RESEARCH ARTICLE   OPEN ACCESS

Brain Tumour Extraction from MRI Images Using Image Processing

Rina Bopche[1], Prof. Amit Kolhe[2], Dr. Pankaj Kumar Mishra[3]

[1]Student, Digital Electronics, Raipur ChhattisgarhS
[2]Assistant professor, ET&T, RCET, Bhilai Chhattisgarh, India
[3]Associate professor, ET&T, RCET, Bhilai Chhattisgarh, India

Abstract:

Mat lab has played very important role in biomedical and it has many technique we are working on image segmentation and by using mat lab we can solve so many problem for example the accurate data of tumor to cure it. As we knows the tumor is abnormal growth of tissue and MRI can't tell the exact location of tumor up to now doctors were treating it by approximation and analysis so, to give complete information about brain tumor we are using image segmentation in mat lab. This project includes noise removal technique (median filter), gray scale, thresholding, histogram equalization, K-means clustering and morphological operation (performing iterations). People affected by different category of tumor in India are 43%, 36% in US, and 31% in UK. By using this mat lab based technique we can get accurate data for its size, location and stage of the tumor. Detection and extraction of tumour from MRI scan images of the brain is done by using MATLAB software (programming).

Keywords: **tumor; median filter; histogram equalization; K means clustering segmentation; morphological operations; MRI**

I. INTRODUCTION

Tumour is defined as the abnormal growth of the tissues. Tumor and cancer are not same cancer will be always malignant but not tumor. Brain tumor is an abnormal mass of tissue in which cells grow and multiply uncontrollably and to cure it we should have accurate data which we can get by this technique (*Reference- Wikipedia*). Brain tumors can be primary or metastatic, and either malignant or benign. Generally doctors will use approximation to cure the brain tumor but now with the help of this technique we can cure it easily and these Brain tumors are classified into:

- Primary brain tumor (benign).
- Secondary brain tumor (pre malignant).
- Tertiary brain tumor (malignant).

(Reference- Kalpana U. Rathore, Prof. Y.D. Kapse IJRTCC)

II. METHODOLOGY

To achieve high quality image of brain tumor we are using magnetic resonance imaging (MRI) technique and these give high resolution images. Median filter is used to select the mid value by this it will reduce the noise this is a great technique to remove the noise from the image, it is also applied to the gray scaled output and then we will be applying thresholding to distinguish between black and white colour and then we will use histogram equalization for equalization, which will equalize the image and then some morphological operations are applied to detect the tumor in the image. The morphological operations are basically applied on MRI for some information for example size and shape of the tumour and at the end the tumour is mapped on the basis of threshold to define the stage and density of tumor and it will tell either it is a malignant tumor or benign growth of cells and after this we will be doing area selection of tumor by using GUI. By applying some iterations and this technique at last we will get the area covered and critical stage and intensity and all important data of tumor. There are several technique to do segmentation namely toboggan algorithm, watershed algorithm, visual dictionary algorithm, clustering method, splat feature segmentation, region based algorithm, edge based segmentation, soon. Compared to other methods K means clustering based segmentations will work on the concept of cluster.

Image processing is a technique which is used to improve the quality of the image and accurate parameter of the desired image for this purpose image filtering, image segmentation and histogram equalization is use, which will helpful to detect tumor parameter during processing. Image processing involves two main steps that is

1. Image enhancement technique (preprocessing).
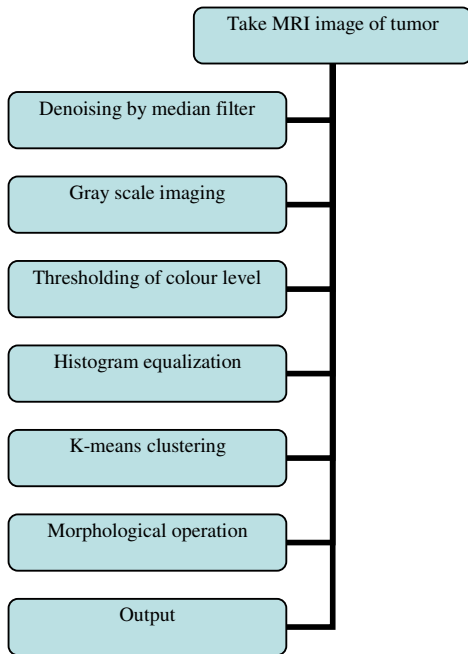2. Image segmentation technique.

Both are having their own properties and important role for improving the quality of the image. Both

