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RESEARCH ARTICLE

Brain Tumor Segmentation of Noisy MRI Images using Anisotropic Diffusion Filter

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Abstract*— The brain tumor segmentation on Magnetic Resonance Image(MRI) is a very difficult and important task which are used in surgical and medical planning and assessments. If experts do the segmentation manually with their own medical knowledge, it will be time-consuming. Therefore, researchers propose methods and systems which can do the segmentation automatically and without any interference. In our paper, Segmentation of noisy MRI images using anisotropic diffusion filter for brain tumor is presented. In this method, Gaussian noise is added to the gray image and to denoise the image three filters are added. Threshold Segmentation is carried out and morphological operator is applied to the image .Finally we calculate the area of the tumor. In our project the percentage of noise removed is more by using anisotropic diffusion filter.

***Keywords*— tumor segmentation, brain tumor, anisotropic diffusion filter, Magnetic Resonance Imaging (MRI), Gaussian Noise**

I. INTRODUCTION

The influence and impact of digital images on modern society is tremendous, and image processing is now a critical component in science and technology. With the computer techniques, multidimensional digital images of physiological structures can be processed and manipulated to help visualize hidden diagnostic features that are otherwise difficult or impossible to identify using planar imaging methods.

In the medical field, magnetic resonance image (MRI) is widely used in many research field[1]. MRI technique is a non-invasive method and uses powerful magnet and radio waves to create the picture of the body. It is suited for examining soft tissues of the human body such as ligament and tendon injury, spinal cord injury and brain tumors, etc. [2]. The detail information of the human brain can be obtained using MRI techniques [1]. Brain, heart and lung etc. are the most important parts of the human body. And then, all parts of the body are controlled by the brain cells [3]. Therefore, brain is a vital organ of the body. Nowadays, brain tumor is a very serious disease among children and adults. The most deadly and intractable diseases are brain tumor [4]. Brain tumor's location and quickly spreading make a critical problem in treatment of tumor [5]. Thus, image segmentation and detection are vital methods to solve the medical problem of the various diseases. Imaging of the brain tumor can be done by computer tomography (CT) scan, magnetic resonance image (MRI) scan, Ultrasound, etc.

Magnetic Resonance Imaging (MRI) is the state-of the-art medical imaging technology which allows cross sectional view of the body with unprecedented tissue contrast. MRI plays an important role in assessing

pathological conditions of the ankle, foot and brain. It has rapidly evolved into an accepted modality for medical imaging of disease processes in the musculoskeletal system, especially the foot and brain due to the use of non-ionizing radiation. MRI provides a digital representation of tissue characteristic that can be obtained in any tissue plane. The images produced by an MRI scanner are best described as slices through the brain. MRI has the added advantage of being able to produce images which slice through the brain in both horizontal and vertical planes.

The main goal is to remove noise from the images. But the noise deletion shouldn't destroy the edges of the image and decrease the clarity and quality of it. There are several methods for removing noise, including: Gaussian filter [19], contourlet transform approach and wavelet thresholding approach [20], median filter [6], anisotropic diffusion filter. So in our proposed technique the brain tumor segments the noisy MRI images using anisotropic diffusion filter and morphological operator. Anisotropic diffusion filter is a method for removing noise which is proposed by Perona and Malik [21]. This method is for smoothing the image by preserving needed edges and structures. Homogenous regions are highly smoothed and strong edge regions are barely smoothed (to preserve the structure).

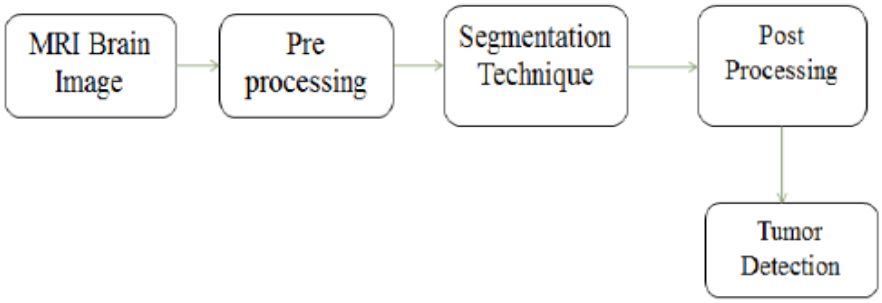


Figure. - Block diagram of the proposed method

II. EXISTING TECHNIQUES

This technique is already existed but in my paper we are adjusting number of iterations such that edges are retained and percentage of noise removed was more.

