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BRAIN TUMOR DETECTION BASED ON SEGMENTATION OF MRI IMAGE USING GLCM WITH FUZZY C – MEAN CLUSTERING

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Abstract - **Image segmentation plays a major role in image process because it helps within the extraction of suspicious regions from the medical images. Throughout the past few years, brain tumor segmentation in magnetic resonance Imaging (MRI) has become an aborning analysis area within the field of medical imaging system. In MR images, the number of information is simply too abundant for manual interpretation and analysis. Accurate detection of size and location of brain tumor plays an important role within the diagnosis of tumor. During this paper an efficient formula is proposed for tumor detection based on segmentation of brain magnetic resonance images exploitation GLCM with Fuzzy C -Means clustering. This paper provides additionally some helpful insight on the appliance of pre-processing techniques towards segmenting and labelling the brain images. The proposed technique consists of three process stages. Within the initial stage, the magnetic resonance imaging of brain image is non inheritable from magnetic resonance imaging brain knowledge set to MATLAB 7.1. In the second stage removing noise in the image using weighted median filter. In the third stage GLCM with Fuzzy C-Means cluster formula for segmentation of the image is employed for tumor detection from the brain magnetic resonance imaging images.**

Keywords - **Image segmentation, Tumor Detection, MRI Brain image, De-noising, Filtering.**

I. INTRODUCTION

In image segmentation, one main challenge is to handle the non-linearity of real knowledge distribution, which frequently builds segmentation methods would like a lot of human interactions and make unhappy segmentation results. Medical image segmentation plays associate instrument in clinical diagnosis. A perfect medical image segmentation scheme ought to possess some most popular properties like minimum user interaction, quick computation and accurate and robust segmentation results. Image segmentation is an image analysis method that aims at partitioning an image into many regions in step with a homogeneity criterion.

Image segmentation could be a terribly complicated task, that advantages from computer help and however no general algorithm exists. it's been a research field in computer science for quite forty years currently and therefore the early hope to search out general algorithms that will accomplish good segmentations severally from the kind of input data has been replaced by the active development of a wide vary of terribly specialised techniques. Most of the existing segmentation algorithms are extremely specific to a particular kind of knowledge and a few analyses are pursued to develop generic frameworks integration these techniques.

Segmentation can be a completely automatic method, however it achieves its best results with semi-automatic algorithms, and this idea of semi-automatic method naturally involves surroundings within which the human operator can act with the algorithms and also the knowledge so as to provide optimal segmentations. The best example of the requirement of a human intervention throughout the task of segmentation results from the specificity of the existing algorithms. looking on the kind of input data, the operator can have to be compelled to rigorously choose the simplest adapted algorithmic rule, that most of the time can't be exhausted an automatic manner. The subjective purpose of read of the human is needed [1]-[3].

A. Magnetic Resonance Imaging (MRI)

Medical imaging analysis faces the challenge of detection tumor through magnetic resonance images (MRI). In 1969 Raymond V. Damadian made-up MRI and was the primary person to use MRI to research the physical body [1]. Magnetic Resonance Imaging [2] could be a powerful tool for investing the body's internal structure. MRI provides higher quality images for the brain, the muscles, the heart and cancerous tissues compared with alternative medical imaging techniques like computerized tomography (CT) or X-rays. The anatomy of the Brain will usually be viewed by the MRI scan. Therefore this method could be a special one for the tumor detection and cancer imaging [4].

B. Brain Tumor

A tumor occur once abnormal cell form inside the brain. There are two main kinds of tumors: malignant (fast growing) and benign (slow growing) tumors. Primary brain tumors are also malignant and have an effect on encompassing tissues and it will contain cancerous cells. The secondary brain tumors are unfolded to the brain from another place within the body. Imaging plays a vital role within the identification of brain tumors. Scientist have classified tumor in step with their location and kind of tissue concerned to find whether or not it is cancerous and non-cancerous. World Health Organization classified a hundred and twenty sorts of tumor and it is done supported the behaviour of the cell from less aggressive to a lot of aggressive.

