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ENHANCED ROUGH SET THEORY FOR DENOISY MRI BRAIN IMAGES USING BILATERAL FILTER

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ABSTRACT

Bilateral filter is an efficient method to denoise an image, better is the result predicted. Moreover, getting accurate details of the images with disturbance is a trial. In the current work, a rough set theory (RST) based strategy is used to obtain pixel level advantage map and category brands which often are used to enrich the efficiency of bilateral filtration. The narrow is substantially used to denoise brain MR images. The results are in contrast to that of the state-of-the-art techniques. The tests have been conducted on two real (normal and pathological disordered) human MR information source. The efficiency of the suggested filter is found to be better, with regards to standard analytics. SVM (Support Vector Machine) is used to separate images into various classes. It is used to load multiple images. ROI(Region Of Interest) is used to find tumor in an MRI images. This technique is more effective in identification of tumor.

Key words: RST, MRI Images, ROI, SVM, denoising, Bilateral Filter.

I. INTRODUCTION

Image processing is a process of analysis and manipulation of a digitized image, especially in order to[1] improve its quality. The term digital image refers to processing of a two dimensional picture by a digital computer. In a broader context, it implies digital processing of any two dimensional data. A digital image is an array of real or complex numbers represented by a finite number of bits. An image given in the form of a transparency, slide, photograph or an X-ray is first digitized and stored as a matrix of binary digits in computer memory.

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A.MAGNETIC RESONANCE IMAGING

A magnetic resonance imaging (MRI) scanner uses powerful magnets to polarise and excite hydrogen nuclei (single proton) in human tissue, which produces a signal that can be detected and it is encoded spatially, resulting in images of the body.

The MRI machine emits radio frequency (RF) pulse that specifically binds only to hydrogen..

MRI uses three electromagnetic fields: static field which is a very strong static magnetic field which polarizes the hydrogen nuclei; gradient field which is a weaker time-varying field used for spatial encoding; and weak radios Switch are collected through radio frequency antenna.

B. NOISY IMAGES

All medical images contain some visual noise. The presence of noise gives an image a mottled, grainy, textured, or snowy appearance. [2] The most significant factor is that noise can cover and reduce the visibility of certain features within the image.

C. SEGMENTATION

Now a days , image segmentation play vital role in medical image segmentations. The segmentation of brain tumor from magnetic resonance images is an important task. Manual segmentation is one of the techniques for finding tumor from the MRI. This method is time consuming but also generates errors.

Bilateral filtering is a non iterative method. It combines domain and range filters simultaneously. It preserves edge information while denoising. The drawback of this filter is that it cannot remove salt and pepper noise also it causes propagation of noise in medical images and it is single resolution in nature.

After removing noise from an MRI image , proceed with a segmentation process to identify accuracy of an image.In bilateral filter,accuracy rate will be identified based on verification process.

II RELATED WORKS

Ashish Phophalia, Ajit Rajwade, Suman K. Mitra [4], proposed a technique to detect noise from an image. Segmentation process is used to identify tumor accurately.. The proposal also considers the adjacent boundary information between objects for getting similar patches. The main drawback is the edge and boundary detection is not clear in 2 D motion.

Pietro Perona and Jitendra Malik [5], propose an anisotropic diffusion method is used to convert images into gray scale images and then identify its location..

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The technique proves to be complicated and expensive.[6] The main drawback is location of an image is not accurate.

Michael J. Black, Guillermo Sapiro, David H. Marimont, and David Heeger[7], proposed an anisotropic diffusion technique to detect boundary between piecewise constant image region. The main disadvantage is edge detection is not clear.

III PROPOSED APPROACH

Initially all MRI brain images are noisy to remove noise in an image various techniques are used. Bilateral filter is a latest technique to remove noise in an image effectively. It removes noise from edges and boundaries exactly. After removing noise use segmentation process to divide an image into multiple pixels based on certain criteria. Use SVM technique used to separate an image into various classes based on pattern and image classification.ROI technique is used to detect tumor in an image.

A.MRI BRAIN DATA SET

Initially all brain images are compressed and store it in training set .It stored it as a dataset and as MRI brain dataset. Each brain image is noisy to remove noise from an image there are various technique will be considered as in Fig:1.1.