III. METHODOLOGY

The methodology includes Non linear Anisotropic Diffusion Filter and morphological operators to segment the tumor**.** In image processing and computer vision, anisotropic diffusion, also called Perona–Malik diffusion, is a technique aiming at reducing image noise without removing significant parts of the image content, typically edges, lines or other details that are important for the interpretation of the image[1] Anisotropic diffusion resembles the process that creates a scale space where an image generates a parameterized family of successively more and more blurred images based on diffusion process. This diffusion process is a linear and *space-invariant* transformation of the original image. Anisotropic diffusion is a generalization of this diffusion process: it produces a family of parameterized images, but each resulting image is a combination between the original image and a filter that depends on the local content of the original image. As a consequence, anisotropic diffusion is a non-linear and space-variant transformation of the original image.

In its original formulation, presented by Perona and Malik in 1987, the space-variant filter is in fact isotropic but depends on the image content such that it approximates an impulse function close to edges and other structures that should be preserved in the image over the different levels of the resulting scale space. This formulation was referred to as anisotropic diffusion by Perona and Malik even though the locally adapted filter is isotropic, but it has also been referred to as inhomogeneous and nonlinear diffusion or Perona-Malik diffusion by other authors. A more general formulation allows the locally adapted filter to be truly anisotropic close to linear structures such as edges or lines: it has an orientation given by the structure such that it is elongated along the structure and

narrow across. Such methods are referred to as shape adapted smoothing or coherence enhancing diffusion. As a consequence, the resulting images preserve linear structures while at the same time smoothing is made along these structures. Both these cases can be described by a generalization of the usual diffusion equation where the diffusion coefficient, instead of being a constant scalar, is a function of image position and assumes as matrix (or tensor) value (see structure tensor

Although the resulting family of images can be described as a combination between the original image and space-variant filters, the locally adapted filter and its combination with the image do not have to be realized in practice. Anisotropic diffusion is normally implemented by means of an approximation of the generalized diffusion equation: each new image in the family is computed by applying this equation to the previous image. Consequently, anisotropic diffusion is an iterative process where a relatively simple set of computation are used to compute each successive image in the family and this process is continued until a sufficient degree of smoothing is obtained.

Morphological operator
Morphological techniques typically probe an image with a small shape or template known as a structuring element. The structuring element is positioned at all possible locations in the image and it is compared with the corresponding neighborhood of pixels. Morphological operations differ in how they carry out this comparison. **.** Morphology is a broad set of image processing operations that process images based on shapes. By choosing the size and shape of the neighborhood we can construct morphological operations that are sensitive to specific shapes in input image.

The most Basic morphological operations are dilation and erosion. Dilation adds pixels to the boundaries of objects in an image. Erosion removes pixels on object boundaries. The number of pixels added or removed from the objects in an image depends on the size and shape of the structuring element used to process the image.

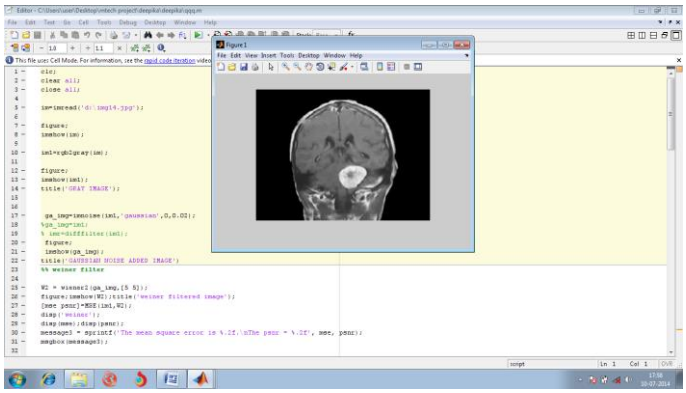
IV. RESULTS

By Applying various tests to the gray image we finally conclude that anisotropic diffusion filter is the best filter compared to wiener and median. In Anisotropic diffusion filter the percentage of noise removed was more , hence it gives best result. Finally the area of the tumor is calculated. The values are listed below

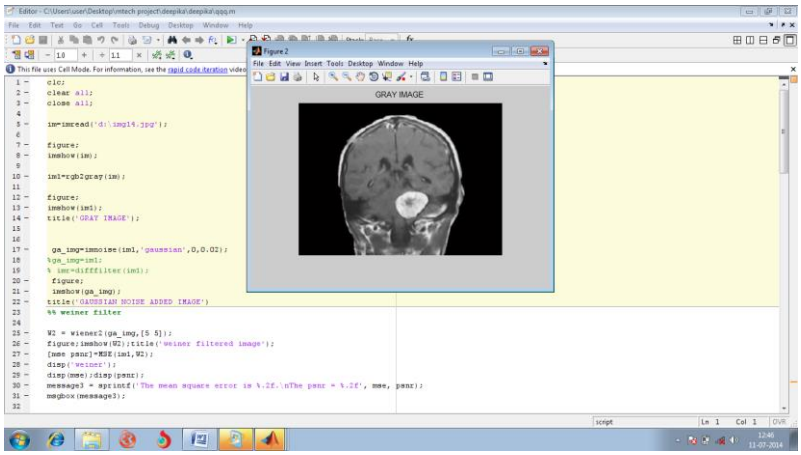
The results obtained are tabulated in below Table which shows that the proposed method is more efficient compared to other filters.

