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Feature Extraction of Brain Tumor Using MRI

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Abstract: Magnetic resonance imaging (MRI) is a medical imaging technique used in radiology to visualize internal structures of the body in detail. MRI provides good contrast between the different soft tissues of the body, which makes it especially useful in imaging the brain, muscles, the heart, and cancers compared with other medical imaging techniques such as (CT) or X-rays. By using this MRI we are going to extract the optimal features of brain tumor by utilizing GLCM, Gabor feature extraction algorithm with help of k-means Clustering Segmentation. The brain tumor characterize by uncontrolled growth of tissue. It can be easily cured if it is found at early stage.

Keywords: MRI, Brain Tumour, segmentation, k- means Clustering, Feature extraction, GLCM, Gabor.

I. INTRODUCTION

This paper deals with the concept for brain tumour segmentation and feature extraction . Normally the anatomy of the Brain can be viewed by the MRI scan or CT scan. In this paper,

The MRI scanned image is taken for the entire process. The MRI scan is more comfortable than CT scan for diagnosis. It is not affect the human body. Because it doesn't use any radiation. But they may have some drawback in segmentation. In this paper, k-means algorithm is used for segmentation. So it gives the accurate result for tumor segmentation. Tumour is due to the uncontrolled growth of the tissues in any part of the body [1][8].

II. RELATED WORKS

The existing method is based on the thresholding and region growing. The thresholding method was ignored the spatial characteristics [4][5][8]. Normally spatial characteristics are important for the malignant tumour detection. In the thresholding based segmentation the image is considered as having only two values either black or white. But the bit map image contains 0 to 255 gray scale values. So sometimes it ignores the tumour cells also. In case of the region growing based segmentation it needs more user interaction for the selection of the seed [7][6].Seed is nothing but the centre of the tumour cells; it may cause intensity in homogeneity problem. And also it will not provide the acceptable result in our feature extraction for all the images. So we are avoiding thresholding and region growing method it is not suitable for feature extraction technique.[1]

The proposed system has mainly three modules: pre-processing, segmentation and Feature extraction. Pre processing is done by median filtering. Segmentation is carried out by K-means clustering algorithms. Feature extraction is an, approximate reasoning method to recognize the tumour shape and position in MRI image using edge detection method. In the existing method many algorithms were developed for segmentation. But they are not good for all types of the MRI images.[1][3][7][8].

III. METHODS USED IN PROPOSED SYSTEM

A.IMAGE PREPROCESSING

According to the need of the first level the pre processing step convert the image. It performs filtering of noise in the image. RGB to grey conversion and Reshaping also takes place here. It includes median filter for noise removal. The possibilities of arrival of noise in modern MRI scan are very less. It may arrive due to the thermal effect. The main aim of this paper is to extract optimal features provide efficient result in feature extraction

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(i). MEDIAN FILTER

In this paper we are using median filter for removing noise from an image. The median filter is a non linear digital filtering technique, is often used to remove noise. Median filtering is very widely used in digital image processing because, under certain conditions, it preserves edges while removing noise. The median filter is normally used to reduce noise in an image, somewhat like the, mean filter. However, it often does a better job than the mean filter.

The median is a more robust average than the mean and so a single very unrepresentative pixel in a neighbourhood will not affect the median value significantly. Since the median value must actually be the value of one of the pixels in the neighbourhood, the median filter does not create new unrealistic pixel values when the filter straddles an edge. For this reason the median filter is much better at preserving sharp edges than the mean filter.[5]

$$\textbf{median}[A(x) + B(x)] \neq \textbf{median}\ [A(x)] + \textbf{median}[B(x)]$$

