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Brain Tumor Detection

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Abstract: *The project presents the MRI encephalon diagnosis support system for structure segmentation and its analysis utilizing K-denotes clustering technique integrated with Fuzzy C-designates algorithm. The method is proposed to segment mundane tissues such as White Matter, Gray Matter, Cerebrospinal Fluid and eccentric tissue like tumour apart from MR images automatically. These MR encephalon images are often corrupted with Intensity Inhomogeneity artefacts cause unwanted intensity variation due to non-uniformity in RF coils and noise due to thermal vibrations of electrons and ions and kineticism of objects during acquisition which may affect the performance of image processing techniques utilized for encephalon image analysis. Due to this type of artefacts and noises, sometimes one type of mundane tissue in MRI may be misclassified as other type of mundane tissue and it leads to error during diagnosis. The proposed method consists of pre-processing utilizing Gaussian filter to abstract noise and K-denotes clustering technique integrated with Fuzzy C-betokens algorithm segments mundane tissues by considering spatial information because neighbouring pixels are highly correlated and additionally construct initial membership matrix desultorily. The system additionally used to segment the tumour cells along with this morphological filtering will be acclimated to abstract background noises for smoothening of region. The project results will be presented as segmented tissues and relegation utilizing neural network classifier.*

Keywords: Numpy, Open-CV, Pillow, Tensorflow, Tumor Detection, Convolutional Neural Network, tkinter, Gaussian Filters, MRI Images, Brain

I. Introduction

With the amelioration of modern medical standards, medical imaging technology plays an increasingly paramount role in daily medical diagnosis and medical research. Ergo, research on medical diagnostic image data is very consequential. As a tumor disease with frequent occurrence and intricacy, encephalon tumor has become a key research topic in the medical field. The diagnosis of encephalon tumors is customarily predicated on imaging data analysis of encephalon tumor images. Precise analysis of encephalon tumor images is a key step in determining a patient's condition. However, the accumulation of medicos' personal medical erudition, differences in experience levels, and visual fatigue can affect the correct analysis of image results.

Ergo, how to accurately detect encephalon tumor images is very paramount. Magnetic Resonance Imaging (MRI) can provide information on the shape, size, and position of human tissues and organs without high ionizing radiation. The images obtained are very pellucid and precise. MRI greatly ameliorates the diagnostic efficiency, eschews the operation of thoracotomy or laparotomy exploration, and provides a good guide for lesion localization and surgical treatment. Encephalon tumor MRI uses three-dimensional multi-band imaging technology, and chest X-ray scanning, etc.

In many recent object apperception systems, feature extraction stages are generally composed of a filter bank, a non-linear transformation, and some scarcely feature pooling layers. Most systems use only one stage of feature extraction in which the filters are hard-wired, or two stages where the filters in one or both stages are learned in supervised or unsupervised mode. This paper addresses three questions: We show that utilizing non-linearity that include rectification and local contrast normalization is the single most paramount ingredient for good precision on object apperception benchmarks. We show that two stages of feature extraction yield better precision than one. Most surprisingly , we show that a two-stage system with arbitrary filters can yield virtually 63% apperception rate on Caltech-101, provided that the felicitous non-linearities and pooling layers are utilized.

II. Problem Statement

Brain Is an Organ that controls activities of all the parts of the body. Magnetic resonance imaging (MRI) is difficult task due to complexity of size and location variability.in this results statically analysis morphological thresholding techniques are proposed to proses the mages obtained by MRI for tumor detection from Brain MRI Images. Feed-Forword backprop neural network will be used to classify the performance of the tumor part of the image the results produced by this approach will increase the accuracy and reduce the number of iterations.

III. Objectives

- To Upload MRI image of brain as input.
- Convert it to a grayscale image.
- To Convert it to a HSV image
- To Compute Threshold segmentation.
- Compute watershed segmentation.
- Finally output will be the tumor region.

IV. Proposed System

4.1 Preprocessing

The preprocessing step amends the standard of the encephalon tumor MR images and makes these images suited for future processing by clinical experts or imaging modalities. It with all avails in amending parameters of MR images. The parameters include amelioration in signal-to-noise ratio, enhancement in visual appearance of MR images, the abstraction of extraneous noise and background of undesired components, smoothing regions of inner part, and maintaining germane edges [5].

