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Texture analysis of Brain tumor in digitized MRI using Gleason and Menhinick Diversity Index

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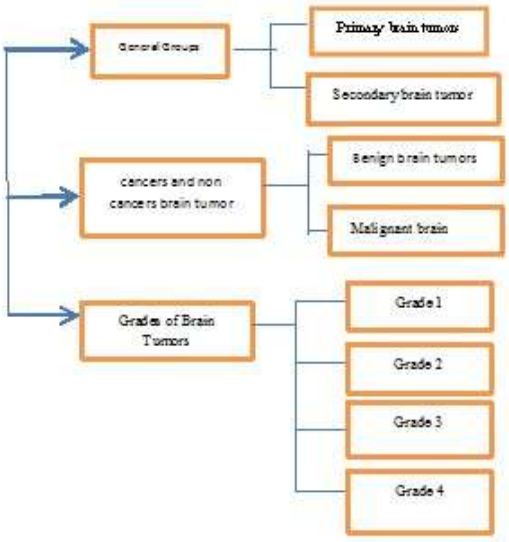
***Abstract* - Tumor is swelling of the body part, due to this abnormal growth of cells in that place of the body. If it is in brain called brain tumor. brain tumor is diagnosed by the magnetic resonance imaging (MRI). In the propose methodology, we firstly detect and extract tumor using watershed segmentation. To increase the efficiency of texture feature extraction, the diversity index's capability to detect patterns of tumor. The Gleason and Menhinick indexes are used. At the end, the extracted texture of brain tumor image is classified using the Support Vector Machine, looking to differentiate the malignant and benign class of tumor.**

Index Terms— Brain tumor, MRI image, segmentation, MATLAB

I.INTRODUCTION

Tumors are the uncontrolled growth of brain tissues. Tumors can be classified as



A brain tumor is a mass of tissue in the brain that are not normal. The brain tumor are two general groups of brain tumors:
Primary brain tumors start in brain tissue and grow in brain and tend to stay there. Secondary brain tumors are generally more common. such cancers start somewhere else in the body and travel to the brain.
Some brain tumors contain cancer and other non cancers:

- Benign brain tumors has non cancer cells. They grow slowly, can often be removed, and rarely spread to the brain tissue around them.
- Malignant brain tumors have cancer cells. The rates of growth vary, but cells can invade healthy brain tissue nearby.
- Grades of Brain Tumors

  - Grade 1. The cells look normal and grow slowly. Long-term survival is likely.
  - Grade 2. The cells look slightly abnormal and grow slowly.
  - Grade 3. The cells look abnormal and are actively growing into nearby brain tissue. These tumors tend to recur.
  - Grade 4. The cells look most abnormal and grow and spread quickly[3].

MRI is commonly used in the medical field for detection soft tissue structure of body. It is used to detect the differences in the body tissues which is considerably better technique as compared to computed tomography (CT) [8]. The aim of this paper is to propose a methodology to differentiate between malignancy and benignancy using the texture of Brain tumor in MRI using Gleason and Menhinick diversity indexes over regions of interest, For detection and extracting tumor from whole brain tumor image, watershed segmentation technique is used. Furthermore, the Support Vector Machine is used to distinguish whether the features produced by the masses will be in the malignant or benign classes.

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II. LITERATURE SERVEY

There are number of literatures available on the topic of brain tumor detection and extraction on MRI images of brain [13]. T. Logeswari and M. Karnan [12] to use two methods for segmentation, i.e. ACO hybrid with Fuzzy and HSOM hybrid with fuzzy to detect brain tumor. Though the detection is done, but still the noise is remaining in the image. Neda Behzadfar and Hamid Soltanian-Zadeh [13] used low pass filtering, Ridler's method, morphological operation and thresholding and lastly region growing methods to extract the brain tumor.

III. PROPOSED METHODOLOGY

The step of the methodology used for differentiation between the benign and malignant classes in brain tumor, by using texture characterization through the diversity indexes of Gleason and Menhinick, . Methodology steps are Image Acquisition, Pre-processing, Image Representation, image segmentation, Feature Extraction and Pattern Recognition.

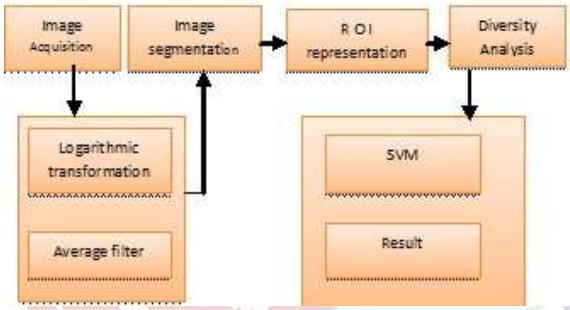

Fig 1 step of the propose methodology

A. Image acquisition

The methodology start with image acquisition was dedicated to obtaining the MRI images that were used in the tests. In the propose methodology we can take both images tumors and non-tumors MRI image, test for we can take directly MRI image from internet[5].