the process having a different technique for the image enhancement and segmentation for the more accurate result the best will choose.

(Reference- Rajesh c. Patil, Dr. A.S. Bhalchandra IJECSCSE)

1. Preprocessing-
      - Denoising.
    - Gray scale image.
    - Thresholding.
    - Histogram equalization.

2. Segmentation-
      - K-means clustering.
    - Area selection
    - Morphological operation.
    .

    .

```
┌─────────────────────────────┐
│   Take MRI image of tumor   │
└─────────────────────────────┘

┌─────────────────────────────┐
│  Denoising by median filter │
└─────────────────────────────┘

┌─────────────────────────────┐
│     Gray scale imaging      │
└─────────────────────────────┘

┌─────────────────────────────┐
│  Thresholding of colour level │
└─────────────────────────────┘

┌─────────────────────────────┐
│    Histogram equalization   │
└─────────────────────────────┘

┌─────────────────────────────┐
│      K-means clustering     │
└─────────────────────────────┘

┌─────────────────────────────┐
│    Morphological operation  │
└─────────────────────────────┘

┌─────────────────────────────┐
│           Output            │
└─────────────────────────────┘
```

The algorithm steps which we are going to perform are as follows –

1. Take MRI image as input.
2. Then denoise this image by using median filter.
3. Gray scale imaging.
4. Apply thresholding.
5. Apply histogram equalization for good quality
6. Do area selection.
7. Compute morphological operation.
8.

III. LITERATURE SURVEY

The process where we divide the image in various category according to various algorithm so many people has been worked on this project they have worked a lot so, according to comparison of this survey this project has been implemented.

No	Date	Author	Conclusion	Remark
1 IIJRRA	June 2016	Bandana Sharma, Brij Mohan Sharma	Image acquisition, segmentation, preprocessing, feature extraction process has been applied.	Fuzzy-c means technique has been applied.
2 IIJDER	2016	Samriti, Paramveer Singh	They have used preprocessing; watershed segmentation watershed segmentation has some disadvantage which they are solving by preprocessing.	Hybrid of watershed and contrast technique has been used.
3 IIEEE	2015	HMW Thomas	FPGA technique has been used and segmentation. Image has converted in binary form, VHDL algorithm used for edge detection.	Computation technique has been used.
4 IIJSET	July 2015	Sonu Suhag, LM Saini	FCM, CAT, segmentation is used preprocessing, morphological operation is applied to get brain tumor data.	Feature extraction is done.
5 IIJECSE	2015	Rajesh c. Patil, Dr. A. S. Bhalchandra	Watershed segmentation, High pass filter, median filter and morphological operation has been applied, and This will provide information about tumor which is benign or malignant.	Tumor with accurate result has been detected.
6 IIJCST	May Apr 2015	Yogita Sharma, Parminder Kaur	Fuzzy-k means clustering technique is used for segmentation and here we will get information about area of tumor.	Mean square error will be removed.
7 IIRJET	May 2015	Pankaj kumar Saini, Mohinder singh	Image preprocessing contrast enhancement for getting accurate data of tumor.	Density and intensity of tumor can be calculated.

