A Survey on Methods for Improving Medical Image Resolution

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ABSTRACT

Diagnostic quality is an essential requirement in the medical images compression field to avoid misdiagnosis by radiologists. In this paper, a novel study on using the logarithm in medical images compression is presented.
In this approach the novel compression and resolution schemes are proposed to improve the image quality. The proposed compression schemes rely on 3D discrete wavelet transform, denoising, gamma correlation method and sparse dictionary representation method. With the increasing use of telemedicine there is a great demand in real-time processing and transmission of medical images. Noise is one of the important factors that degrade the quality of medical images. Impulse noise is a common noise that could be caused by malfunctioning of sensors or by data transmission errors. It is one the most common noises that have extensively been studied in recent years. For real-time noise removal hardware techniques are more suited, since software methods are complex and slow. Usually hardware techniques have low complexity and low accuracy. In this paper a low complexity, high accuracy, de-noising method is proposed.It first categorizes image pixels into a number of groups. Then noisy pixels are restored in different ways in each category. Local analysis of image blocks allows us to restore a noisy pixel by using its neighbouring non-noisy pixels. All steps are designed to have low hardware complexity. Simulation results show that in the case of MR images, the proposed method removes impulse noise with acceptable accuracy.

Keywords:-*Medical images, DWT, Sparse dictionary, filtering technique*

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1. INTRODUCTION:

- **Medical imaging** is the technique and process of creating visual representations of the interior of a body for clinical analysis and medical intervention, as well as visual representation of the function of some organs or tissues (physiology). Medical imaging seeks to reveal internal structures hidden by the skin and bones, as well as to diagnose and treat disease. Medical imaging also establishes a database of normal anatomy and physiology to make it possible to identify abnormalities. Although imaging of removed organs and tissues can be performed for medical reasons, such procedures are usually considered part of pathology instead of medical imaging. The different types of medical images are:- X-ray, MRI, Ultrasound, Computed Tomography (CT),Positron Emission Tomography (PET), etc.

1.1 Medical image processing system:-

Medical Image Processing is the process of creating visual representations of the interior of a body for clinical analysis and medical intervention, as well as visual representation of the function of some organs or tissues.

- M
edical image processing :- Deals with the development of problem specific approaches to enhance the raw medical data for the purposes of selective visualization as well as further analysis.

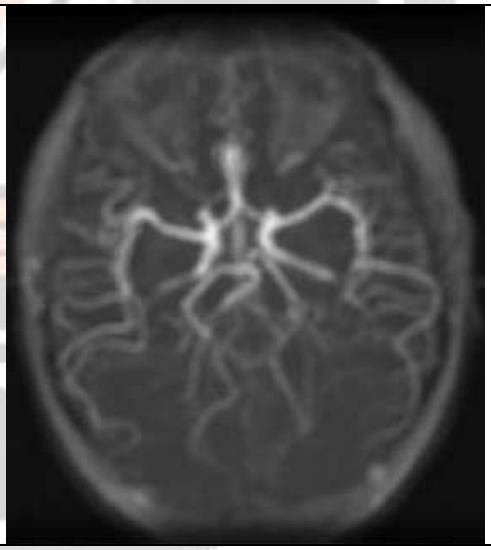
- M
edical image analysis :-Concentrates on the development of techniques to supplement the usually qualitative and frequently subjective assessment of medical images by human experts. – Provides quantitative, objective and reproducible information extracted from the medical images.

- S
egmentation :-The process of splitting an image into multiple parts is known as segmentation. It is also described as "The process of labeling each pixel in an image such that they share the same characteristics". It creates various sets of pixels within the same image. Segmenting an image makes it easier for us to further analyze and extract meaningful information from it[2].