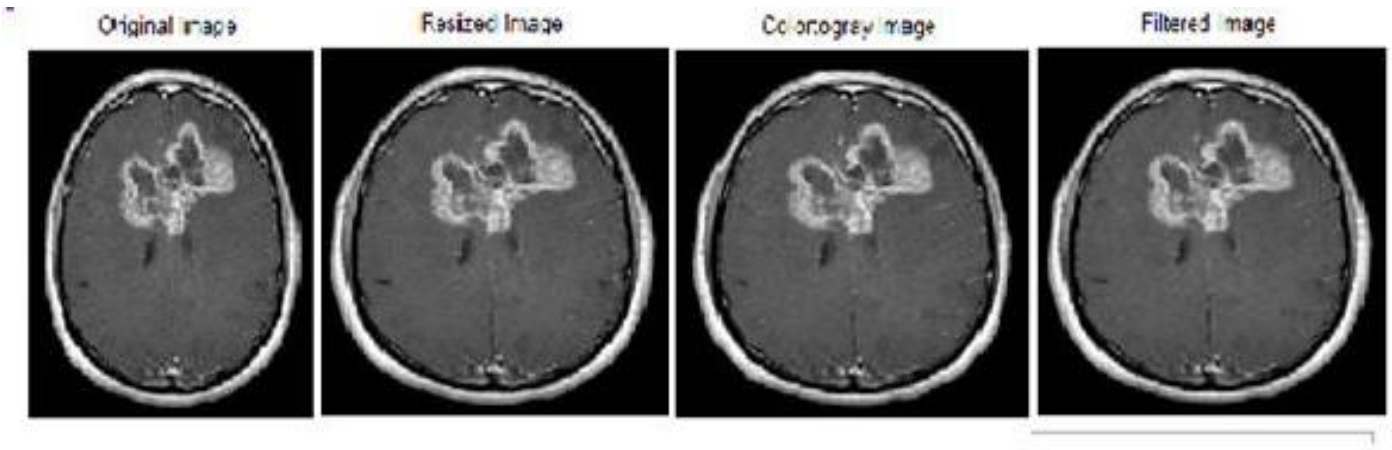

Fig 1:(a)Original image (b)Resized image (c)Gray scale image (d)Filtered image

B.SEGMENTATION USING K-MEANS CLUSTERING:

Image segmentation methods can be classified into three categories: Edge-based methods, region-based methods, and pixel-based methods [3].The K-means clustering technique is a pixel-based method, it is one of the most simple techniques, it's complexity is relatively lower than other region-based or edge-based methods. Furthermore, K-means clustering is suitable for biomedical image segmentation as the number of clusters is usually known for images of particular regions of the human anatomy[3]. Combined with the existing methods and aiming to get better results, it is useful to take segmentation method into account.There is a two-phase iterative algorithm to minimize the sum of point-to-centroid distances.

- . Batch updates: Each iteration consists of reassigning points to their nearest cluster centroid, all at once, followed by recalculation of cluster centroids.
- . Online updates: Points are individually reassigned; in doing so the sum of distances is reduced, and cluster centroids are recomputed after each reassignment.
- Each iteration during this second phase consists of one passing through all the points. K-means can converge to a local optimum, in this case a partition of points in which moving any single point to a different cluster increases the total sum of distances.

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In our project we are using k-means clustering for to segment the brain tumour purpose. In this method, we are grouping the data and to select the mid value, then we are cluster the data in k-means cluster the grouping data are also present in another group of data, but fuzzy and c-means method it is not possible to group same data present in another cluster so we are avoiding fuzzy c-means and c-means clustering algorithm, instead we used k-means clustering method. [2].It produce good result in segmentation techniques and helpful in our feature extraction using GLCM and Gabor feature extraction techniques.

