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A Review on Brain Tumor Segmentation and Its Area Calculation in Brain using MRI Images

(Review Paper on Brain Tumor Segmentstion and Area Calculation in Java and Open-CV by Using K-Means Clustering and Convolution Neural Network)

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ABSTRACT: In this paper we make a java based medical application. This application based on brain tumor segmentation and its area calculation. Among brain tumors, gliomas are the most common and aggressive, leading to a very short life expectancy in their highest grade. Thus, treatment planning is a key stage to improve the quality of life of oncological patients. Magnetic Resonance Imaging (MRI) is a widely used imaging technique to assess these tumors, but the large amount of data produced by MRI prevents manual segmentation in a reasonable time, limiting the use of precise quantitative measurements in the clinical practice. So, automatic and reliable segmentation methods are required; however, the large spatial and structural variability among brain tumors make automatic segmentation a challenging problem. Surely with the help of this application Doctors reduces their time for finding the area of Tumor. So that in this project we will do the image processing on the MRI images. By doing and applying Edge Detection, grayscale conversion, K-means clustering on MRI images, Boundary Approach (Thresholding), Edge Based Approach, Region Based Approach. The algorithms The K –Means Algorithm, Convolutional Neural Network, Binarization and line segmentation suavely algorithm, Image Thresholding algorithm. The whole system can be implemented in very low cost and provides better accuracy.

KEYWORDS: Image preprocessing, k-means clustering, binarization, thresholdind, CNN(Convolution Nueral Network), Mathematical formule. JAVA based application.

I. INTRODUCTION

The human body is made up of many cells which have their own special characteristics. Most of the cells in the human body grow and split to form a new cell of the same kind as they are required for proper functioning of the human body. When those cells lose control and develop in an uncontrollable way, it rises to a mass of undesired tissue forming a tumor. Brain tumor is the human mass of tissue in which cells grow and multiply uncontrollably. These brain tumors may be embedded in the areas of the brain that provides the sensitive functioning of the body to be disabled. Its location and dynamic spreading capacity provides its treatment very complex and risky. MRI is mostly used in the biomedical to detect and envisage finer details in the internal structure of the human body. This method is basically used to detect the differences in the tissues which have a far improved method as compared to computed tomography. So this makes this procedure a very special one for the brain tumor detection. This system, an automatic segmentation method based on Convolution Neural Networks (CNN), exploring small 3X3 kernels is suggested. The use of small kernels allows designing a deeper architecture, besides having a positive effect against over fitting, given the fewer number of weights in the network. Also use of intensity normalization as a pre-processing step investigated the, which though not common in CNN-based segmentation methods, proved together with data augmentation to be very effective for brain tumor segmentation in MRI images.

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II. RELATED WORK/ SURVEY

Tumor is an uncontrolled growth of tissues in any part of the body. Tumors are of different types and they have different Characteristics and different treatment. As it is known, brain tumor is inherently serious and life threatening because of its character in the limited space of the intracranial cavity (space formed inside the skull). Most Research in developed countries show that the number of people who have brain tumors were died due to the fact of inaccurate detection. Generally, CT scan or MRI that is directed into intracranial cavity produces a complete image of brain. This image is visually examined by the physician for detection diagnosis of brain tumor. However this method of detection resists the accurate determination of stage size of tumor. To avoid that, uses computer aided method for segmentation (detection) of brain tumor based on the combination of three approaches and K-Means cluster algorithm. This method allows the segmentation of tumor tissue with accuracy and reproducibility comparable to manual segmentation. In addition, it also reduces the time for analysis. At the end of the process the tumor is extracted from the MR image and its exact position and the shape is also determined. The stage of the tumor is displayed based on the amount of area calculated from the cluster. Among brain tumors, glooms are the most common and aggressive, leading to a very short life expectancy in their highest grade. Thus, treatment planning is a key stage to improve the quality of life of ontological patients. Magnetic Resonance Imaging (MRI) is a widely used imaging technique to assess these tumors, but the large amount of data produced by MRI prevents manual segmentation in a reasonable time, limiting the use of precise quantitative measurements in the clinical practice.

III. FUNCTIONAL REQUREMENT

A. Image Pre-processing

Apply Processing on input Image (OpenCV image)

a. Edge Detection: Edges are the sharp black shadow surrounding the objects.
b. Apply grayscale conversion

B. Boundary Approach(Thresholding)

In thresholding, pixels are allocated to categories according to the range of values in which a pixel lies. Thresholding is the simplest and most commonly used method of segmentation. Given a single threshold, t, the pixel located at lattice position (i, j), with greyscale value fij, is allocated to category 1 if fij ≤ t or else, the pixel is allocated to category 2.

C. Edge Based Approach

In edge based segmentation, an edge filter is applied to the image, pixels are categorized as edge or non-edge depending on the filter output, and pixels which are not divided by an edge are owed to the same category. Edge based segmentation is based on the fact that the position of an edge is given by an extreme of the first order derivative or a zero crossing in the second order derivative. There a pixel is classified as an object pixel judging solely on its gray value independently of the context. To improve the results, feature computation and segmentation can be repeated until the procedure converges into a stable result.

D. Regin Based Approach

Region-based segmentation algorithms operate iteratively by grouping together pixels which are neighbors and have similar values and splitting groups of pixels which are dissimilar in value. Segmentation may be regarded as spatial clustering. Clustering in the sense that pixels with similar values are grouped together whereas spatial in that pixels in the same category also form a single connected component. Clustering algorithms may be agglomerative, conflict-ridden or iterative.