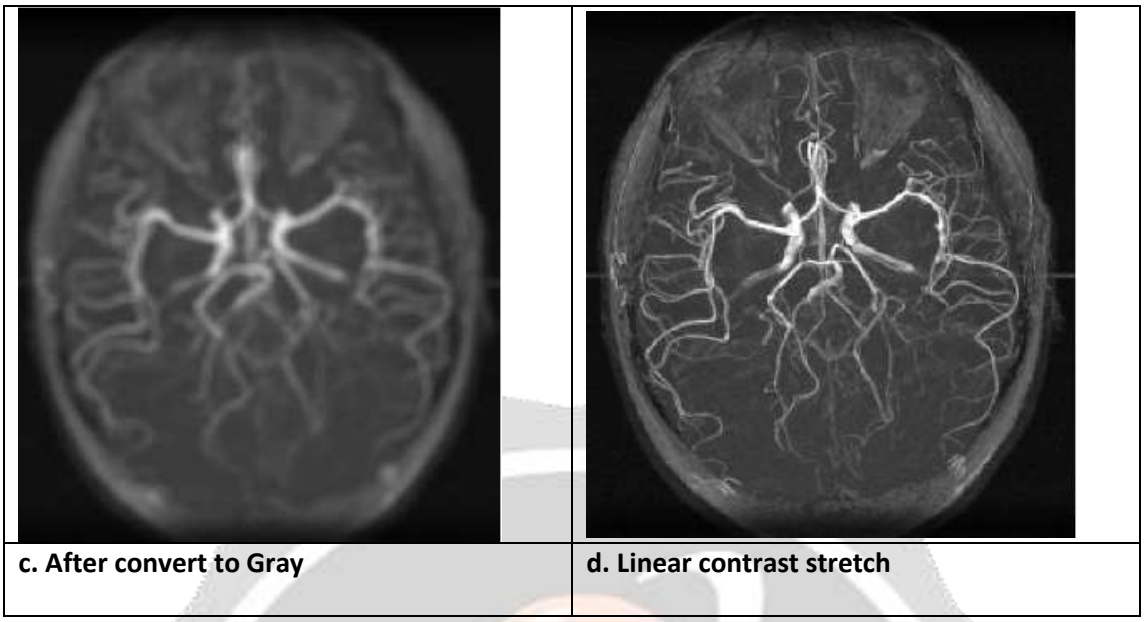
- F
iltering is a technique for modifying or enhancing an image. For example, you can filter an image to emphasize certain features or remove other features. Image processing operations implemented with filtering include smoothing, sharpening, and edge enhancement.

- F
iltering is a neighborhood operation, in which the value of any given pixel in the output image is determined by applying some algorithm to the values of the pixels in the neighborhood of the corresponding input pixel. A pixel's neighborhood is some set of pixels, defined by their locations relative to that pixel. Linear filtering is filtering in which the value of an output pixel is a linear combination of the values of the pixels in the input pixel's neighborhood.

a. Main image



b. After applying Wavelet Transform



c. After convert to Gray	d. Linear contrast stretch

Fig. Applying filter techniques on medical image

2. LITERATURE REVIEW:

2.1 Medical Images Compression with Clinical Diagnostic Quality Using Logarithmic DWT

- In [3]M. ShaabanIbraheem, S. Zahid Ahmed, Khalil Hachicha, Sylvain Hochberg, Patrick Garda, presents that the structural similarity index (SSIM) was used to assess the two approaches in terms of the image quality. The performance has been evaluated for the proposed approaches and has been compared to the classical approach.Both approaches show a significant improvement in the image quality in addition to providing better compression rate compared to the classical approach which does not include any logarithmic operations

2.2 Real-Time Removal of Random Value Impulse Noise in Medical Images

- In [4]Z. HosseinKhani, N. Karimi, S.M.R. Soroushmehr, M. Hajabdollahi, S. Samavi, K. Ward, K. Najarianpresents A low complexity, high accuracy, de-noising method . It first categorizes image pixels into a number of groups. Then noisy pixels are restored in different ways in each category.
  Local analysis of image blocks allows us to restore a noisy pixel by using its neighboring non-noisy pixels. All steps are designed to have low hardware complexity.