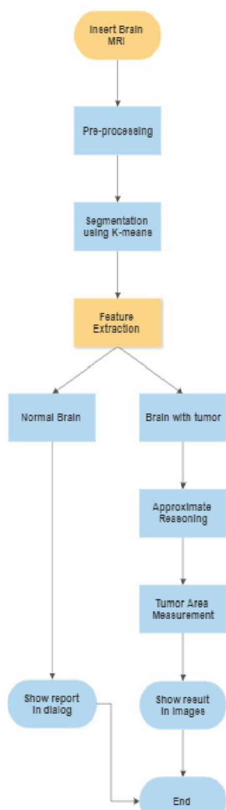

Figure 1: Flowchart

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4.2 Segmentation

Segmentation is a process in which the image is divided into different regions. Let an entire region of the picture be represented by S. This process can be viewed as the partition of S into p subparts like S1, S2, S3, …Sp. Certain conditions have to be struck such as the segmentation must be intact; that is each and every pixel should be within the region, every point in the regions should be connected at some point, regions should be disjoint, etc.

4.3 Feature Extraction

It is a process of extracting quantitative information from a picture such as color features, texture, shape, and contrast. Here, we have utilized discrete wavelet transform (DWT) for extracting wavelet coefficients and gray-level co-occurrence matrix (GLCM) for statistical feature extraction. By utilizing 2D discrete wavelet transform, the images were decomposed into spatial frequency components were extracted from LL subbands and since HL subbands have higher performance when compared to LL, we have utilized both LL and HL for better analysis which describes image-text features. The different frequency components and each component were studied with a resolution matched to its scale and expressed as

$$DWTp(s)=\{di,j=\sum p(s)h*i(s-2ij)$$

$$\{di, j=\sum p(s)g*i(s-2ij)$$

The coefficients di,j refers to the component attribute in signal p(s) corresponding to the wavelet function, whereas bi,j refer to the approximated components in the signal. The functions h(s) and g(s) within the equation represent high-pass and low-pass filters coefficients, respectively, while parameters i and j ask wavelet scale and translation factors.

4.4 Image Processing

It is the strategy of dispersing a picture into more minuscule bits. It makes a few arrangements of pixels inside the same picture. Doles out a tag to each pixel in a picture and the pixels with the commensurable mark share categorical highlights. Fragmenting makes it simpler to supplementally break down and perceive paramount data structure in an advanced picture.

4.5 K-Means Algorithm

Majority of picture handling procedures use K-Means calculation for picture division. It is profoundly valuable for brobdingnagian pictures with helpless intricacy. In any case, it has been understood that K-Designates is susceptible to resoluteness of tests and substrata of fluffy sets.

J: Objective Function
K: Number of c
N: Number of cases
Cj: Centroid of cluster 'j'

$$J = \sum_{j=1}^{k} \sum_{i=1}^{n} ||x_i^{(j)} - c_j||^2 \text{------------------}(1)$$

Methods for Segmentation	Used parameter	Prone towards
Threshold method	gradient magnitude is applied to find the potential edge pixels [11].	Difficult to be applied to pictures having low contrast.
Region Based method	Used for separation of regions in an image based on similar properties [13].	Quality of final result may be impacted by noise.
Fuzzy C Means, K Means and Level Set Techniques	Can be applied to pictures with large size and poor contrast.	Establishment of fuzzy sets and selecting sample may be bit hard [15].

Figure 2: Different segmentation methods

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4.6 CNN Algorithm

CNN or the convolutional neural network (CNN) is a class of deep learning neural networks. CNN is a machine learning algorithm that can take in an input image, assign importance (learnable weights and biases) to various aspects/objects in the image, and be able to differentiate one from the other.

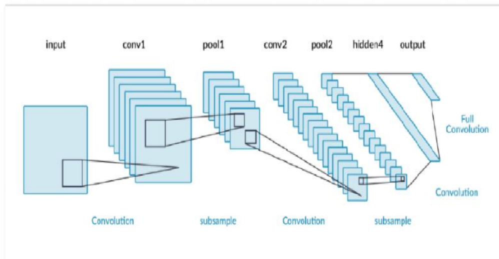

Figure 3: Classification of CNN

4.7 Tkinter Programming

Tkinter is the standard GUI library for Python. Python when amalgamated with Tkinter provides an expeditious and facile way to engender GUI applications. Tkinter provides a potent object-oriented interface to the Tk GUI toolkit. The GUI is made up using Tkinter.

