Volume 6, Issue 1, January 2016 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

# Brain Tumor MRI Image Segmentation and Detection Using Fuzzy Clustering

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***Abstract— Image processing is highly challenging field in medical image processing. To recognize the image or object is the main aim of the image processing technique. Medical imaging methods are used to image the internal part of the human body for medical diagnosis. Brain tumor is one of the critical and life changing disease condition. Image segmentation is important technique which plays a significant role in image processing as it helps in the extraction of suspicious areas from the images. Segmentation of brain MRI image is done using Fuzzy clustering algorithm. Then morphological filtering is used to avoids the misclustered regions that can be formed after segmentation of the brain MRI image for detection of tumor location. In image processing input image is processed to get output also as an image under consideration easier visually .All the images utilized as a part of today's reality are in the digital format. Medical images are those images that demonstrate the physical attributes distribution. Medical imaging modalities as in MRI, CT scan mostly rely on computer technology to generate or display digital images of the interior organs of the human body which helps the doctors to visualize the inward partitions of the body. CT scanner, Ultrasound and Magnetic Resonance Imaging assumed control ordinary x-ray imaging, by permitting the specialist see the body's third measurement.***

***Keywords— Image segmentation, Morphological Filtering, Binarization , Fuzzy Clustering, MRI scan Image.***

## I. INTRODUCTION

MRI needs the data in form of scan image .MRI stands for Magnetic Resonance Imaging. Data is passed through images. Image processing is a procedure where input image is prepared to get yield additionally as an image. Principle point of all image processing techniques is to perceive the image or object under consideration easier visually[1]. All the images utilized as a part of today's reality are in the digital format. Restorative pictures are pictures that demonstrate the physical traits conveyance. Restorative imaging modalities as in MRI, CT check for the most part rely on upon PC innovation to create or show computerized pictures of the inside organs of the human body which helps the specialists to envision the inward divides of the body.

Segmentation is a technique of partitioning the image into multiple segments. The main aim of segmentation is to simplify the image so that it will be more meaningful and easier to analyze. Image segmentation is the main process in majority of medical image analysis. Fuzzy clustering is nothing but the enhancement to the K-means clustering algorithm. Fuzzy clustering is a method of clustering which allows one piece of data belongs to two or more clusters. Fuzzy-c algorithm gives more accuracy than K-means algorithm.

## II. EXISTING SYSTEMS FOR TUMOR DETECTION

Clustering techniques :A group of pixels which have similar relationship can be considered as cluster[1] . Clustering is also known as unsupervised classification technique.In unsupervised classification algorithm automatically classifies objects based given criteria by user. Here K-means clustering algorithm which is followed by morphological filtering is used for tumor detection from the brain MRI images .MRI scans of the human brain is the input image for our system.The preprocessing stage will convert the RGB input image to grey scale image. Median is is used to remove the noise present if any. The preprocessed image is given for image segmentation using K-means clustering algorithm. As there are chances of occurrence of misclustered regions after applying K-means clustering algorithm, there is a technique called morphological filtering which is performed after the image is segmented by K-means clustering algorithm. The main aim of morphological filtering is that it removes these misclustered regions.

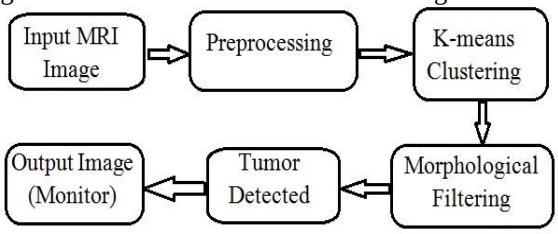


Fig.1.:- Architecture Of Existing system

 

**Advantages:-**

1. If variables are huge, then K-Means most of the times computationally faster if we keep k small.
2. This algorithm improves the primary results of segmentation of tumor done by k-means.
3. **Simplicity** :All the operations of system have very simple architecture.

**Limitations**:-

1. Difficult to predict K-Value & k-means cannot find Non-convex clusters.
2. Different initial partitions can result in different final clusters.
3. This method does not work well with clusters of different size and different density.

## III. PRAPOSED SYSTEMS FOR TUMOR DETECTION

We have proposed brain tumor detection system based on MRI image as input. Pre-processing is performed on this MRI scanned image. Pre-processing includes 2 phases i.e. RGB to Grey scale image conversion and second one is use of median filter. The input image may in RGB format so the first step must be the conversion of that image into Grey scale. Grey scale image is combination of black and white pixels. After converting the image into grey scale median filter is used to remove the noise that may be present in image. Image segmentation is performed to divide the image into multiple segments. After segmentation Fuzzy clustering algorithm is applied on that segments. This clustering algorithm is some what similar to k-means clustering. But the accuracy of Fuzzy clustering algorithm is higher than k-means. In this algorithm different clusters are formed and pixels with same properties are grouped into clusters. Binarization technique is used to convert all the pixels into 0 and 1 format. Black pixels treated as 0 where as white pixels treated as 1.Here white pixels are tumor affected pixels. Morphological filter is used to remove the misclusterd data. After performing filtering remaining part will be treated as tumor affected area. Depending upon that resulted tumor area and stage of tumor is identified. Stage could be normal, critical etc.