2.3 Example-based super-resolution for enhancing spatial resolution of medical images

- In [5]Dai-Viet Tran, Sebastien Li-Thiao, Marie Luong, Thuong Le-Tien, Franc¸oiseDibos, Jean-Marie Rocchisani,focuses onthe sparsity of patches, the reconstruction of a high-resolution (HR) patch from each low-resolution (LR) input patch can be performed with the help of a database, by solving a non-negative sparse optimization problem. To cope with this issue, we propose a metric to measure the similarity between image patches based on the Earth Mover's Distance (EMD) in order to select only the most similar candidates that will be used in the optimization problem.

2.4 Medical image super resolution with non-local embedding sparserepresentation and improved IBP

- In [6]Mingli Zhang, Christian Desrosiers, Qiang Qu, FenghuaGuo, Caiming Zhang Proposed Highresolution images are reconstructed from low resolution observations with an efficient technique based on the alternating direction method of multipliers (ADMM).post-processing step to remove residual noise

and artifacts in the reconstructed image. method combines sparse representation and non-local patch embedding in a single model

2.5 Single image super-resolution of medical ultrasound images using a fast algorithm

- In [7]Ningning Zhao, Qi Wei, Adrian Basarab, Denis Kouam´e , Jean-Yves Tourneret, proposes proposed an p-norm (1 p 2) regularizer for the US tissue reflectivity function/image to be estimated. To solve the associated optimization problem, they propose a novel way to explore the decimation and blurring operators simultaneously.

3. COMPARATIVE TABLE:

Table -1: Comparative Table

Sr. no	Title	Year of publication	Technique	Advantages	Disadvantages
1	Medical Images Compression with Clinical Diagnostic Quality Using Logarithmic DWT	2016	DWT and LNS	1.Both schemes give higher image quality than the classical DWT. 2. LNS-DWT performs a near-lossless compression. 3. A novel logarithmic DWT was proposed, which achieves higher speed than the LNS-DWT. This gives the tradeoff between the speed and the image quality, which is an essential factor for the radiologists. 4. The evaluated SIMM and PSNR has are still much higher than the classical DWT. 5. The evaluated SIMM and PSNR has are still much higher than the classical DWT.	1. LNS-DWT performs a near-lossless compression but with a cost of time.
2.	Real-Time Removal of Random Value Impulse Noise in Medical Images.	2016	removal hardware techniques	1.High accuracy of noisy-pixel detection in the first stage, and their removal in the next stage, led to better restoration of noisy images. 2. the proposed approach removes random value impulse noise with high accuracy. 3. Also low hardware resource utilization of the proposed method makes it suitable for applying it in medical imaging hardware systems	1.it is complex in implementation phase.
3.	Example-based super-	2016	Example-	1. An effective example-	1.It is highly time-consuming

	resolution for enhancing spatial resolution of medical images.		based, sparse-representation, Earth Mover's Distance.	based SR methodwhich enhances the spatial resolution while robustly reducing the noise in an degraded low-resolution image.	and it is a metric only for normalizedDistributions.
4.	Medical image super resolution with non-local embedding sparse representation and improved IBP	2016	alternating direction method of multipliers (ADMM).	1.A post-processing step, using a robust iterative back-projection technique, is proposed to remove residual artifacts in the reconstructed image. 2.Experiments on benchmark medical images show the advantage of our method compared to several state of the art approaches. 3.In comparison to NARM and SRSW, our method is better at recovering finedetails in the image, which could be useful for assessing themicrostructure of tissues.	1. Standard IBP methods can produce reconstruction artifacts by amplifying noise from one iteration to another.
5.	Single image super-resolution of medical ultrasound images using a fast algorithm .	2016	Fast SR algorithm	1. Due to the implementation of the analytical solution, the proposed method allowed to reduce the computation time comparing with the classical method.	1. However, these algorithms assume that the function to be optimized is differentiable, which limits their applications.

4. CONCLUSION:

According to literature review various author have research based on medical image resolution to improve quality of medical images. In proposed work try to get the maximum accuracy of medical images by eliminating noise and increasing compression ratio which is much needed for diagnosis purpose. With the proposed method we can achieve more accuracy. Image enhancement using this method can give the better quality and higher compression rate.

