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MULTIFRACTAL TEXTURE FEATURE EXTRACTION OF BRAIN TUMOR IN MRI IMAGES

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Abstract: To detect the correct tumor from an MRI image is a difficult task as it is done manually. So automatic detection of brain tumor plays very important role in medical as well as in image processing. While identifying tumor from MRI images that image will go through the number of process and feature extraction is one of those method which help to increase the accuracy of detection and segmentation. Multifractal is one of the features which describe the self similarities preset in an image. This fractal geometry describes the irregular or discontinuous shape of natural features and complex objects that traditional Euclidean geometry is unable to analyze. The combination of Multifractal dimension with intensity feature will help to improve the detection and segmentation of brain tumor.

Keywords: Texture, Brain Tumor, MRI

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INTRODUCTION

In twenty century even a lot of progress in medical and Science field brain Tumor is major cause of death among people. Tumor is uncontrolled, abnormal growth of tissue, if it is perfectly identified in the primary stage then it can be curable but as time passes it become serious cause of death. The National Cancer Institute (NCI) estimated that 22,070 new cases of brain and other central nervous system (CNS) cancers would be diagnosed in the United States in 2009. The American Brain Tumor Association (ABTA) clarifies this statics further by estimating that 62,930 new cases of primary brain tumors would be diagnosed in 2010 [1]. According to the Central Brain Tumor Registry of the United States (**CRTRUS), there** were 64,530 new cases of primary brain and central nervous system tumors diagnosed by the end of 2011 and they are increasing every day [2].Magnetic Resonance Imaging (MRI) is major source which gives the cross sectional view of a body .It provides the detail information of tumor region which is further helpful for the effective diagnosis and treatment of disease. Most of the diagnosis of MRI is done manually by a radiologist or a expert of that area which increases the chances of incorrect tumor detection and classification. On the other side digital image processing give a quick and correct decision of tumor. Number of techniques are available to detect the area of tumor like detection and segmentation, feature extraction and classification.

Feature extraction is an important element to extract the visual content or geometry of an image like shape, intensity, texture, color etc.

BACKGROUND REVIEW

Fractal and Fractional Brownian Motion (fBm) is used for Tumor Segmentation. A fractal is an irregular geometric object with an infinite nesting of structure at all scales. Fractal texture can be quantified with the noninteger FD [FD estimation is proposed in brain MRI using piece-wise-triangular-prism surface-area (PTPSA) method. shows statistical efficacy of FD for tumor regions segmentation in brain MRI. Proposes fractional Brownian motion (fBm) model for tumor texture estimation. An fBm process, on [0, T], T ∈ R, is a continuous Gaussian zero-mean nonstationary stochastic process starting at t = 0. It has the following covariance structure

$$E[B_H(t)\ B_H(s)] = \frac{1}{2}(|t|^{2H} + |s|^{2H} - |t-s|^{2H}$$

Where H=Holder Exponent whose value $0 < H < 1$ the value of H determines the fBm process such that the curve $B_H(t)$ is very rough if H = 0.01, while for H = 0.99, the curve is very smooth. Fig. 1 shows an example of simulated BH (t) versus time plots for different H values

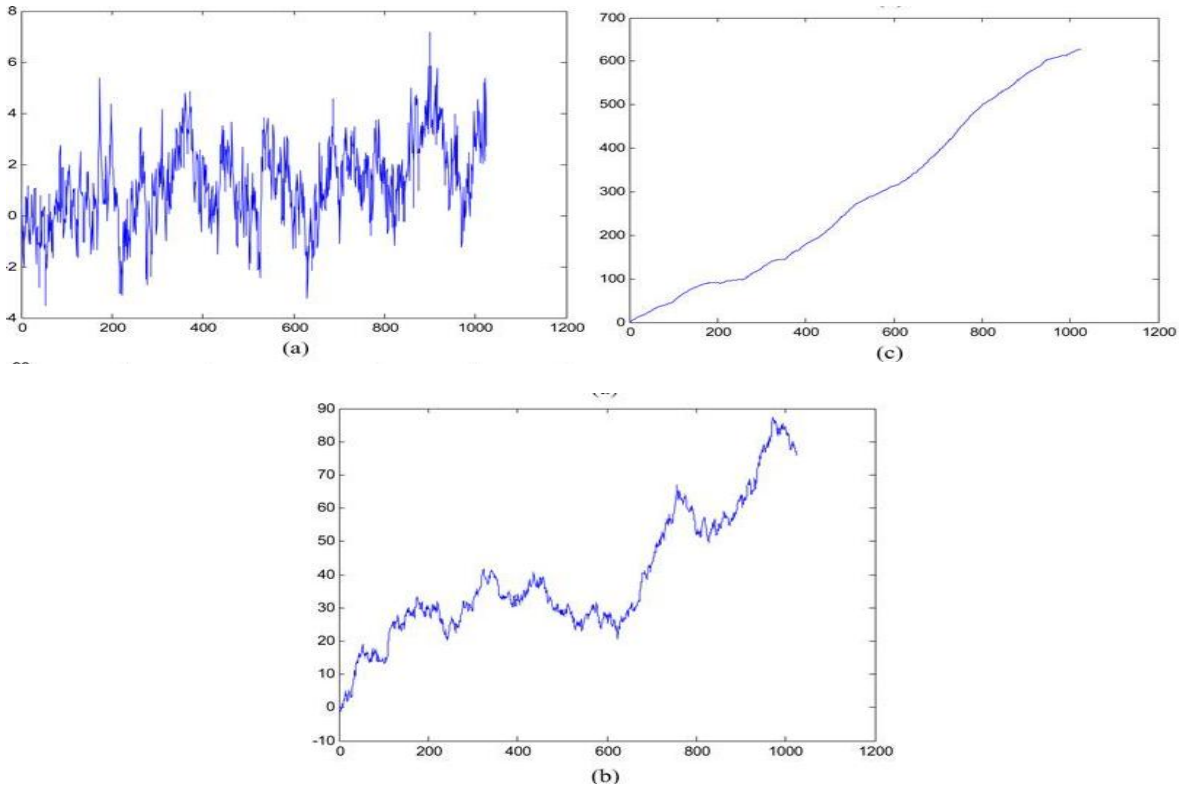
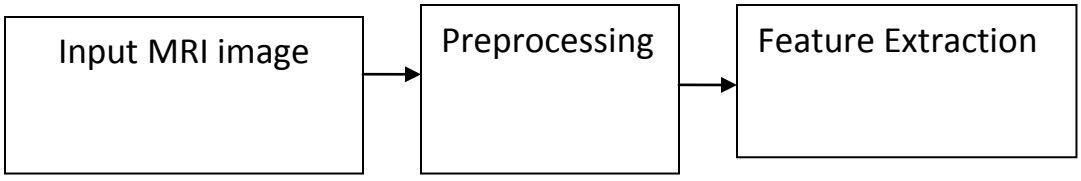