8 IEEE	2014	Kailash Sinha, G.R. sinha	Worked on k means and fuzzy-c means clustering technique to do segmentation.	They did colour based segmentation.
9 IJJAIT	Feb. 2014	Ed. Edily Mohammad Azhari	Automatic segmentation, Edge detection segmentation is used.	Filters were used for accurate output.
10 IEEE	2010	Badran, Esraa Galal Mahmoud.	Image segmentation and neural network technique has been used and laplacian Gaussian parameter also used.	Area of tumor has been calculated.

A. MRI *(magnetic resonance imaging)-*

Magnetic resonance imaging (MRI) is a technique where we are using that magnetic field and radio waves. This is just a simple report on which we want to do analysis. This imaging modality produces images of soft tissues. The acquired medical images show the internal structure, but the doctors want to know more than peer images, such as abnormal tissue, quantifying the size, depicting its shape in MRI image. If such tasks are covered by doctors themselves, it may be inaccurate, time consuming and burden them heavily. By using this project we can solve all these problem we can get the size, exact location and stage of tumor *(Reference- math works).*

B. Denoising by median filter -

The median filter is a nonlinear digital filtering technique often used to remove noise from an image or signal. Such noise reduction is a typical pre-processing step to improve the results of later processing. The median filter replaces a pixel by the median, instead of the average, of all pixels in a neighborhood. It is widely used as it is very effective at removing noise while preserving edges of the MRI image of brain tumor. It is particularly effective at removing 'salt and pepper' type noise. The median filter works by moving through the image pixel by pixel, replacing each value with the median value of neighbouring pixels. *(Reference- Sivasankari, Sindhu, Sangeetha, Shenbaga Rajan IJIRSET)*

The pattern of neighbours is called the "window", which slides, pixel by pixel over the entire image and removes the noise from it. For 1D signals, the most obvious window is just the first few preceding and following entries, whereas for 2D (Two dimensional) signals such as images, more complex window patterns are possible (such as "box" or "cross" patterns). Note that if the window has an odd number of entries, then the median is simple to define: it is just the middle value after all the entries in the window are sorted numerically. For an even number of entries, there is more than one possible median. This filter enhances the quality of the MRI image. At the last we got image without noise. Instead of this filter we can use other filter also but we will not get correct output this filter is more convenient then other filter *(Reference- Sivasankari, Sindhu, Sangeetha, Shenbaga Rajan IJIRSET)*

FIG 1. FILTERED OUTPUT

C. Gray scale imaging-

The gray scale image will separate the black and white part of MRI image of brain tumor with accuracy by sharpening the image. To get gray scale image first we need to take MRI magnetic resonance image, when we see MRI images on computer they looks like black and white images. In analog practice, gray scale imaging is sometimes called Black and White image but technically this is a wrong theory. In true black and white, also known as halftone, the only possible shades are pure black and pure white. Grayscale images can be the result of measuring the intensity of light at each pixel of the given image according to a particular weighted combination of frequencies. The illusion of gray shading in a halftone image is obtained by rendering the image as a grid of black dots on a white background (vice versa), with the sizes of the individual dots determining apparent lightness of the gray in their vicinity. Generally the halftone technique is commonly used for printing photographs in newspapers and as MRI image is taken on computer then while getting the gray scale image we will be getting three colour red, green, blue it is represented by R, G, B in this condition when we are transmitting light these data are represented by 0 to binary 00000000 to 11111111 means 0 to 255. For every pixel in a red-green-blue (RGB) grayscale image the red green blue will be having same value. The lightness of the gray is directly proportional to the number representing the brightness levels of the primary colors. Black is represented by 0 means all colour red green and blue will be zero R = G = B = 0 or R = G = B = 00000000, and white is represented by 1 means all colour will be represented by R = G = B = 255 or R = G = B = 11111111. Because there are 8 bit s in the binary representation of the gray level, this imaging method is called 8-bit grayscale *(Reference- Rajesh c. Patil, Dr. A.S. Bhalchandra IJECSCSE).*
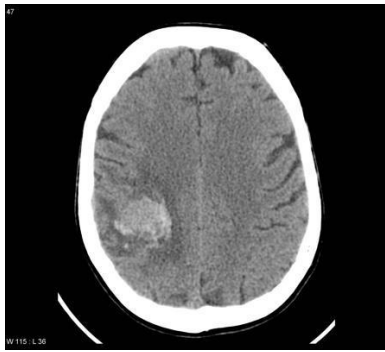
FIG 2. GRAY SCALE OUTPUT