5. REFERENCES:

[1] Angenent, S., Pichon, E., Tannenbaum, A.: Mathematical Methods in Medical Image Processing. Bulletin of the American Mathematical Society 43, 365–396 (2006)

[2] M. S. Ibraheem, S. Z. Ahmed, K. Hachicha, S. Hochberg, P. Garda, "Logarithmic Discrete Wavelet Transform for Medical Image Compression with Diagnostic Quality", 5th EAI Int. MobiHealth, London, UK, Oct. 2016

[3] M. ShaabanIbraheem*, S. Zahid Ahmed*, Khalil Hachicha*, Sylvain Hochberg‡, Patrick Garda* "Medical Images Compression with Clinical Diagnostic QualityUsing Logarithmic DWT" UPMC Univ Paris 06, CNRS, LIP6 UMR 7606, Paris, France

[4] Mingli Zhang1, Christian Desrosiers, Qiang Qu, FenghuaGuo, Caiming Zhang "Medical image super- with non-local embedding sparse representation and improved ibp" School of Computer Science and Technology, Shandong University, Jinan, China

[5] Pratibha Sharma Electronics Department, RTMNU Nagpur, Maharashtra, India "Digital Image Watermarking Using 3 level Discrete Wavelet Transform" Conference on Advances in Communication and Control Systems 2013 (CAC2S 2013)

[6] DipaleeGupta , Siddhartha Choubey, International Journal of Emerging Technology and Advanced Engineering "Discrete Wavelet Transform for Image Processing" ISSN 2250-2459, ISO 9001:2008 Certified Journal

[7] Dai-Viet Tran1, S´ebastien Li-Thiao-T, Marie Luong2, Thuong Le-Tien, Francoise Dibos, Jean-Marie Rocchisani , "Example-based super-resolution for enhancing spatial resolution of medical images" University Paris 13, France, Hochiminh University of Technology, Vietnam

[8] Z. HosseinKhani1, N. Karimi, S.M.R. Soroushmehr, M. Hajabdollahi1, S. Samavi, K. Ward, K. Najarian, "Real-Time Removal of Random Value Impulse Noise in Medical Images", 2016 23rd International Conference on Pattern Recognition (ICPR) CancúnCenter, Cancún, México, December 4-8, 2016

[9] S. Collange, J. Detrey, and F. de Dinechin, "Floating Point or LNS: Choosing the Right Arithmetic on an Aapplication Basis," in 9thEUROMICRO Conference on Digital System Design: Architectures,Methods and Tools, Dubrovnik, Croatia, pp. 197–203, Aug. 2006.

[10] S. Z. Ahmed, Y. Bai, I. Dhif, L. Lambert, I. Mhedhbi, P. Garda, B. Granado, K. Hachicha, A. Pinna, F. Ghaffari, A. Histace, and O. Romain, "SmartEEG: A multimodal tool for EEG signals," in IEEEFaible Tension FaibleConsommation, Monaco, pp. 1–4, May 2014.

[11] I. Mhedhbi, F. Kaddouh, K. Hachicha, D. Heudes, S. Hochberg, and P. Garda, "Mask motion adaptive medical image coding," in IEEE-EMBSInternational Conference on Biomedical and Health Informatics, Valencia, Spain, pp. 408–411, Jun 2014.

[12] Deepak Raghuvanshi, Shabahat Hasan, Mridula Agrawal, "Analysing Image Denoising using Non Local Means Algorithm" International Journal of Computer Applications (0975 – 8887) Volume 56

[13] I. Daubechies and W. Sweldens, "Factoring wavelet transforms into lifting steps," The Journal of Fourier Analysis and Applications, vol. 4, no. 3, pp. 247–269, May 1998.

[14] Z. Wang, A. C. Bovik, H. R. Sheikh, and E. P. Simoncelli, "Image quality assessment: from error visibility to structural similarity," IEEETrans. on Image Processing, vol. 13, no. 4, pp. 600–612, Apr. 2004.