B.SEGMENTATION PROCESS

In segmentation process it has both Bilateral filter and Region growing. Segmentation is the most important part in image processing. These several parts that are rejoined will cover the entire image [8].

Region growing is a technique for extracting an image region that is connected based on some predefined criteria. These criteria can be based on intensity information and/or edges in the image . It is also classified as a pixel-based image segmentation method since it involves the selection of initial seed points.

Bilateral filtering is one of the examples of non linear filtering. It combines domain and range filters simultaneously. It preserves edge information while denoising. It smooth images while preserving edges. Several qualities of bilateral filter are:[3]

- It is simple to formulate it. Each pixel is replaced by a weighted average of its neighbors.
- It depends only on two parameters that indicate the size and contrast of the features to preserve.
- It is a non iterative method. This makes the parameters easy to set

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since their effect is not cumulative over several iterations .

The Bilateral Filter (BF) intrinsically characterizes spatial and range (photometric) channel to denoise a picture as per spatial domain and power area individually [7]. The last channel uses the result of weights of both the channels for a neighboring pixel. Mathematically, BF can be characterized as

$$\Delta(i,j) = \Psi(i,j)\zeta(i,j)$$

Where Ψ and ζ are monotonically diminishing non-negative functions for spatial and intensity degree, i is the pixel location placed at the center and area j is in neighborhood of i, i.e. j ∈ N(i), within window w × w.

$$\psi(i,j) = G_{\sigma_\psi}(\|i-j\|)$$

$$\zeta(i,j) = G_{\sigma_\zeta}(\|Y(i)-Y(j)\|)$$

Where Y(i) represent intensity at location i. The denoised pixel intensity Y (i) at the location i given by

$$Y(i) = \frac{\sum_{j\in N(i)} \Delta(i,j)Y(j)}{\sum_{j\in N(i)} \Delta(i,j)}$$

1)Root Mean Square Error (RMSE)

$$\text{MSE: } \frac{1}{MN}\sum_{i=1}^{M}\sum_{j=1}^{N}(I(i,j)-\hat{I}(i,j)$$

$$\text{RMSE=} \sqrt{MSE}$$

2)Structural Similarity Index (SSIM)

$$\text{SSIM}(x,y) = \frac{(2\mu_x\mu_y+\epsilon_1)(2\sigma_{xy}+\epsilon_2)}{(\mu_x^2+\mu_y^2+\epsilon_1)(\sigma_x^2+\sigma_y^2+\epsilon_2)}$$

$$MSSIM = \frac{1}{M}\sum_{j=1}^{M} SSIM(x_i, y_j)$$

Where ϵ1 and ϵ2 ensure the stability $(\sigma_x^2+\sigma_y^2)$ or $(\mu_x^2+\mu_y^2)$ when either is close to zero.

C. IMPROVED RST ALGORITHM

Clustering is the process of partitioning a group of data points into a small number of clusters. For instance, the items in a supermarket are clustered in categories (butter, cheese and milk are grouped in dairy products). Of course this is a qualitative kind of partitioning. A quantitative approach would be to measure certain features of the products, say percentage of milk and others, and products with high percentage of milk would be grouped together. In general, we have n data points xi,i=1...n that have to be partitioned in k clusters. The goal is to assign a cluster to each data point. K-means is a clustering method that aims to find the positions μi,i=1...k of the clusters that minimize the square of the distance from the data points to the cluster. K-means clustering solves

argmincΣi=1kΣx∈cid(x,μi)2=argmincΣi=1kΣx∈ci‖x−μi‖22

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where c_i is the set of points that belong to cluster i. The K-means clustering uses the Euclidean distance $d(x,\mu_i)=\|x-\mu_i\|_2$. This problem is not trivial (in fact it is NP-hard), so the K-means algorithm only hopes to find the global minimum, possibly getting stuck in a different solution[9].

