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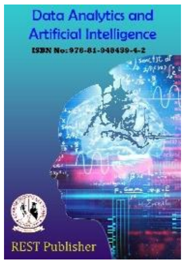

A Comparative Study on Various Filtering techniques for Brain Tumor Detection

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Abstract: *Medical Image processing is one of the growing filed. CT scans, X-RAY and MRI are various imaging methods used for detecting various abnormalities in the human body. Alump also known as cancer is an anomalous matter which nurtures by an abandoned cell division where as ordinary cells grow in a precise manner. Detection of brain tumor becomes complex if it is not known at earlystage. Tumor Segmentation done physically by investigators with the help of medical data is time consuming and will not produce precise results. With the improvement of many algorithms and different image processing techniques automatic detection of brain tumor is made possible. ANN is a powerful classifier that is used for detection of disease in medical field. The basis of this study gathers representative work that shows how various filtering techniques are applied to brain tumor images and the comparative study is made for selecting the best filter based on image quality measures.*
Keywords: *Medical Image processing, Artificial Neural Network, MRI Images, Pre-processing.*

1. INTRODUCTION

The brain is one of the major and complex part in the human body. It controls all the actions through neural system. Every portion of the brain has a specific function. In some cases these parts grows abnormally in an uncontrolled manner which is called as tumor or lesion. Brain tumors are of two types Benign also referred to as primary and Malignant also referred to as secondary. Primary tumor grows slowly and spreads rarely. Secondary tumor grows rapidly and spreads to neighboring brain regions. Brain tumor can be detected by taking physical examination such as brain CT, MRI scan, brain angiogram and spinal biopsy. Early detection of tumor can increase the lifespan of a person. In the analysis of lump detection of aparticular location is an essential task which aids to find out itsnature and size. Artificial neural networks emerges as a dominant tool across a wide range of medicinal applications in simplifying, analyzing and building effective decisions for a medical practitioner and making intelligence of complex clinical data. The majority of the medical applications using artificial neural networks are associated with classification problems because the job is to allocate the patient to a small set of classes on the basis of the obtained features. The application of neural networks techniques in recent years with respect to medical diagnosis problems is immense. The feed forward network is one of the popular network structures which only allow the network connections between the nodes in one layer and those in the next layer. One of the drawbacks of ANN is the determination of network structure. This paper provides brief description of various filtering techniques.

2. LITERATURE SURVEY

2.1 Image Pre-Processing: Image pre processing stage is the simplest form of medical image processing. The central goal of this stage is to reduce noise and enhance edges. Image pre-processing includes enhancement stage such as resolution enhancement and contrast enhancement. In pre-processing stage if the acquired input image is color image it is first transformed to greyscale image to convert the RGB components to black and white pixels. This stage also removes data irregularities and unwanted noise from the image. In this module the image obtained is processed for obtaining correct results. Medical images may include certain artifacts such as labels, symbols and unwanted parts which are identified and detached for better results. In this paper the filters used for noise removal includes median, unsharp, Gaussian, wiener and anisotropic filters.

2.2Median Filter:

This filter is a nonlinear digital filtering technique which preserves useful information in the image. This filter is mostly used for eliminating salt and pepper noise. Median filter works by sorting all the neighbourhood pixels in the window in an increasing order and taking the middle one as median pixel. Instead of a local neighbourhood pixels average or weighted average it computes the middle value of the neighbourhood pixel in the window. By using this filter outliers can be removed without reducing the sharpness of MRI image.

2.3Un sharp Filter:
This filter is a linear filtering technique. It is sued to increase sharpness in the image. Sharpening can emphasize texture and fine details in the image. It works by a technique which deducts flattened part from the original image. It enriches boundaries and high rate components in the image. When using this filter contrast is selectively increased along the edges.

2.4 Gaussian Filter:
This filter is a smoothing linear filter defined by the gaussian kernel. It is analogous to mean filter but it uses a different kernel. This filter uses point spread function. It slightly blurs and remove noise form the image.The representation of this filter shows bell shaped distribution. The kernel in gaussian filter is separable which allows fast computation. The major drawback of this filter is it might not preserve edges.

2.5Wiener Filter:
This filter is one the widely used method for removing distortion in images. It is based on statistical approach and reduces the mean square error between the expected arbitrary process and chosen process. It works by computing statistical estimation of an unknown signal with an input signal to yield the final result. This filter can also be used to eliminate noise from degraded signal. The advantage of this filter is it removes additive noise and blur simultaneously

2.6Anisotropic Filter:
Anisotropic filter is a non-linear and space variant filter. It aims at reducing noise in the image without excluding important portions in the image information such as boundaries, outlines and additional facts. This filter is generally used for denoising purposes. It moderates noise in smooth areas and preserves boundaries to a higher range. The major drawback is it damages thin details reducing the perseverance of the image.