Early detection and proper treatment supported correct identification are necessary steps to enhance disease outcome. Now days, magnetic resonance imaging (MRI) is that the non-invasive and extremely a lot of sensitive imaging check of the brain in routine clinical observe. The medical test that helps physicians diagnose and treat medical conditions in MRI may be a non-invasive. MR imaging uses a robust magnetic field, radio frequency pulses and a computer to provide elaborated footage of organs, soft tissues, bone and just about all different internal body structures. It does not use radiation (x-rays) and MRI provides elaborated footage of brain and nerve tissues in multiple planes while not obstruction by superimposed bones. Brain MRI is that the procedure of selection for many brain disorders. It provides clear images of the brain-stem and posterior brain that are tough to look at on a CT scan. It is additionally helpful for the identification of demyelization disorders (disorders like multiples clerosis (MS) that cause destruction of the myelin sheath of the nerve) [5], [6].

II. PROPOSED METHODOLOGY

A. Pre – Processing

In this module, the pre-processing ways use a little neighbourhood of an element in an input image to induce a brand new brightness value within the output image. Such pre-processing operations also are referred to as filtration. Local pre-processing ways are often divided into the 2 groups according to the goal of the processing: Smoothing suppresses noise or alternative tiny fluctuation within the image is such as the suppression of high frequencies within the frequency domain. Unfortunately, smoothing additionally blurs all sharp edges that bear vital information concerning the image.

Gradient operators are supported local derivatives of the image function. Derivatives are larger at locations of the image wherever the image function undergoes fast changes. The aim of gradient operators is to point such locations within the image. Gradient operators suppress low frequencies within the frequency domain (i.e. they act as high-pass filters). Noise is usually high frequency in nature; unfortunately, if a gradient operator is applied to a brain image, the noise level will increase at the same time. Finally clear the smoothing and gradient operators have conflicting aims. Some pre-processing algorithm process, solve this drawback and allow smoothing and edge [7], [8].

B. De-Noising An Image Using Weighted Median Filtering

In a wide range of image process applications, it is necessary to swish an image whereas conserving its edges. The gray levels typically overlap that creates any post-processing task like segmentation, feature extraction and labelling tougher. Filtering is probably the foremost basic operation in several medical specialty image process applications, wherever it reduces the noise level and improves the standard of the image. In general, the matter of the way to choose an appropriate de-noising algorithmic rule depends on the particular targeted application. The idea is that noise is captured by the high frequency coefficients, so by filtering these coefficients, the unwanted noise is removed. Unfortunately, edges even have high frequency elements and by removing the noise, high frequency elements happiness to edges also are removed. One methodology to avoid this is often by victimization weighted median filters to preserve edges whereas remove noise.

The benefit of exploitation weighted median filter is, it will remove salt and pepper noise from MRI while not troubling of the sides. during this improvement stage, the weighted median filtering is applied for every pixel of an 3×3, 5 ×5, 7 ×7, 9 ×9, 11 ×11window of neighborhood pixels are extracted and analyzed the mean gray value of foreground , mean value of background and contrast value[11].

C. Image Segmentation

In this module, to calculate the dimensions of segmented tumor the relabelled methodology supported remaps the labels related to object during a divided image such the label numbers are consecutive with no gaps between the labels number used. Any object is extracted from the relabelled output employing a binary threshold. Here, the algorithm is adjusted to extract and relabelled the tumor so notice its size in pixels. The algorithm works well in 2 stages. The primary stage is to work out the input image labels and also the number of pixels in every label. The second stage is to work out the output requested region to induce total number of pixels accessed. Segmented areas are automatically calculated and to induce desired growth space per slice. Two-dimensional figure region of interest of the objects in binary image is to be specified. Total space could be a scalar whose value corresponds roughly to the whole number of pixels within the image [9],[10].