Type of filter	Mean square error(MSE)	Peak signal to noise ratio(PSNR)
Weiner filter	9.8	39.5
Median filter	8.6	40.3
Anisotropic diffusion filter	6.2	42.2
Area of the tumor	11526.2	

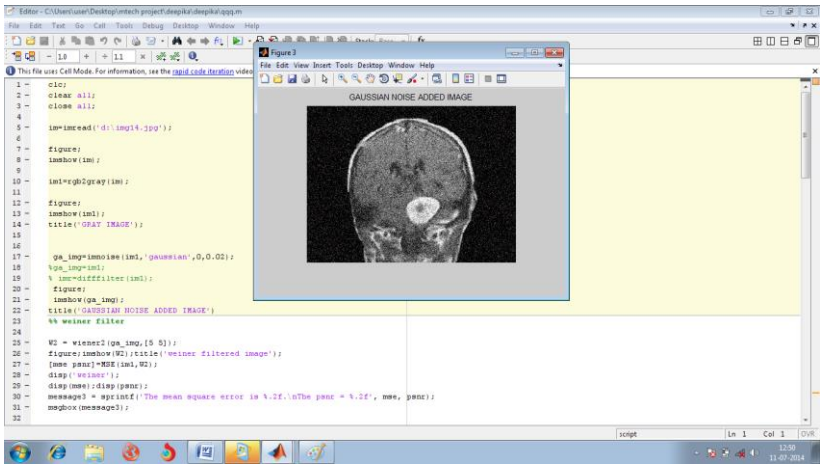
The above table shows the MSE and PSNR values of different filter.



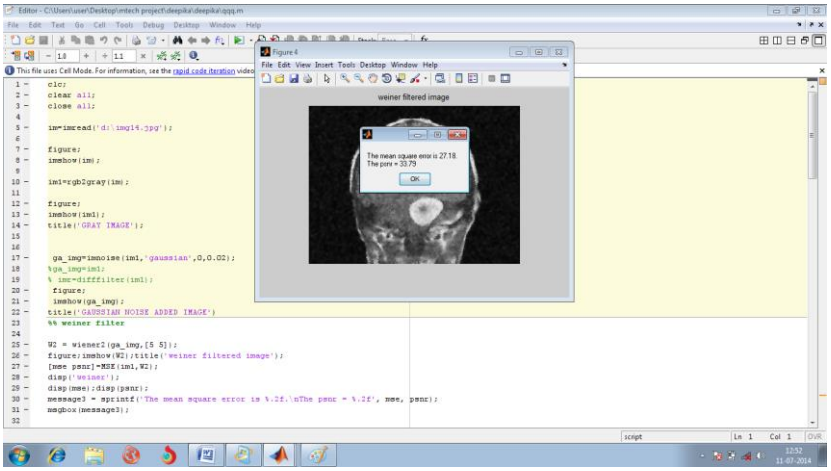
The above figure shows input image of brain tumor



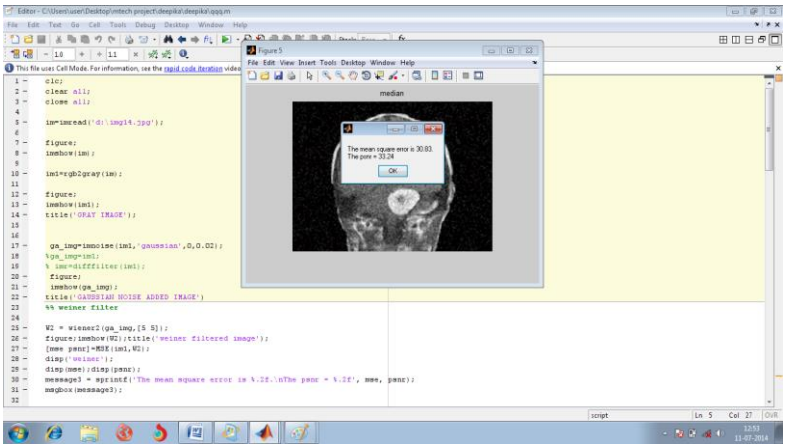
The above figure shows input image converted to gray image