D. Thresholding-

After gray scale imaging just to distinguish between black and white colours we are doing thresholding, it will explain gray scaled output clearly on the basis of thresholding. Thresholding will enhance the colour and contrast of MRI image then this output will be equalized by histogram equalization *(Reference- Wikipedia)*

E. Histogram equalization-

Histogram equalization is a technique for adjusting image intensities to enhance contrast of image. Histogram (Hist.) equalization is a specific case of the more general class of histogram remapping methods. These methods seek to adjust the   image to make it easier to   analyze or improve visual quality. Here we are using this technique to get more clearity to detect the brain tumor.
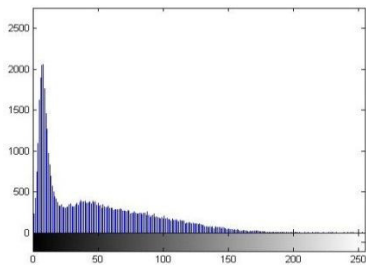

FIG 3. HISTOGRAM OUTPUT

If the histogram of any image has many peaks and valleys, it will still have peaks and valley after equalization, but peaks and valley will be shifted. Because of this, "spreading" is a better   term than "flattening" to describe histogram (hist) equalization. In histogram equalization each pixel is assigned a new intensity value based on its previous intensity level.

As you can clearly see from the images that the new image contrast has been enhanced and its histogram has also been equalized. There is also one important thing to be note here that during histogram equalization the overall shape of the histogram changes, where as in histogram stretching the overall shape of histogram remain same *(Reference- Niladri*

Halder, Dibyendu Roy, Debarghya Roy, Nitin Kumar Jha IJIRCCE).

F. K-Means clustering-

K-means clustering is a simple unsupervised learning algorithm that is used to solve clustering problems. It follows a simple procedure of classifying a given data set into a number of clusters, defined by the letter "K" which is fixed beforehand. The clusters are then positioned as points are associated with the nearest clusters, computed, adjusted and then the process starts over using the new adjustment until a desired result is reached. K means clustering is a method of vector quantization, originally from signal processing, that is popular for cluster analysis in data mining. K means clustering aims to partition n observations into k clusters in which each observation belongs to the cluster with the nearest mean, serving as a prototype of the cluster. This results in a partitioning of the data space into Voronoi cell.
(Reference- Wikipedia, Stormy Attaway).

G. Morphological operations-

In this morphological operation we are going to perform some iteration to get accurate data because if we will be performing the operation many time then our output accuracy will increase and if accuracy will increase then we can get the correct information and data about the tumor that's why it is essential to perform the morphological operation, once we will be getting the accurate data about the tumor then the doctors can cure it very easily without any assumption and approximation. This is used as a image processing tools for sharpening the region and filling the gaps for binarized image of brain tumor. The dilation operator is used for filling the broken gaps at the edges of the image and to have continuities at the boundaries of image. A structuring element of square matrix is used to perform dilation operation for image.

According to Wikipedia, morphological operations depends only on the order of pixel value, not on their numerical values, and therefore are especially suited to the processing of binary images because working with binary image is easy and it gives accurate output. Morphological operations can also be applied to grayscale images such that their light transfer functions are unknown and therefore their absolute pixel values are of   no or minor interest. Morphological techniques probe an image with a small shape or template called a structuring element. The dimensions of matrix specify the structuring element size of image. The binary number one and zero specify the shape of the structuring element. This morphological operation will give accurate output because here we are performing operation many times. The structuring element has been generated from the binary value, pixels, although generally the origin can be outside the structuring element *(Reference- Rajesh c. Patil, Dr. A.S. Bhalchandra IJECSCSE).*
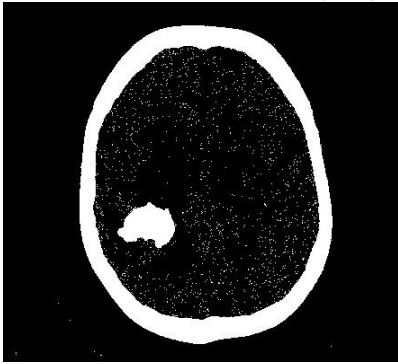
FIG 4. OUTPUT