D. Contrast Enhancement

In this module, the primary image is expanded and then eroded exploitation java functions. Now, to reduce the number of valleys found by the watershed transform, the contrast of the objects of interest is maximized. A typical technique for contrast improvement is the combined use of top-hat and bottom-hat transforms. The top-hat transform is outlined because the difference between the original image and its opening. The opening of an image is that the collection of foreground elements of an image that fit a particular structuring element.

The top-hat image contains the peaks of objects that match the structuring element. The bottom-hat transform is outlined because the difference between the closing of the original image and the original image.

E. MRI Pre-processing

Pre-processing images normally involves removing low frequency, background noise, normalizing the intensity of individual sensible images, removing reflections and masking portion of images. Image process is that the technique of enhancing knowledge images before computational process. The subsequent pre-processing steps involve realignment and undo slices among a volume, individually for each modality the flow diagram is shown in Fig.1

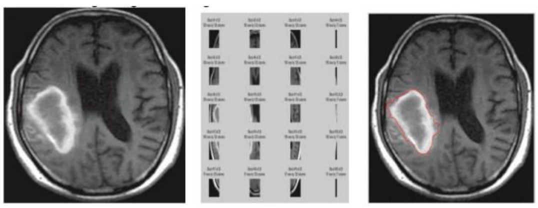

Fig: 1 (a) original MRI (b) sub blocks of MRI (c) segmented tumor using

Fuzzy-C-Means

Following commonplace pre-processing steps for brain imaging, the corresponding form and intensity features are extracted. At intervals following step, entirely completely different mixtures of feature sets are exploited for tumor segmentation and classification. An AdaBoost classifier to classify the tumor and non-tumor regions by directly fed the feature value. Manual labelling to tumor regions is performed for supervised classifier training. The trained classifiers realize the tumor or non-tumour segments in unknown brain imaging are then accustomed [7]-[9].

F. Feature Extraction

Feature extraction could be a special kind of dimensionality reduction. Once the input data to an algorithm is just too massive to be processed and it is suspected to be notoriously redundant (e.g. identical activity in each feet and meters) then transforms the input data into a reduced representation features vector. Transforming the input data into the feature vector is called feature extraction. If the features extracted are rigorously chosen it is expected that the features set from the input file can extract the relevant data, so as to perform the specified task exploitation this reduced illustration rather than the total size input.

G. Brain Tumor Segmentation And Classification From Non-Tumor Tissue

A support vector machine (SVM) searches an optimum separating hyper-plane between members and non-members of a given category in a very high dimension feature space. The inputs to the Fuzzy-C-Means algorithm are the feature set selected throughout information pre-processing step and extraction step. In Fuzzy-C-Means kernels functions are used like graph kernel, polynomial kernel, Radial Basis function kernel etc. Among these kernel functions, a Radial Basis function (RBF) proves to be useful, because of the very fact the vectors are nonlinearly mapped to a very high dimension feature space. For tumor or non-tumor tissue segmentation and classification, imaging pixels are considered as samples. These samples are described by a group of feature values extracted from totally different magnetic resonance imaging modalities. Features from all modalities are amalgamating for growth segmentation and classification. A changed supervised GLCM Fuzzy C-Means ensemble of classifier is trained to differentiate tumor from the non-tumor tissues.

1) *Algorithm For Segmentation Is As Follows*

- Obtain the sub-image blocks, ranging from the top left corner.
- Decompose sub-image blocks exploitation 2 level 2-D Fuzzy-C-Means.
- Derive spatial gray Level Dependence Matrices (SGLDM) or gray Level Co-occurrence matrices.
- For every two level high frequency sub-bands of decomposed sub image blocks with 1 for distance and 0, 45, 90 and 135 degrees for θ and averaged.
- From these co-occurrence matrices, the subsequent 9 Haralick second order statistical texture features known as wavelet Co-occurrence Texture features (WCT) are extracted.

