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MRI Segmentation using K-Means Clustering in HSV Transform

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Abstract — **In this Project, a valuable technique or method is proposed for the precise segmentation of normal, abnormal and pathological tissues in the MRI brain images. The segmentation technique performs classification process by using K- means clustering. This propose a HSV approach for classification of brain magnetic resonance images (MRI) based on color converted K- means clustering segmentation algorithm. Segmentation of images shows an important position in the area of image processing. It becomes more critical while typically handling with medical images. A well known segmentation problem within MRI is the task of labeling voxels according to their tissue type which include White Matter (WM), Grey Matter (GM) , Cerebrospinal Fluid (CSF) and sometimes pathological tissues like tumor etc. This paper describes an efficient method for automatic brain tumor segmentation.**

I. INTRODUTION

Magnetic resonance imaging (MRI) segmentation is a complex issue. Different imaging techniques or method are help to diagnosis, treatment and surgery. In most of the hospitals, radiologists performs the diagnosis of brain tumor manually on MR images, but it is time consuming and error prone process, in particular because of large number of image slices of single patient and the involvement of various disciplines covering pathology, radiologist's perception [1], and due to the large variation in the intensity of various images representing different brain structures.

Since the process of medical image segmentation, many methods have been implemented for brain structure segmentation from magnetic resonance imaging (MRI). The traditional classification of MR images by a specialist is difficult and time-consuming task. The segmentation becomes more challenging or difficult when one wants to derive common decision boundaries on different object types in a set of images.

II. WHAT IS SEGMENTATION

"Image segmentation is the division of an image into a set of no overlapping regions whose union is the entire image. The purpose of segmentation is to break down the image into parts that are useful with respect to a particular application."

The quality of the segmentation depends upon the digital image. Segmentation is the process of dividing an image into distinct regions with property that each region is characterized by unique feature such as intensity, color etc .Further it refers to the process of dividing a digital image into multiple segments such as a sets of pixels, also known as super pixels [2]. The main objective of segmentation is to transform the representation of an image into meaningful image that is more understandable and easier to analyze. [2]

Segmentation is an important step in the analysis of medical images for computer-aided diagnosis and therapy [1]. Medical image segmentation separates the image into distinct classes such as brain tumors, and necrotic or malignant tissue, etc.

A. There is many methods to segmented images:

i).Clustering

ii).Thresholding

iii).Region Based

iv).Edge Based

v). Edge Detection

B. Magnetic Resonance Imaging (MRI):

Medical image is the technique and process used to establish images of the human body. In medical image processing segmentation has been used for various purposes like: surgical planning, heart image eradication from cardiac cine angiograms, detection of tumors, checking tumor volume, detection of small classification on mammograms, detection of the coronary border in angiograms, its recipience to therapy, automated classification of blood cells, etc. The advances in image technology, diagnostic imaging has become a crucial tool in medicine today.

- MRI is a noninvasive imaging method that does not involve disclosure to ionizing radiation.
- MR images of the brain and other cranial structures are fair and more detailed than with other imaging methods. This information makes MRI an invaluable tool in early diagnosis and calculation of many situations, including tumors.
- MRI can find stroke at a very early stage by mapping the motion of water molecules in the tissue. This water motion, known as dispersion, is harmed by most strokes, often within less than 30 minutes from the onset of symptoms.

III. METHOD

Various algorithms are there for brain tumor segmentation. Many methods are available in medical image segmentation all have some advantage and limitations. These methods are chosen based on the specific applications and imaging procedure. Imaging antiquity such as noisy, partial volume effects, and motion can also have significant consequences on the performance of segmentation algorithms.

K-means clustering algorithm: K-Means is the one of the unsupervised learning technique for clusters. Clustering the image is organizing the pixels according to the some features. In the k-means algorithm initially we have to define the number of clusters k. Then k-cluster center are select randomly. The distance between the each pixel to each cluster centers are figured. The distance may be of simple function.

- It is relatively capable and quick.
- k-means clustering used to machine learning or data mining
- Used on audio data in speech understanding to convert waveforms into one of k categories (known as Vector Quantization or Image Segmentation).
- Quick, robust and easier to understand.
- Gives best results when data set are different or well separated from each other.
- *K*-means is simple and can be used for a wide variety of data types; it is vocate sensitive to initial positions of cluster centers. The main cluster centroids may not be optimal ones as the algorithm can converge to local optimal solutions. An blank cluster can be obtained if no points are allocated to the cluster during the assignment points. Therefore, it is quite important for *K*-means to have good initial cluster centres. The algorithms for initialize the cluster centres for *K*-means have been proposed a new cluster centre initialization algorithm. Hence the enhanced k-means algorithm will be as follows.
  1. Read the input image.
  2. Decide the number cluster and initialize the cluster centre obtained from cluster centre initialization algorithm.
  3. Partitioning the input data points into k clusters by assigning each data point to the closest cluster centroid using the selected distance measure,
  4. Computing a cluster assignment matrix U.
  5. Re-computing the centroids.
  6. If cluster centroids or the assignment matrix does not change from the previous iteration, stop; otherwise go to step 2.