E. The K -Means Algorithm

K-means algorithm is the most well-known and widely-used unsupervised clustering technique in partitioned clustering algorithms. Purpose of this algorithm is to minimize the distances of all the elements to their cluster centers. Most of the algorithms in this field are developed by inspiring or improving k-means. The algorithm upgrades the clusters iteratively and runs in a loop until it reaches to optimal solution. Pseudo-code of the K-means clustering algorithm is

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shown. Performance of K-means algorithm depends on initial values of cluster centers. Therefore the algorithm should be tested for different outcomes with different initial cluster centers by multi-running.

F. Calculate Region of Interest and area

The detected region of tumor is shown after k-means clustering algorithm is applied on the image. The highlighted ROI is then analyzed to find area of tumor.

IV. ALGORITHM USES/ INTERESTED ALGORITHAM

G. Convolutional Neural Network Algoritham

a. In machine learning, a convolutional neural network (CNN, or ConvNet) is a type of feed-forward artificial neural network in which the connectivity pattern between its neurons is inspired by the organization of the animal visual cortex, whose individual neurons are arranged in such a way that they respond to overlapping regions tiling the visual field.

b. Convolutional networks were inspired by biological processes and are variations of multilayer perceptron designed to use minimal amounts of preprocessing.

a) Initialization: It is important to achieve convergence. Xavier initialization is used. With this, the activations and the gradients are maintained in controlled levels; otherwise back-propagated gradients could vanish or explode.

b) Activation Function: It is responsible for non-linearly transforming the data. Rectifier linear units (ReLU), defined as

$$f(x) = max(0, x),$$

Were found to achieve better results than the more classical sigmoid, or hyperbolic tangent functions, and speed up training. However, imposing a constant 0 can impair the gradient flowing and consequent adjustment of the weights. These limitations are coped using a variant called leaky rectifier linear unit (LReLU) that introduces a small slope on the negative part of the function. This function is defined as

$$f(x) = \max(0, x) + \alpha \min(0, x)$$

Where **α** is the leakyness parameter. In the last FC layer, we use softmax.

H. Image Thresholding algorithm

The simplest implementation of thresholding is to choose an intensity value as a threshold level and the values below this threshold become 0 (black) and the values above this threshold become 1 (white). If T is the global threshold of image f(x,y) and the g(x,y) is the thresholding image.

$$g(x,y) = \begin{cases} 1, & if \quad f(x,y) \geq T \\ 0, & otherwise \end{cases}$$

I. Binarization and line segmentation sauvola algorithm

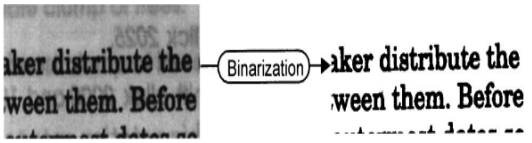

Fig.1 Example of image Binarization.

$$T(x,y) = m(x,y) \cdot \left[1 + k \cdot \left(\frac{s(x,y)}{R} - 1 \right) \right],$$

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V.WORK FLOW OF PROJECT

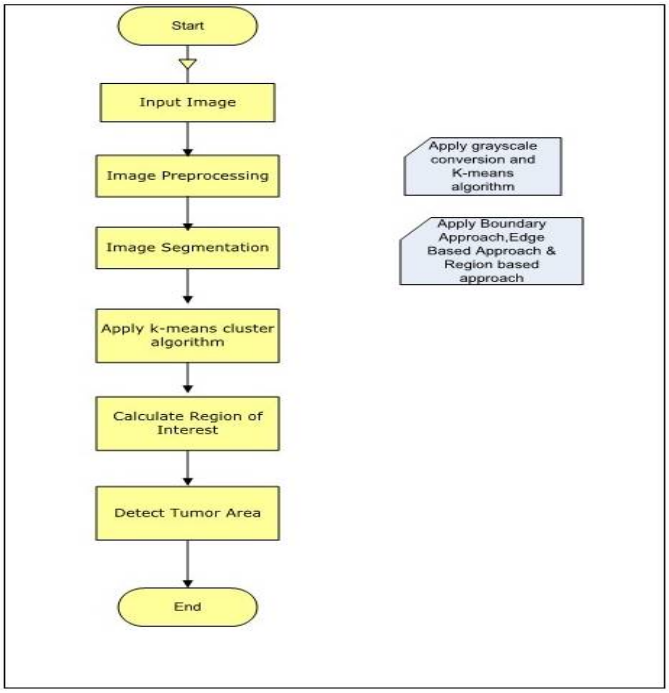

Fig.2 Work flow Diagram.

VI. FURTHER ISSUE

Normally the anatomy of the Brain can be viewed by the MRI scan or CT scan. This system 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. It is based on the magnetic field and radio waves. There are different types of algorithm were developed for brain tumor detection. But they may have some drawback in detection and extraction. This system contain, three approaches are used for segmentation. So it gives the accurate result for tumor segmentation.

VII. GOLAS AND OBJECTIVE

- To minimize the manual work by Doctor's.
- It gives more accurate result.
- It reduces time for calculation.
- It finds the approximate shape and position, calculation.
- Easy to operate and maintain

VIII. CONCLUSION

Brain Tumor Segmentation and Its Area Calculation in Brain using MRI Images detected region of tumor using K-Means cluster algorithm. The highlighted ROI is analyzed to find area of tumor. Thus we will implementing the automatic segmentations in minimum time and providing accurate result for further treatment of Doctors.

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