(i).STEPS FOR K-MEANS:
1. Give the no of cluster value as k.
2. Randomly choose k cluster centres
3. Calculate mean or centre of the cluster
4. Calculate the distance b/w each pixel to each cluster centre
5. If the distance is near to the centre then move to that cluster.
6. Otherwise move to next cluster.
7. Re-estimate centre.
8. Repeat the process until the centre doesn't move

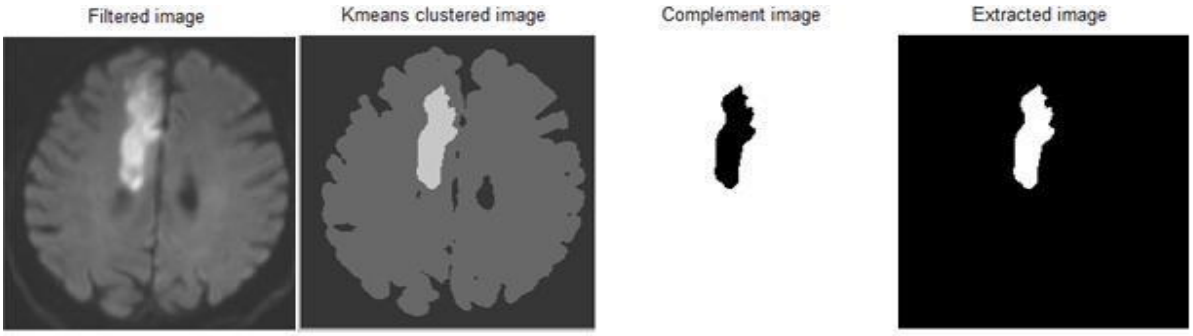
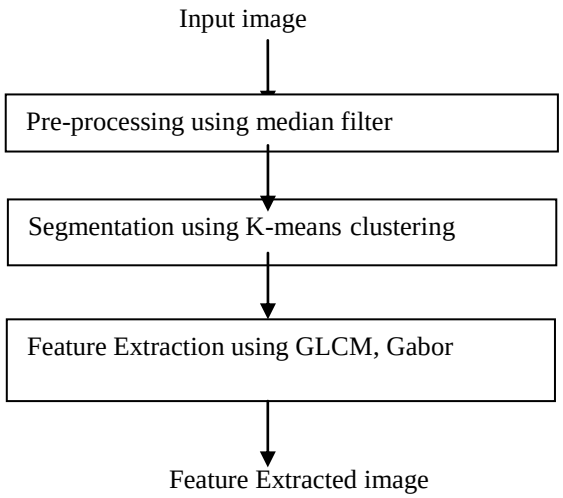


Fig 2: (a)Filtered image (b)Clustered image (c)Complement image (d) Extracted image.

C.METHODOLOGY:



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D.FEATURE EXTRACTION

In pattern recognition and in image processing, feature extraction is a special form of dimensionality reduction. When the input data to an algorithm is too large to be processed and it is suspected to be notoriously redundant then the input data will be transformed into a reduced representation set of features (features vector).

Feature Extraction is helpful in identifying brain tumour where is exactly located and helps in predicting next stage. Transforming the input data into the set of features is called feature extraction [4].

In this paper we're extracting some features by using GLCM [6] and Gabor are:

- Contrast
- Correlation
- Homogeneity
- Entropy
- Energy
- Shape
- Colour
- Texture
- Intensity

(i)CONTRAST:

Contrast is defined as the separation between the darkest and brightest area.

$$Contrast = \sum_{i,j=0}^{n-1} P_{i,j}\ (i-j)^2$$

(ii)CORRELATION:

Correlation is computed into what is known as the correlation coefficient, which ranges between -1 and +1.

$$Correlation = \sum_{i,j=0}^{n-1} P_{ij}\ \frac{(i-\mu)(j-\mu)}{\sigma^2}$$

(iii)HOMOGENITY:

Homogeneity is defined as the quality or state of being homogeneous.

$$Homogenity = \sum_{i,j=0}^{n-1} \frac{P_{ij}}{1+(i-j)^2}$$

(iv)ENTROPY

Entropy is a measure of the uncertainty in a random variable.

$$Entropy = \sum_{i,j=0}^{N-1} -ln(P_{ij})P_{ij}$$

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(v) ENERGY:

It provides the sum of squared elements in the GLCM .Also known as the uniformity or the angular second moment.

$$Energy = \sum_{i,j=0}^{N-1} (P_{ij})^2$$

(vi) SHAPE:

The term shape is commonly used to refer to the geometric properties of an object or its external boundary, as opposed to other properties such as color, texture, material composition.