H. GLCM With Fuzzy C-Means

This helps to introduce two segmentation approaches for MRI brain images and investigate its application to the detection of region of interest (ROI) supported gray Level Co-occurrence Matrix (GLCM), which incorporates each masses and therefore the pectoral muscles exploitation Fuzzy C-Means a neural network analysis. Within the mammograms, masses are assumed to be distinctive regions that are comparatively brighter than the encircling background, whereas the pectoral muscles seem to be additional uniformly bright that produces their presence at a predictable location of tumor region. Within the initiative correct threshold is chosen so as to differentiate the inside area from different organs within the MR image dataset. Then changed gradient magnitude region growing algorithmic rule is applied, within which gradient magnitude is computed by Sobel operator and used because the definition of homogeneity criterion. This implementation allowed stable boundary detection once the gradient suffers from intersection variations and gaps. By analyzing the gradient magnitude, the adequate contrast present on the boundary region that will increase the accuracy of segmentation.

FCM partitions a set of n objects x {x , x ,..., xn} in R d dimensional space into c(1 < c < n) fuzzy clusters with y = { y1, y2 , y3 ,..., yc} cluster centers or centroids .

The fuzzy clustering of objects is described by a fuzzy matrix µ with n rows and c columns in which n is the number of data objects and c in the number of clusters.

µij, the element in the i-th row and j-th column in µ, indicates the degree of association or membership function of the i-th object with the j-th cluster. The objective function of FCM algorithm is to minimize the following equation.

Equation 1:

$$J_m = \sum_{j=1}^{c} \sum_{i=1}^{n} u_{ij}^m d_{ij}$$

$$d_{ij} = \|x_i - y_j\|$$

Equation 2:

$$y_j = \frac{\sum_{i=1}^{n} u_{ij}^m x_i}{\sum_{i=1}^{n} u_{ij}^m}$$

1. Select (m > 1); initialize the membership function values µij, i = 1,2,...,n; j = 1,2,...,c.
2. Compute the cluster centers yj, j = 1,2,..., ,c . According to equation (2)
3. Compute Euclidian distance dij, i = 1,2…,n j = 1,2,…,c.
4. Display the result.

III. RESULTS

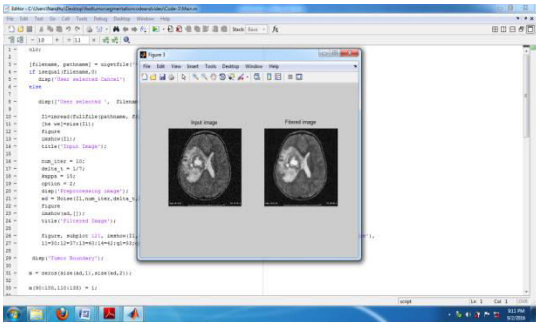

FIG 1: a) Oringal image of MR Image b) filtered image

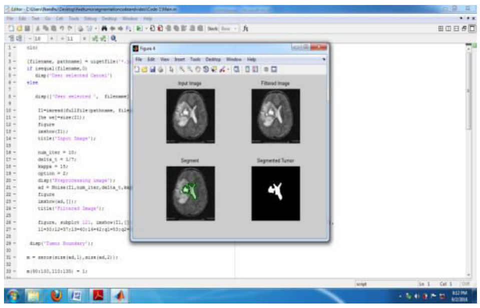

FIG 2: a) Oringal image of MR Image b) filtered image c) segmented image with enhancement d) Tumor detected from MRI brain

IV CONCLUSION

Segmentation of brain image is imperative in surgical designing and treatment within the field of medicine. During this work, Detection of tumor location exploitation GLCM with Fuzzy C- means that clustering algorithm thus proposed a computer aided system for Brain MR Image segmentation. The proposed brain tumor detection contains 3 steps: during this initial step, pre processing of magnetic resonance imaging brain image. The second steps, to de-noising of brain image exploitation weighted median filter. The third step, GLCM C-Means clustering algorithm for segmentation n of the image is employed for tumor detection from the brain magnetic resonance imaging images .We were ready to segment tumor from totally different brain MR images from our database.

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