Canny Edge detection is used to remove noise from an image effectively in edges and boundaries. The algorithm runs in 5 separate steps:

1. Smoothing: Blurring of the image to remove noise.

2. Finding gradients: The edges should be marked where the gradients of the image has large magnitudes.

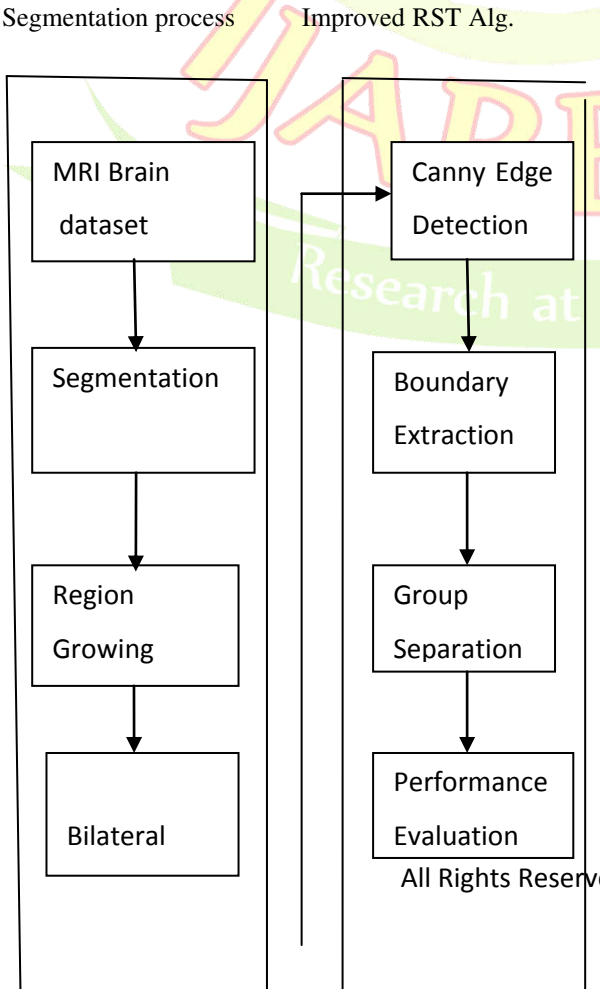

Fig 1.1 System architecture

3. Non-maximum suppression: Only local maxima should be marked as edges.

4. Double thresholding: Potential edges are determined by thresholding.

5. Edge tracking by hysteresis: Final edges are determined by suppressing all edges that are not connected to a very certain (strong) edge[10].

SVM is a set of image used to load images continuously, it separate images into multiple classes based on pattern and Image classification. ROI is a technique is used to identify tumor in an image based of edge detection method.The accuracy will be more compare with other technique.

III PERFORMANCE ANAYSIS

The PSNR (Peak to Signal Noise Ratio) the ratio between the maximum possible power of a signal and the power

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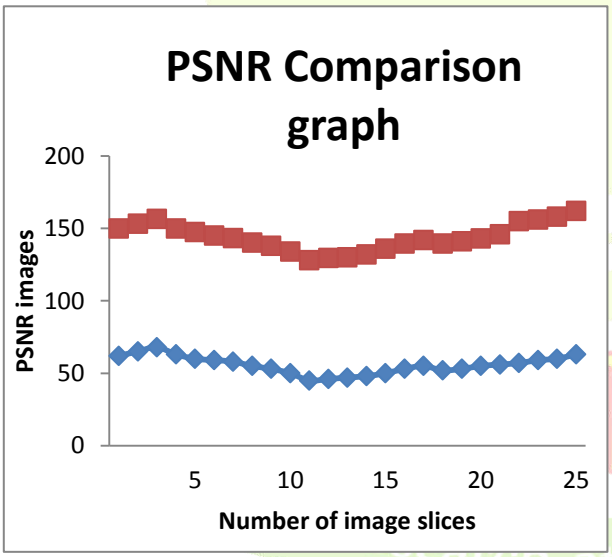
of corrupting noise that affects the fidelity of its representation. Because many signals have a very wide dynamic range, PSNR is usually expressed in terms of the logarithmic decibel scale[11].

$$\text{PSNR} = 10\log_{10}\left(\frac{L^2}{MSE}\right)$$

The accuracy will be more when compared with other technique as shown in below graph.By using Bilateral filter and ROI technique is easy to show an more accuaracy.



IV CONCLUSION

It is concluded that, in image processing the image denoising is a main problem, to overcome that used a technique bilateral filter and it is more effective to denoise an image. Brain tumor will be detected using ROI method and it is more accurate compared with other methods. The PSNR value will be less compared with existing techniques.

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