Bayesian network cannot on the other hand, it represent certain induceddependencies. The underlying graph of a Markov random field may be finite or infinite. CRF is a popular probabilistic method for the prediction of a large set of input images withthe combination of classification and graphical modeling.

C. *Processing Stage:*

The diagnosis of Brain tumor involves the two major steps:
Image Classification and
Image Segmentation.

On Image Classification, diagnosis of Brain tumor is based on Similarity measurement. In the Image Segmentation diagnosis of Brain tumor is based on size and shape.

D. *Post-processing Stage:*

The segmentation processing is done by the following methods.

1. Threshold Method: The Optimal Threshold is the simple but effective tool to separate the ROI and background.ie The segmentation is then achieved by grouping all pixels with intensity greater than the threshold into one group, and all other pixels into another group The threshold value which

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will convert the gray scale image into a binary image format which is used to select the threshold value.[14],[15].

2. K-means and watershed segmentation: Watershed Segmentation is the best methods forgrouping pixels of an image on the basis of their intensities. It is a mathematically morphological operating tool and is used for checking the output rather than input segmentation techniques because of its drawback over segmentation and under segmentation. To overcome over-segmentation, the combination of K-Means and watershed segmentation are used.[16]

3. Texture Segmentation: Texture is the regular repetition of an element or pattern on a surface that has some amount of variability in element appearance and relative position.