B. Pre-processing

The aim of this stage is to improve the contrast. It performs filtering of noise in the image. RGB to grey conversion of image and Reshaping of image also takes place here. The Average filter is low pass filter, Average filter is easy to implement and a simple method of smoothing images [11].

The logarithmic transformation is defined by the equation:

$$gt(x,y) = G\log_{10}(g(x,y)+1) \ldots\ldots\ldots \text{Eq 1}$$

Where

gt(x, y) = new value of gray level at the point (x, y)

g(x, y) is the original gray level value, The logarithmic transformation is used for to give more relevance to dark gray levels than the bag round.

C.Post-Processing

In processing stage segmentation is done using following methods.

a) Threshold Segmentation: In threshold segmentation, gray scale image converted in to binary format. This method is based on a threshold value which will convert gray scale image into a binary image format. The main purpose is the selection of a threshold value.

b) Watershed Segmentation: It is the best methods to group the pixels of an MRI image on the basis of their intensities. Pixels of similar intensity group together. This is good segmentation technique for dividing an image to separate a tumor from the image, Watershed is a mathematical morphological operating tool [11].

D. Feature extraction

This stage aims to produce descriptive measures for the images In this work, texture analysis was performed using the statistical approach in Gonzalez and Woods (2002), through adapting the concept of the Ecological Diversity index.In this paper, we used Gleason and Menhinick's Indexes.

a) The Gleason Diversity Index

In this , Considers only the number of species (s) and the logarithm of the total number of individuals (Broweretal, 1997).

This index is defined by the equation:

$$Dg = s(2)\log N \ldots\ldots\ldots\ldots\ldots\ldots \text{Eq 2}$$

where

s= is the number of sampled species and

N= is the total number of individuals in all species.

b)Menhinick Diversity Index

Second diversity index used in this methodology is Menhinick (1964), which considers only the number of

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species (s) and the square root of the total number of individuals and is calculated by the equation:

$Db = s/\sqrt{N}$ ..... Eq 3

where
s = the number of sampled species, and
N= is the total number of individuals in all species[5].
This use to analyze whether the produced features differentiate between a benign and a malignant pattern.

A. Support Vector Machine

To validate the proposed methodology and classify the masses as benign or malignant, we used the Support Vector Machine (SVM) (Vapnik, 1998). This technique has performed well when applied to image processing of brain tumor , especially to distinguish patterns of the brain tumor in mass or normal tissue, as reported in Braz et al. (2009), Carvalho et al. (2012) and Martins et al. (2010). Previously, in Rocha et al. (2012), the SVM was used successfully for diagnosing breast regions as benign and malignant[5].

IV. RESULT

Take input MRI image and converted into gray scale than threshold value of image converted in to binary image, then applying the watershed segmentation. Compare input image with standard image give the result ROI image, apply diversity index on it for feature extraction then lastly support vector machine for separation malignant and benign class of tumor.

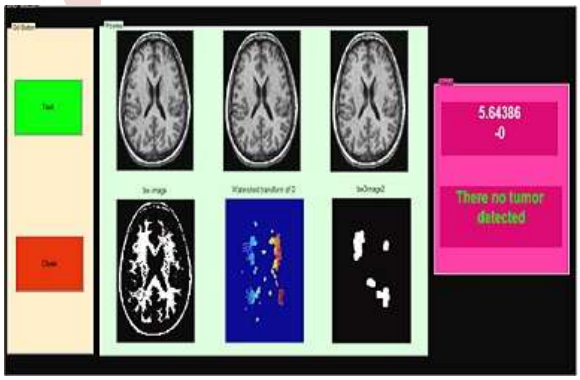

Fig No-1 Tumor detected

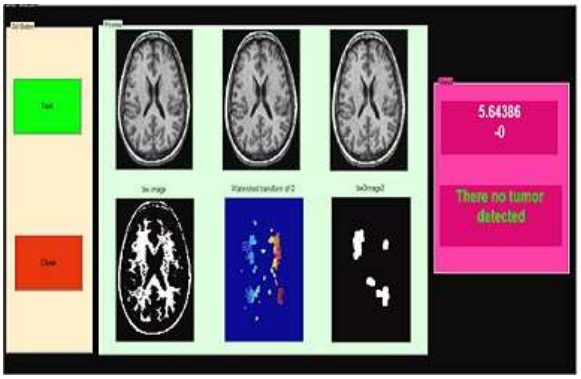

Fig No-2 No tumor detected

V. CONCLUSION

In this study, result of this paper highly accurate by using watershed algorithms. Take any brain image, preprocess on it detect and extract the brain tumor using watershed algorithm, consider as regain of inserts (ROI). The goal of this paper is to propose a methodology to differentiate between malignancy and benignancy using the texture of masses in digitized MRI using Gleason and Menhinick diversity indexes over regions of interest. Furthermore, the Support Vector Machine is used to discriminate whether the features produced by the masses should be in the malignant or benign classes.

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