3. IMAGE QUALITY METRICS

3.1Peak to signal noise ratio (PSNR):PSNR measures the degree of restoration. PSNR stands for Peal Signal to Noise Ratio. The signal in this instance is the input data and the noise is fault introduced by some operation. A greater PSNR valueshows that the restoration is of higher quality

This quality measure can be expressed as

$$\mathbf{PSNR = 10\log\frac{255^2}{\mathit{MSE}}}$$

3.2Mean Square Error (MSE):The mean square error is calculated by averaging the squared intensity of the original image and the resultant image i.e output image. The lower MSE value shows that the restoration is of lower quality.

This quality measure can be expressed as

$$MSE = \frac{1}{MN}\sum_{j=1}^{M}\sum_{k=1}^{N}(x_{j,k-}\, x'_{j,k})^2$$

3.3 Normalized Absolute Error (NAE):

NAE provides error differences between theinput and resultantimage. A higher value of NAE shows that image is of poor quality.

This quality measure can be expressed as

$$NAE = \sum_{j=1}^{M}\sum_{k=1}^{N}\left|x_{j,k-x'_{j,k}}\right| \;/\; \sum_{j=1}^{M}\sum_{k=1}^{N}\left|x_{j,k}\right|$$

3.4Structural content:

This quality measure can be expressed as

$$SC = \sum_{j=1}^{M}\sum_{k=1}^{N} x_{j,k^2} \Big/ \sum_{j=1}^{M}\sum_{k=1}^{N} x'_{j,k^2}$$

A high value of SC shows that image is of poor quality.

4. RESULTS AND DISCUSSION

The above table shows the comparison of various filters with image quality metric values

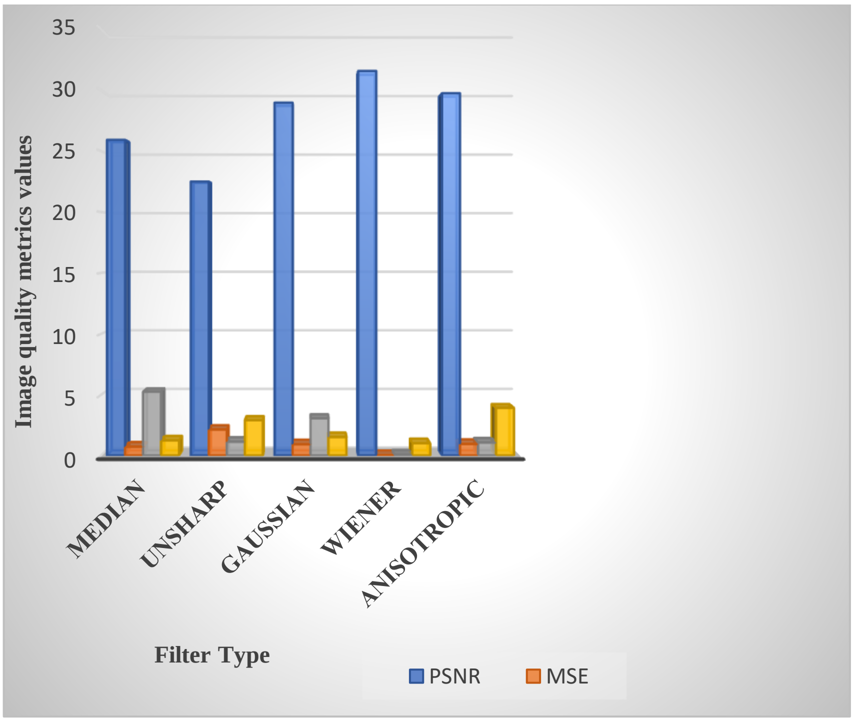
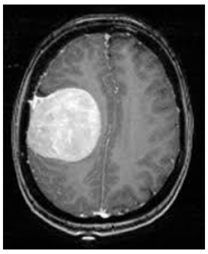
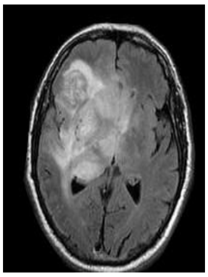
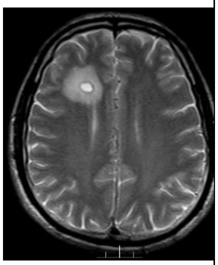
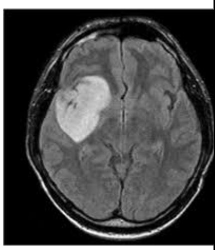
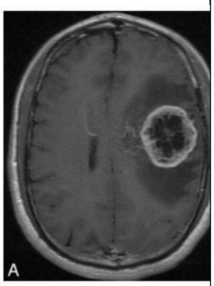