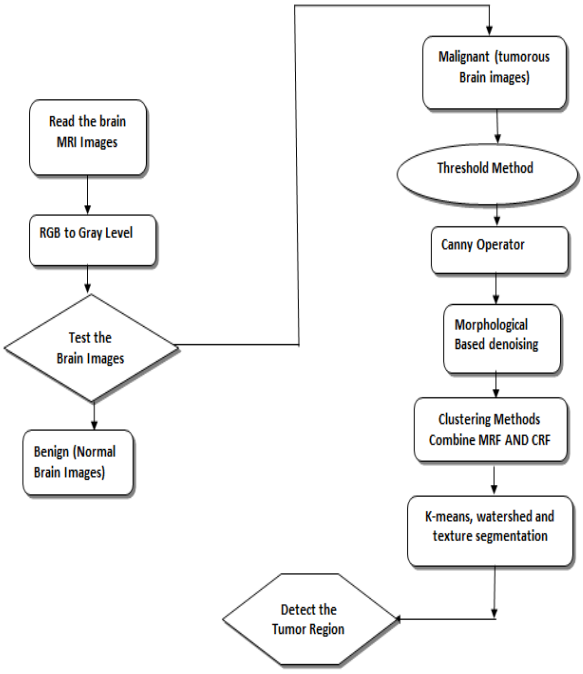

Fig 1.Flow of KWT

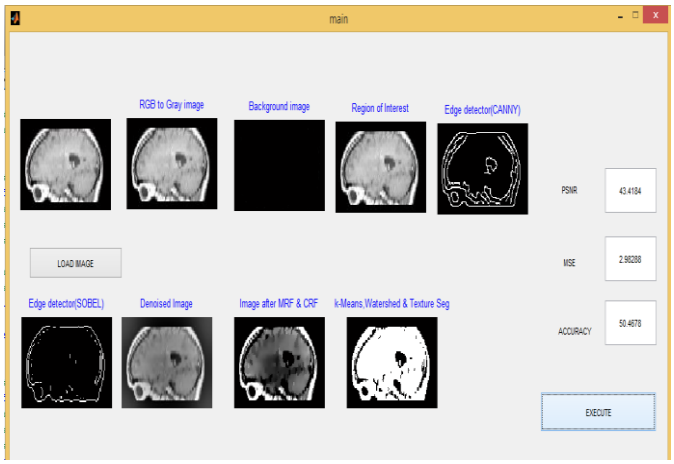

Fig.2 Process of Brain tumor detection

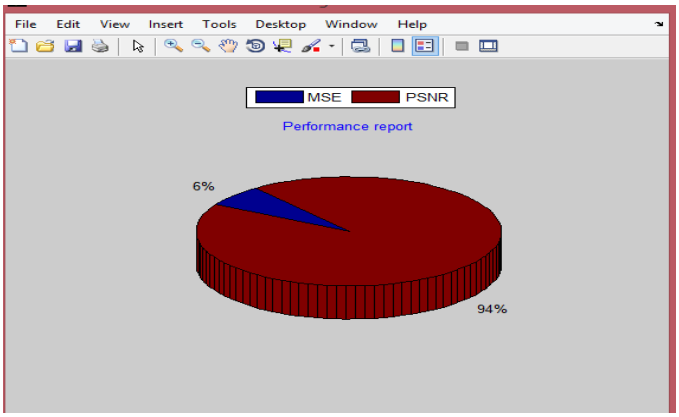

Fig.3 Graph chart of PSNR AND MSE

I. EXPERIMENTAL RESULTS ANALYSIS AND ACCURACY

The segmentation is the process of dividing an image into regions with its similar properties such as gray level, color, texture, brightness, and contrast. The main aim is to detect the tumor present in the patient brain, which is very useful for the diagnosis, which is very easy to take treatment for the survival of the patients. For the experiment, 20 brain tumor images obtained from the clinical laboratory are included for to test the code. Fig2.

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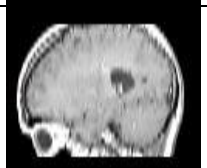
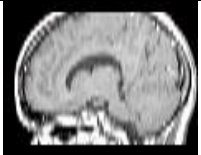
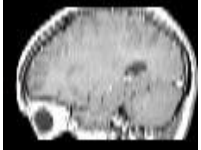
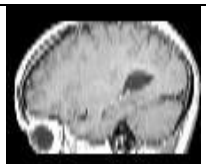
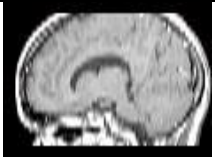
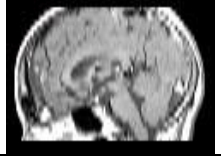
Describe the whole process of the brain tumor detection. There are two most common error options, namely the peak signal noise ratio (PSNR) and Mean Square Error (MSE) are shown in the above fig.3.The result for the K-Means, Watershed and Texture segmentation are shown below and table.1 also clearly shows the implemented on different images taken from the laboratory for our research work. Calculation of MSRand PSNR are shown the accuracy of the proposed algorithm.

Table 1. Work Calculation of MSE AND PSNR

Sl.No	Images	MSE	PSNR
1.		2.98288	43.4184
2.		3.76846	42.4032
3.		2.98846	43.4103
4.		3.77502	42.3956
5.		3.76673	42.4052
6.		3.22324	43.0819
7.		3.62542	42.5712
8.		3.23476	43.0664
9.		2.98288	43.4184
10.		3.6944	42.4846
11.		2.9534	43.4616
12.		3.7224	42.4565
13.		3.4938	42.7319
14.		3.4441	42.7940
15.		3.5192	42.7004

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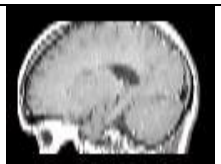
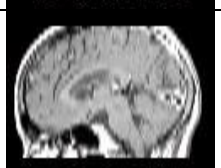
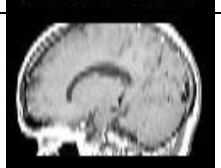
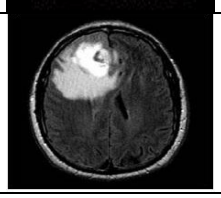
16.		3.1315	43.2073
17.		3.0865	43.2701
18.		3.09210	43.2600
19.		2.9210	43.5095
20.		1.8389	45.5192

V. CONCLUSIONS AND FUTURES WORK

In this paper,we introduce a new technique for medical images which give an accurate detection of brain tumor. In the future research, result will be better with some other combination of image segmentation could be implemented in Matlab.

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