Figure 4: GUI using Tkinter

IV. Methodology

The algorithm has two stages, first is pre-processing of given MRI images and after that segmentation and then performing morphological operations. Steps of algorithm are as follows:

1. Upload MRI image of brain as input.
2. Convert it to a grayscale image.
3. Convert it to a HSV image
4. Compute Threshold segmentation.
5. Compute watershed segmentation.
6. Finally output will be the tumor region.

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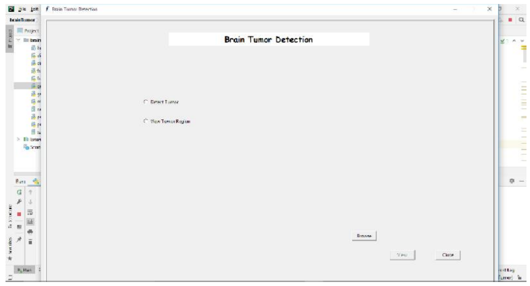


Figure 5: First GUI of BTD system

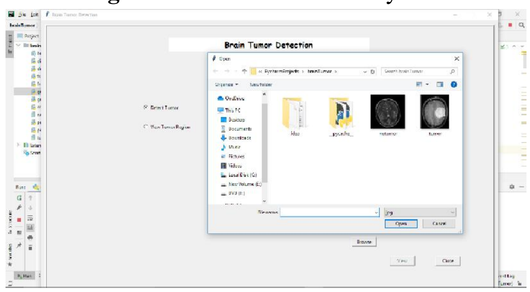


Figure 6: Image Uploading Module

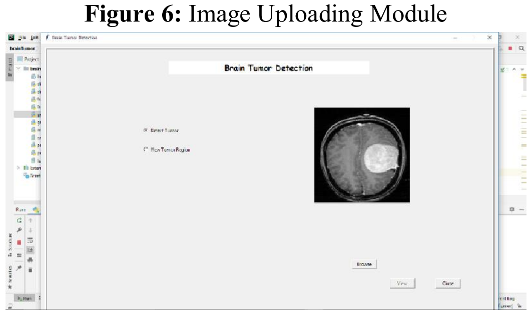


Figure 7: Image conversion(BGR to Gray)

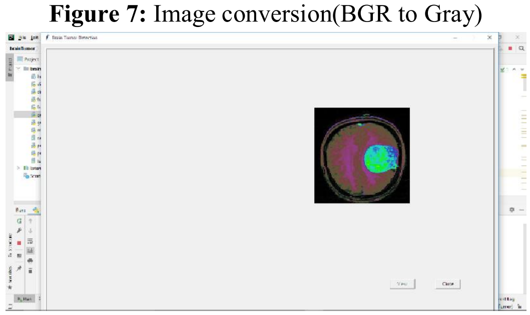


Figure 8: Image Conversion (RGB to HSV)

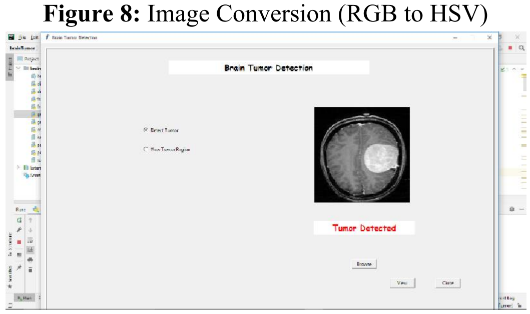
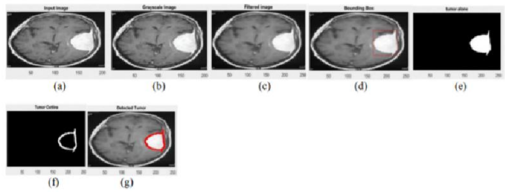


Figure 9: Tumor Detection



V. Conclusion

Capricious amendment of tissues in the cerebrum which impact authentic psyche limits is considered as a cerebrum tumor. The key target of clinical picture taking care of is to apperceive exact and paramount information utilizing pictures with the base error possible. Encephalon tumor unmistakable bits of proof through MRI pictures is an inconvenient task because of the multifaceted conception of the cerebrum. These tumors can be divided utilizing diverse picture division methodologies. The path toward apperceiving cerebrum tumors through MRI pictures can be masterminded into four unmistakable sections; pre-taking care of, picture division, feature extraction and picture request.

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