EAI Endorsed Transactions
on Pervasive Health and Technology
Research Article EAI.EU

Speckle Noise Removal from Biomedical MRI Images and Classification by Multi-Support Vector Machine

B. Hemalatha*[1], B. Karthik[1] and C. V. Krishna Reddy[2]

[1]Department of ECE, Bharath Institute of Higher Education and Research, Chennai, India
[2]Nalla Narasimha Reddy Education Society's Group of Institutions, Hyderabad, India

Abstract

INTRODUCTION: Image Processing (IP) methods play a vital role in medical images for diagnosing and predicting illness, as well as monitoring the patient's progress. The IP methods are utilized in many applications for example in the field of medicine.
OBJECTIVES: The images that are obtained by the MRI magnetic Resonance imaging and x rays are analyzed with the help of image processing.
METHODS: This application is very costly to the patient. Because of the several non-idealities in the image process, medical images are frequently tainted by impulsive, multiplicative, and addictive noise.
RESULTS: By replacing some of the original image's pixels with new ones that have luminance values which are less than the allowed dynamic luminance range, noise frequently affects medical images.
CONCLUSION: In this research work, the Speckle type noises are eliminated with the help of Mean Filter (MF) and classify the images using Multi-SVM classifier. The entire system developed using python programming.

Keywords: Signal to Noise Ratio, Speckle, MRI Images, Classification, Mean Filter, Multi SVM

Received on 15 November 2023, accepted on 30 January 2024, published on 08 February 2024

doi: 10.4108/eetpht.10.5076

1. Introduction

Medical images are being obtained from patients who take X-Rays and MRI scans from reputed scan centers [1]. In the medical industry, noise is categorized into two stages. A criterion for estimating the presence of impulsive noise makes up the first stage. The image is processed for the second stage of another criterion to determine whether the noise is multiplicative or additive if the outcome of this criterion is negative.
The main reason for this speckle noise is the waves or radiation that has been emitted during scanning in scan centers. There are many types of noises present in medical images. In X-Rays the presence of Poisson noise will be very high. In case of MRI and Ultrasound images we will be having more Speckle noise which will reduce the prediction accuracy during classification [2].
Among all noises in medical imaging, this speckle noise plays a main role in reducing the prediction of diseases or the current state of the patient's status. So, our proposed system will help in clearing and removing this speckle noise in an efficient manner.
Today, image processing methods are applied in a number of medical applications, such as brain tumour classification, liver image validation, and cancer diagnosis. Breast cancer is the most aggressive type of cancer that currently affects women, particularly in developing countries, and the risk associated with it rises with age [3]. Because the exact aetiology of breast cancer is yet unknown, prevention is difficult. The rate of survival can

*Corresponding author. Email: hema.contact@gmail.com

5. Conclusion

IP techniques are mainly used in the medical domain for identifying and classifying diseases in an earlier manner. Various kinds of noises occurred due to different causes. In the medical domain, noises are decreasing image qualities. Denoising can assist healthcare professionals to detect diseases. In this research work, the MRI image speckle noises are removed from the images using MF. The filtered images are then classified using the Multi SVM model. The findings of the suggested system's Python implementation are contrasted with those of more conventional methods. Future neural network algorithms, including Convolution Neural Networks (CNN) and Recurrent Neural Networks (RNN), will provide results that are more accurate than those of our suggested approach.

References

[1] Jayachitra, S, Prasanth, A: Multi-feature analysis for automated brain stroke classification using weighted Gaussian naïve Bayes classifier. journal of circuits, systems and computers. 2021; Vol. 30, pp. 1–19.

[2] Sekar J, Aruchamy, P, Lebbe A:. An efficient clinical support system for heart disease prediction using TANFIS classifier. Computational Intelligence. 2022; Vol. 38:pp.610-640.

[3] Braveen, M, Nachiyappan, S, Seetha, R: ALBAE feature extraction based lung pneumonia and cancer classification. Soft Computing. 2023; pp. 1-14.

[4] Ayana G, Dese K, Raj H, Krishnamoorthy J, Kwa T. De-Speckling Breast Cancer Ultrasound Images Using a Rotationally Invariant Block Matching Based Non-Local Means (RIBM-NLM) Method. Diagnostics (Basel).2022; 12(4):862.

[5] S R S Chakravarthy, H Rajaguru. A Novel Noise Removal in Digital Mammograms based on Statistical Algorithms. International Conference on Advances in Computing and Communication Engineering (ICACCE). 2019;14(2):1-4.

[6] Huang Shuoa, Zhou Pinga, Shi Haoa , Sun Yua, Wan Suirena.Image Speckle Noise Denoising by a Multi-Layer Fusion Enhancement Method based on Block Matching and 3D Filtering. International Laboratory for Children's Medical Imaging Research, School of Biological Sciences and Medical Engineering.2020;17(4):1-17.

[7] Melaku Bitew, Haile,Ayodeji, Olalekan Salau, Icon,Belay Enyew,Abebech, Jenber Belay. Detection and classification of gastrointestinal disease using convolutional neural network and SVM. Cogent Engineering.2022;9(1):1-14.

[8] Abdulaziz Saleh, Yeslem Bin-Habtoor, Salem Saleh Al-amri. Removal Speckle Noise from Medical Image Using Image Processing Techniques. International Journal of Computer Science and Information Technologies.2016;7 (1):375-377.

[9] K Karthikeyan, C.Chandrasekar. Speckle Noise Reduction of Medical Ultrasound Images using Bayesshrink Wavelet Threshold. International Journal of Computer Applications 2011;22(9):8-14.

[10] Ahmed S.Bafaraj. Performance Analysis of Best Speckle Filter for Noise Reduction in Ultrasound Medical Images. International Journal of Applied Engineering Research.2019;14(6):1340-1351.

[11] S LeenaNesamani S, Nirmala SugirthaRajini, M S. Josphine, J Jacinth Salome. Deep Learning-Based Mammogram Classification for Breast Cancer Diagnosis Using Multi-level Support Vector Machine. Springer Lecture Notes in Electrical Engineering.2021;700(2):371-383.

[12] Nalin Kumar , M Nachamai. Noise Removal and Filtering Techniques used in Medical Images. Oriental Journal Of Computer Science & Technology.2017;10(1):103-113.

[13] Pichid Kittisuwan. Speckle Noise Reduction of Medical Imaging via Logistic Density in Redundant Wavelet Domain. International Journal on Artificial Intelligence Tools. 2018;27(2):45-52.

[14] S Rameshkumar, J AnishJafrinThilak, P Suresh, S Sathishkumar,N Subraman. Speckle Noise Removal in MRI Scan Image Using WB – Filter. International Journal of Innovative Research in Science, Engineering and Technology.2018; 28(1):1079- 21083.

[15] S Anitha ,L Kola, P Sushma, S Archana. Analysis of filtering and novel technique for noise removal in MRI and CT images. IEEE International Conference on Electrical, Electronics, Communication, Computer, and Optimization Techniques (ICEECCOT). 2017;2018(2):825-827.

[16] B Deepa, M G Sumithra. Comparative analysis of noise removal techniques in MRI brain images. IEEE International Conference on Computational Intelligence and Computing Research (ICCIC).2015;25(4):1-4.

[17] Rajaguru Harikumar, Chakravarthy Sannasi. Efficient Denoising Framework for Mammogram Images with a New Impulse Detector and Non-Local Means. Asian Pacific Journal of Cancer Prevention.2020;21(4):179-183.