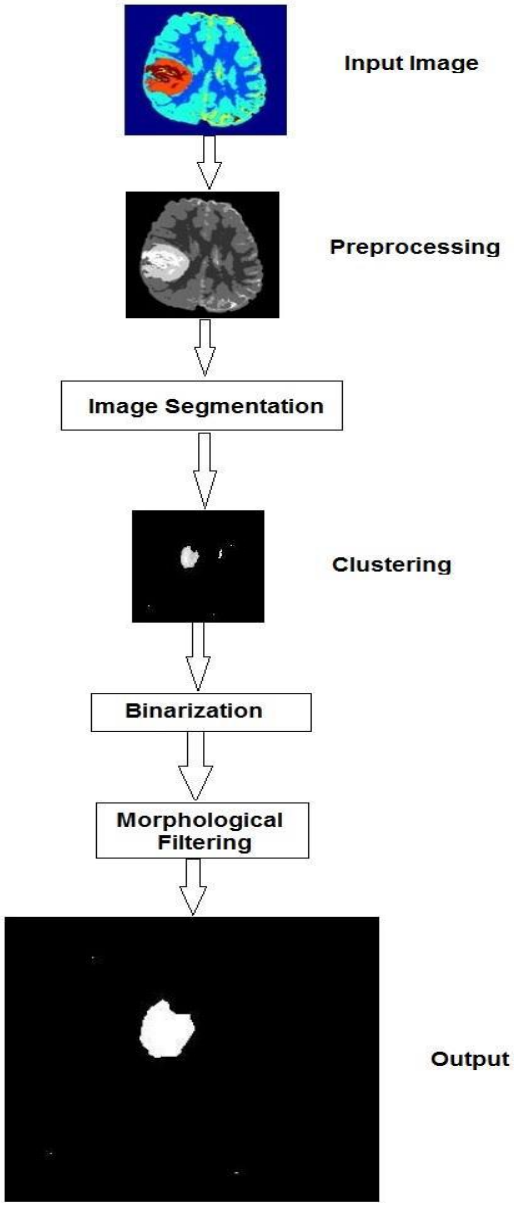


Fig.2.:- Architecture of proposed system

 

**1. Input Dataset:-**

Our system makes use of MRI scanned images as input. MRI image is in Colour format which should be converted to grey scale image.

**2. Preprocessing:-**

It includes RGB to Grey conversion and median filtering. The RGB image is of 24 bit which will be converted into the grey scale image which will be of 8 bit. Median filter is used to remove noise from image if any.

**3. Fuzzy Clustering algorithm:-**

It does the work of the image clustering according to pixels similarity. In this first the image is divided into multiple segments ,then the fuzzy c algorithm is applied to the preprocessed image.

**4. Binarization:-**

It converts a grey-scale document image into a binary document image and accordingly facilitates the ensuing tasks such as document skew estimation and document layout analysis.

**5. Morphological Filtering:-**

It removes misclustered regions and hence tumor is detected i.e. clustered area. There are two morphology operations called erosion and dilation. Erosion means thinning of the object in the image where dilation means thickening of the object in the image.

**Algorithmic steps for Fuzzy c-means clustering**

Let $X = \{x_1, x_2, x_3 ..., x_n\}$ be the set of data points and $V = \{v_1, v_2, v_3 ..., v_c\}$ be the set of centers.

1) Randomly assume *'c'* cluster centers.

2) Fuzzy membership $'\mu_{ij}'$ is calculated by using:

$$\mu_{ij} = 1 / \sum_{k=1}^{c} (d_{ij} / d_{ik})^{(2/m-1)}$$

3) Compute the fuzzy centers $'v_j'$ using following formula:

$$v_j = (\sum_{i=1}^{n} (\mu_{ij})^m x_i) / (\sum_{i=1}^{n} (\mu_{ij})^m), \forall j = 1, 2, .....c$$

4) Repeat step 2) and 3) until the minimum *'J'* value is obtained or $||U^{(k+1)} - U^{(k)}|| < \beta$.

where,

*'k'* is the step of iteration.

*'β'* is the termination criterion between [0,1].

*'*$U = (\mu_{ij})_{n*c}$*'* is the matrix fuzzy membership.

*'J'* is the objective function.

## IV. CONCLUSION

Segmentation of brain image is imperative in medical planning and treatment planning in the field of medicine. In this work, we have proposed a computer aided system for brain MR image segmentation for detection of tumor location using fuzzy clustering algorithm followed by morphological filtering. Further study includes the implementation of the algorithm and analysis of the result.

## ACKNOWLEDGMENT

We take this opportunity to thank our project guide Prof. Neeta S. Shirsat and head of the department Prof. G.V. Garje for their valuable guidance and for providing all the necessary facilities, which were indispensable in the completion of this project report. We are also thankful to all the staff members of the department of Information Technology of PVG'S College of Engineering and Technology Pune for their valuable time, support, comments, suggestion and persuasion. We would also like to thank the Institute for providing the required facilities, internet access and important books.

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