FIGURE 1. Comparison of PSNR, MSE, NAE and SC metric values for different filters

IMAGES	FILTERS USED	PSNR VALUE	MSE VALUE	NAE VALUE	SC VALUE
	MEDIAN	25.9282	0.7329	5.2425	1.2495
	UNSHARP	22.5002	2.1453	1.1382	2.9031
	GAUSSIAN	28.9749	0.9287	3.0644	1.5273
	WIENER	**31.5822**	**0.0095**	**0.0587**	**1.0161**
	ANISOTROPIC	29.7505	0.9526	0.0721	3.9220
	MEDIAN	24.7505	0.0464	5.4010	1.0464
	UNSHARP	22.5583	0.9537	0.1681	0.8761
	GAUSSIAN	22.8765	0.9533	0.0838	1.0490
	WIENER	**30.2839**	**0.0296**	**0.0747**	**1.0289**
	ANISOTROPIC	29.6138	0.1228	0.0813	1.0320
	MEDIAN	30.2884	0.0488	3.3742	1.0160
	UNSHARP	32.9165	0.9365	0.0536	1.0124
	GAUSSIAN	34.3788	0.9373	0.0325	1.0977
	WIENER	**38.3537**	**0.0064**	**0.0278**	**0.0033**
	ANISOTROPIC	34.1240	0.0231	0.0537	1.0259
	MEDIAN	22.4245	0.8152	5.3380	1.0863
	UNSHARP	20.8703	0.0745	0.1960	0.7973
	GAUSSIAN	27.4203	0.0028	0.1001	1.0593
	WIENER	**30.2103**	**0.0318**	**0.0872**	**1.0390**
	ANISOTROPIC	29.8790	1.7100	0.0924	1.0391
	MEDIAN	29.9804	1.9423	4.3859	1.0169
	UNSHARP	28.9565	0.4521	0.0804	0.9407
	GAUSSIAN	34.3410	1.0660	0.0375	1.0252
	WIENER	**35.7991**	**0.0452**	**0.0150**	**1.0213**
	ANISOTROPIC	32.2653	1.7245	0.0614	1.0305

REFERENCES

[1]. Nandha Gopal, M. Karnan, “Diagnose brain tumor through MRI using image processing clustering algorithms such as Fuzzy C Means along with intelligent optimization techniques, IEEE, 31 January 2011.
[2]. Kai Xiao, A.Lei Liang,Hai Bing Guan,Aboul Ella Hassanien, “Extraction and Application of Deformation Based Feature in Medical Images “ELSEVIER Neuro computing, 2013
[3]. Kailash D. Kharat, “Efficient Segmentation methods for tumor detection in MRI Images” IEEE, Volume 24 April 2014
[4]. Parveen “Detection of Brain Tumor in MRI Images using Combination of Fuzzy C-Means and SVM” International Conference on Signal Processing and Integrated Networks (SPIN), 2015
[5]. Sergio Pereira “Brain Tumor Segmentation Using Convolutional Neural Networks in MRI Images” IEEE Trans Med Imaging., volume.35, no.5, May 2016
[6]. Ali Isin, Cem Direkoglu, Melike Shah, “Review of MRI-based Brain Tumor Image Segmentation Using Deep Learning Methods”Volume 102 Issue C, December 2016.
[7]. Pham N.H. Tra “Image Segmentation for Detection of Benign and Malignant Tumors” IEEE Trans on Med Imaging, 2016
[8]. Badri Narayan Subudhi, Veerakumar Thanraj, Essaki Rajan, Asish Gosh, “Tumor or abnormality identification from magnetic resonance images using statistical region fusion based segmentation” Science direct, Volume 17 July 2016.
[9]. Saumya gupta, Monika Agarwal, Sanjay kumar, “Analysis of different brain tumor detection and segmentation techniques in MRI and other medical images” IJCST Vol.7, Issue 1, Jan-March 2016