Figure 1. Simulation of fBm process with different H values; (a) H = 0.01; (b) H = 0.5; (c) H = 0.99

The figure confirms variation of surface roughness with variation of H values. The FD is related to the Hurst coefficient, H, as follows: FD = E + 1 − H [1]

The parameter E is Euclidean dimension (2 for 2-D, 3 for 3-D and so on) of the space

PROPOSED METHODOLOGY



MRI brain image contain tumor is an input image for preprocessing.

Preprocessing: It is done in order to remove the noise from an MRI input image. Histogram Equalization method is used to remove the low frequency component present in an image it is very first procedure that allow to get processed image with equalized intensities. Figure 1 gives the output of preprocessing step as equalized image.

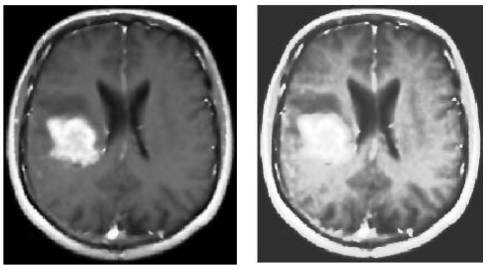


Figure 1: Original Image Equalized Image

Feature Extraction: Due to complex structure of brain tumor Multifractal Dimension or multiFD feature is extracted with the help of Multifractal Brownian motion(mBm) in which the tissue texture is extracted. That Brownian motion is explained by Hurst parameter or called as Hurst component "H'. The value of H is calculated and from that value FD is calculated from equation 1.

Algorithm to calculate multiFD : Use box dimension and relate it with fractal dimension. In this method place the box randomly on whole image and increase the box size then compare the result with other position in an image and calculate difference

$$D_q \propto \frac{1}{q-1}\left(\frac{\log m_q\,(r)}{logr - logL}\right)$$

r =increasing size of box .

By applying Legendre transform gives relationship between $T(q)$ and $\alpha(q)$

$$T(q) = (q-1)D_q$$

$$\alpha(q) \cong \frac{d_T\,(q)}{d_q}$$

$\alpha(q)$ =Holder Exponent

q=Monotonically decreasing function

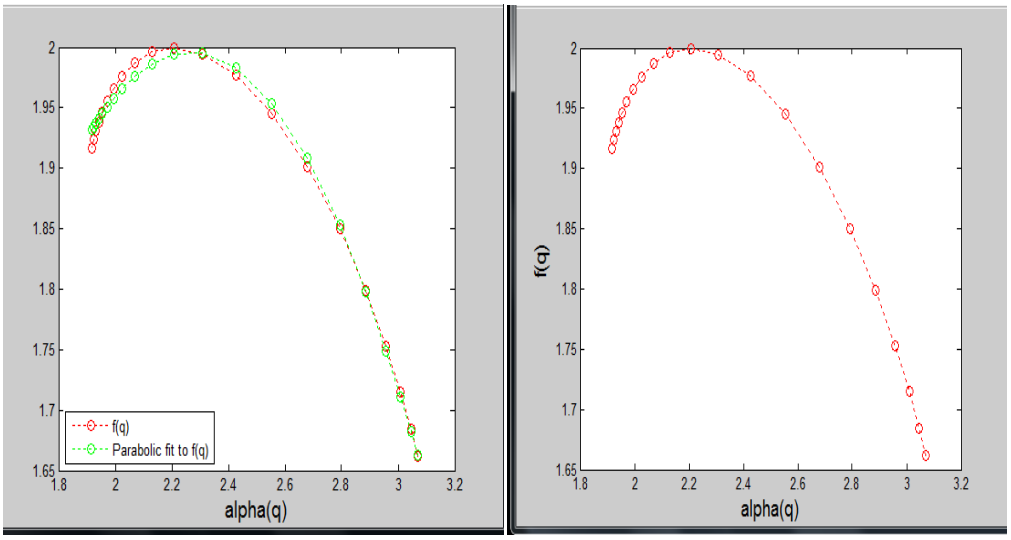


Figure 2: Graph showing difference between healthy and unhealthy tissue.

CONCLUSION

This paper gives a novel method of calculation of Multifractal texture estimation for feature extraction .In Future this work is extended for detection and segmentation of brain tumor. Also the classification of tumor using SVM classifier to get accurate result.

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