IV. RESULT AND DISCUSSION

The figures show the images as an output of median filter, grayscale image, threshold image, histogram image and K-means clustering. We can find the density of tumor by using K-means clustering and finally input image and extracted tumor from MRI image. Here we are enhancing the segmentation section as u can see in this project we have used K means clustering based segmentation. for analysis purpose real time patient data is taken for analysis. As tumor in MRI image have an intensity more than that of its background so it becomes very easy locate it and extract it from a MRI image. After getting this output doctor can cure or work on brain tumor with accuracy and accurate data and doctor will not feel difficulty because now he has correct observation and information about brain tumor.

V. FUTURE WORK

We can get the 3D image and observe the situation and condition of brain tumor. By using K-means clustering we can determine the stage of patient. We can use K-means clustering technique to get the stages of tumor that if we have tumor then we are in initial stage or in final so we can determine it by K-means clustering technique. To determine this that we have a tumor or not we can use this technique. These are some future scope where we can work and solve the problem of brain tumor matlab is one of the best programming technique to get accurate information about brain tumor.

a. Abbreviations and Acronyms

1. MRI- Magnetic resonance imaging.
2. Hist. - Histogram equalization.
3. RBG- Red, Green, Blue.
4. Vicinity- Around anything.
5. Malignant - Malevolent.
6. Benign - Soft.

VI. REFERENCES

1. Rajesh C. Patil, Dr. A. S. Bhalchandra International Journal of Electronics, Communication & Soft Computing Science and Engineering IJECSCSE @2015.

2. Ehab F. Badran, Esraa Galal Mahmoud, and Nadder Hamdy IEEE @2010.

3. Samriti, Mr. Paramveer Singh, Brain tumor detection using image segmentation IJEDR @2016.

4. Sushma v. telrandhe, Divya chikate, pooja, Brain tumor detection using back propagation nueral network International Journal of Soft Computing and Artificial Intelligence, IJSCAI May-@2015.

5. Bandana Sharma, Dr. Brij mohan singh, Brain tumor detection using pattern recognition technique, international journal of recent research @2016.

6. Yogita Sharma, Parminder Kaur, Brain tumor detection International Journal of Computer Science Trends @2015.

7. Book-MATLAB A practical approach by stormy attaway @2009.

8. Vipin Y. Borole, Sunil S. Nimbhore, Dr. Seema S. Kawthekar, Image processing of brain tumor IJETTCS @Oct 2015.

9. Kalpana U. rathore, prof. Y.D, Kapse, Matlab based brain tumor extraction using artificial neural network IJRITCC@2016.

10. Monica subashini, sarat kumar sahoo, Brain MR Image segmentation for tumor detection using artificial neural networks IJET @Apr-May 2013.

11. Sonu Suhag, L.M. Saini, Automatic detection of brain tumor by image processing in matlab IJASET @July 2015.

12. Ed-Edily Azhari, Muhd. Mudzakkir, Mohd. Hatta, Zaw Zaw Htike and Shoon Lei Win, Tumor detection in medical imaging IJAIT@Feb 2014.

13. Pankaj Kr. Saini, Mohinder Singh, Brain tumor detection in medical imaging using matlab IRJET@May 2015.

14. Esmail Hassan and Abobakr Aboshgifa, Detection brain tumor from MRI image using matlab GUI programme IJCSES@Dec 2015.