(vii) COLOR:

Colour is a component of light which is separated when it is reflected off of an object. Colours can be identified numerically by their coordinates.

(viii) INTENSITY:

Intensity is a purity or strength of colour.

(ix) TEXTURE:

It is the visual characteristic of a surface. For example, a surface can be rough or smooth.

S.NO	Contrast	Correlation	Energy	Homogeneity	Entropy
Image1	0.0068	0.9425	0.8753	0.9966	0.3386
Image2	0.0099	0.9291	0.8508	0.9951	0.3851
Image3	0.0159	0.9133	0.8008	0.9920	0.4753
Image4	0.0114	0.9393	0.8016	0.9943	0.4834
Image5	0.0145	0.9572	0.6475	0.9928	0.7512
Image6	0.0127	0.9395	0.7774	0.9936	0.5266
Image7	0.0218	0.9337	0.6503	0.9891	0.7351
Image8	0.0127	0.9102	0.8459	0.9936	0.3896
Image9	0.0068	0.9240	0.9037	0.9966	0.2731
Image10	0.0113	0.9475	0.7738	0.9944	0.2675

IV. EXPERIMENTAL RESULTS

In this paper, the proposed technique for pre-processing was median filter. It is used to remove the noise in an image. It is better than mean filter, Weiner filter, Gaussian filter. In this segmentation technique, we are using k-means clustering method which gives more accurate result with help of the complement of segmented brain tumour image. Using the K-means algorithm, it has an advantage of less computing time. In other words, the partitioned clustering is faster than the hierarchical clustering.Further it is also helpful for feature extraction. In this feature extraction technique we are use two different types of algorithm so it gives efficient result.

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Fig-3 a)Pre-processing b) Segmentation

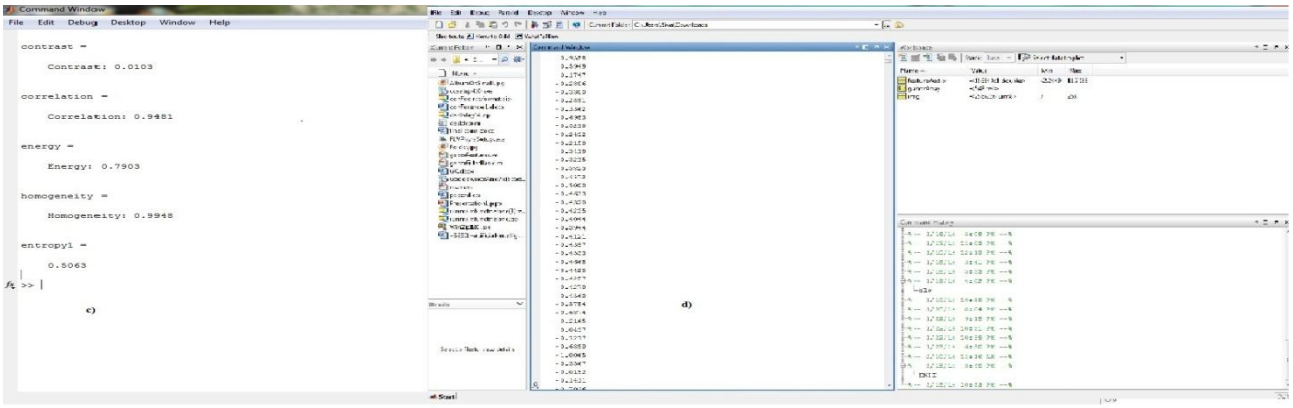

Fig-4 c) Feature Extraction using GLCM&GABOR

V.CONCLUSION

Finally feature was extract and compared with these standard metrics. Thus the proposed method performs better than the existing works. We have extracted nearly 30MRI images in our project. In future 3D assessment of brain using 3D slicers with mat lab can be developed.

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