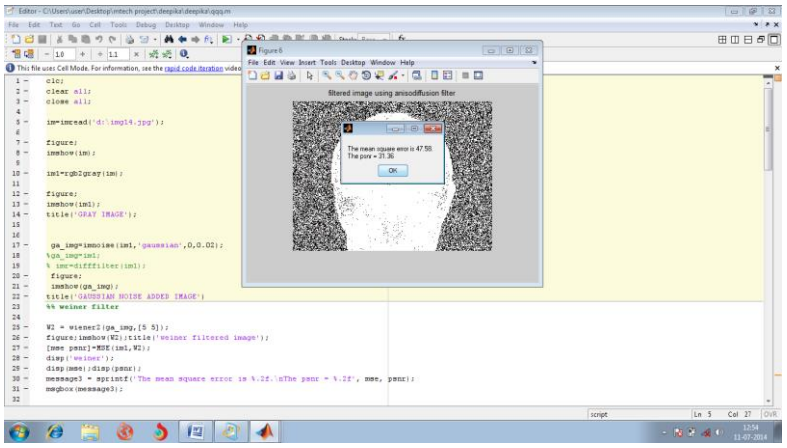
The above figure shows Gaussian noise added image



The above figure shows weiner filter added to noisy image.



The above figure shows median filter added to noisy image.



The above figure shows anisotropic diffusion filter added to noisy image

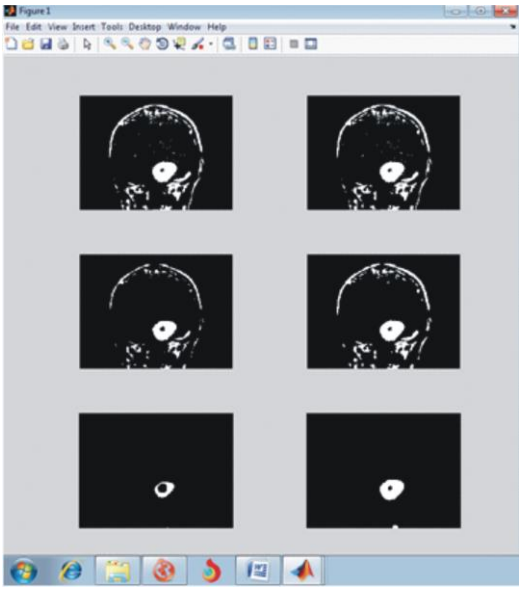


Figure shows segmentation of tumor using morphological operator

V. CONCLUSION

It can be noted that anisotropic diffusion filter outperforms other filtering technique in denoising in medical images. Further, denoising performance can be improved by modifying some parameters of filtering technique.It can be extended to color images.

REFERENCES

[1] Perona, P.; Malik, J.; "Scale-space and edge detection using anisotropic diffusion" Pattern Analysis and Machine Intelligence, IEEE Transactions on Volume 12, Issue 7, July 1990 Page(s):629 – 639

[2]. M. Masroor Ahmed and Dzulkifli Bin Mohamad "Segmentation of Brain MR Images for Tumor Extraction by Combining Kmeans Clustering and Perona- Malik Anisotropic Diffusion Model" International Journal of Image Processing, Volume (2) Issue (l),2010.

[3] Arash Azim Zadeh Irani and Bahari Belaton "A K-means Based Generic Segmentation System" 2009 Sixth International Conference on Computer Graphics, Imaging and Visualization.

[4] Ming-Ni Wu, Chia-Chen Lin and Chin-Chen Chang "Brain Tumor Detection Using Color-Based K-Means Clustering Segmentation" International Conference on Computer Graphics,2009.

[5] S.Sathish Kumar, M.Moorthi, M.Madhu3and Dr.R.Amutha "An Improved method of Segmentation using Fuzzy-Neuro Logic" Second International Conference on Computer Research and development,2009

[6] S. Murugavalli and V. Rajamani" An improved Implementation of Brain tumor Detection Using Segmentation Based on Neuro Fuzzy Technique", Journal of Computer Science 3 ,2007 october.\

[7] Kharrat, A. Benamrane, N. Ben Messaoud, M. Abid, Computer. & Embedded Syst. Lab. (CES), Nat. Eng. Sch. of Sfax, Sfax, Tunisia, Nov.2009 .

[8] M. Schmidt, I. Levner, R. Greiner, A. Murtha, and A. Bistritz. "segmenting Brain Tumors using Alignment-Based Features".International Conference on Machine Learning and Applications, Los Angeles, December 2005.

[9] S.R. Kannan , Jan. 2005 "Segmentation of MRl using new Unsupervised Fuzzy C means algorithm" ICGST-GVIP Journal, Volume 5, Issue2.

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