The proposed algorithm is based on the k-means clustering algorithm in HSV transform which applied to color brain tumor images. First segment the image by the colors present in it we read about an idea that uses the k means clustering algorithm, which includes mapping the image pixels to the RGB color space.

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The RGB color space is further converted to a HSV color model. Here we are using K-Means algorithm for the clustering purpose. Use K-means to cluster the objects into three clusters.

After performing the enhancement in HSV color space, they convert back to RGB color space to save and/or display the processing result. There are basically two types of markers internal marker and external marker. For internal marker the location of all regional minima gradient image is computed using MATLAB toolbox.

The clustering based method such as K-means algorithm has a fast speed which allows it to run on large data sets. Convert the RGB (Red, Green, and Blue) values of each pixel of any segment of the original image to HSV (Hue, Saturation, and Value) values.

HSV color space

The HSV (Hue, **S**aturation, Value) color model shows a color space in terms of three constituent components:

H**ue:** the color type (such as red, blue, or yellow). Ranges from 0 to 360° in most applications. (each value related to one color : 0 is red, 45 is a shade of orange and 55 is a shade of yellow).

S**aturation**: the intensity of the color. Ranges from 0 to 100% (0 means no color, that is a shadow of grey between black and white; 100 means sharpe color). Also sometimes called the "purity" by analogy to the **colorimetric** quantities excitation purity.

Value: the brightness of the color. Ranges from 0 to 100% (0 is always black; depending on the saturation, 100 may be white or a more or less saturated color).

This algorithm, which is a method of cluster analysis, aims to partition *n* observations into *k* clusters (a number that is chosen manually).

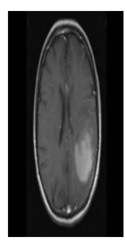
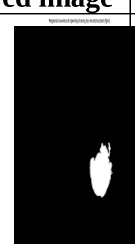
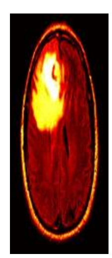
Process following steps:

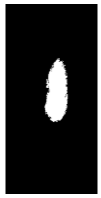
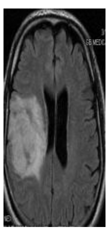
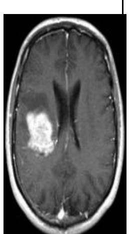
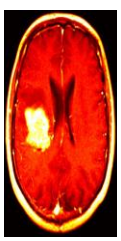
- Load a color image.
- Read (r, g, b) values for each pixel of any of the two segments.
- Convert RGB color space of the two segments to HSV color space.
- Apply the K-means for segment the color image into dark and bright segments.
- Apply the saturation enhancement on the component of each segment.
- Convert HSV color space to RGB color space.
- Store the enhanced color image.

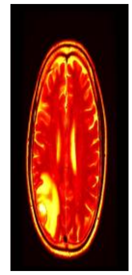
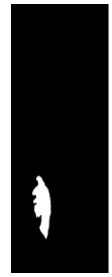
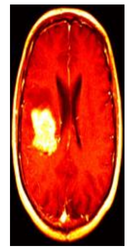
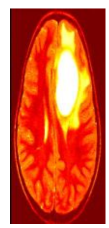
IV. RESULT

The proposed brain tissue segmentation technique is implemented in the working platform MATLAB (version 2007) and it is evaluated using 10 medical brain MRI images, which are collected medical diagnosis centers. The sample image considered in this work and their respective outputs after RGB color space conversion, color sharpening and K-means Clustering Segmentation, this segmentation process allows for an image to be more precisely segmented.

The Segment result is:

Gray image	**HSV image**	**Segmented image**	**Tumor Size(cm)**
			**3.99478**
			**5.1313**

			**6.1558**
			**6.4082**
			**B21** **11.7978**
			**1.43259**
			**B13** **6.3986**

			**B14** **2.55395**
			**B16** **1.43583**
			**B17** **6.9871**

V. CONCLUSION

An efficient segmentation algorithm was developed to segment the normal and pathological tissues from the MRI brain images. The performance of the proposed segmentation was analyzed using defined set of MRI normal and abnormal images. There are different types of tumor s are present. They may be as mass in brain or malignant over the brain. Suppose if it is a mass then K- means algorithm is enough to extract it from the brain cells. If there is any error are present in the MR image it is removed before the K-means method. The noise less image is given as an input to the k-means and tumor is extracted from the MRI image. And then segmentation using k means for accurate tumor shape extraction of malignant tumor. Finally approximate reasoning for calculating tumor shape and position calculation.

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