Brain Tumor Image Segmentation Using Hybrid Assured Convergence Particle Swarm Optimization And Fuzzy C-Means

P. Kavitha, S. Prabakaran

Abstract: Recently, the medical image processing is extensively used in several areas. In earlier detection and treatment of these diseases is very helpful to find out the abnormality issues in that image. Here there are number of methods available for diagnosis to detect the brain tumor of MRI image. The main result of this paper, the earlier detection of brain tumor using Pre-processing techniques of Median, Bilateral Filter and adaptive bilateral filter was compared both filtering methods and proved the adaptive bilateral filter is suitable method for CT images. The proposed segmentation technique using hybrid Assured Convergence PSO (ACPSO) and Fuzzy C-Mean Clustering (FCM) was proposed method. The segmentation algorithm presented in this paper gives 95% of accuracy rate to detect brain tumor. The experimental results were achieved better accuracy and effective performance of the proposed techniques for identifying normal and abnormal cells from MRI image.

Index Terms: MRI Image, Adaptive bilateral, PSO, Fuzzy C-Mean, ACPSO

I. INTRODUCTION

The medical image techniques are most important technology is screening of cancer images. Computer Tomography is better diagnosis for detecting and assessing cancer images. The nodules are differentiating benign and malignant. For the present study, pre-processing of original sample image to reduce noise detection and gaussian blur using adaptive bilateral filter, by comparing adaptive bilateral filter is best method to find better accurate rate. Three segmentation techniques are compared and proved the combination of marker based watershed algorithm based on PSO and Fuzzy C-mean was proved best accuracy value measured. The proposed techniques are implemented by pre-processing to reduce noise reduction and smoothing of the original image quality was improved. In this article, the top-hat transform filter in morphological methods to extract the small unit of image pixel. The small extraction image computed by morphological opening and then the filter image is subtracted by original image. In segmentation, Otsu's method can perform cluster based thresholding and it convert into a binary image. It assumes two pixel classes compute the threshold value and separate two classes and the total variances and mean is calculating threshold value. A graythresh() method are used to perform Otsu thresholding. Watershed transformations to finding the watershed ridge line and catchment basins in an image. In classification, the support vector machine (SVM) to classify better accuracy 90% compared other classification method. The proposed method was implemented by Ayushi Shukla, Chinmay Parab and Pratik Patil [2].

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The method was proposed [2] extension of adaptive bilateral method to apply sub-bands of low frequency signal decomposed using wavelet transform. A wavelet threshold is combined with adaptive bilateral method to form an innovative structure in image de-noising method. It's very efficient to eliminate noise in original noisy images. First detected block boundary and texture regions discontinuities to adapt or control the parameters of spatial and intensity in bilateral filter and adaptive method can improve the restored image quality in this test result compared with standard bilateral filter. The improvements of fast bilateral method using the combination of Gaussian filter. I proposed the various image resolution of adaptive bilateral method was proved better results.Emre Dandl [4] was proposed method to classify the lung nodules. In LUVEM (Lung Volume Extraction Method), using median filter to reduce the noise and to implement LUVEM method to extract the nodules from CT scan image. After that the Self Organizing Method (SOM) is successful detection of early stages. It's unsupervised neural network method and easily segmented to small nodules on the lung nodules. In feature extraction, first we used shape based method for analyzing lung nodule image and to utilize GLCM method is used to statistic of gray level lung nodule. Finally the lung nodules are extracted and computed to the segmentation object. Finally, using Probabilistic Neural Network (PNN) to classify the bengin and malign lung nodule. The result f the proposed classification method of PNN is given better accuracy value.

II. PROPOSED METHODOLOGY

A. Adaptive bilateral filter for multi-resolution

An experimental study of optimal parameter values should change the noise variance of image de-noising application. The relationship among the parameter σ_d , σ_r and standard deviation σ_n. To reduce noise in input image using bilateral method was applied and test multi-variance of image resolution using the parameters σ_d and σ_r [2]. The efficient noise variance was repeated and MSE and PSNR values were recorded. The parameter σ_d range from 1.5 to 2.0 and then σ_r value change significantly as the standard deviation σ_n value changes. To change the various image resolution analyses is one of the best effective methods for reducing noise and it is possible to discriminate between image and noise in sequence is

enhanced one image resolution level to another. In the various image resolution of adaptive bilateral method were combine with wavelet threshold. The adaptive bilateral method was applied sub-bands to reducing low frequency noise components. The architecture diagram of proposed technique is:

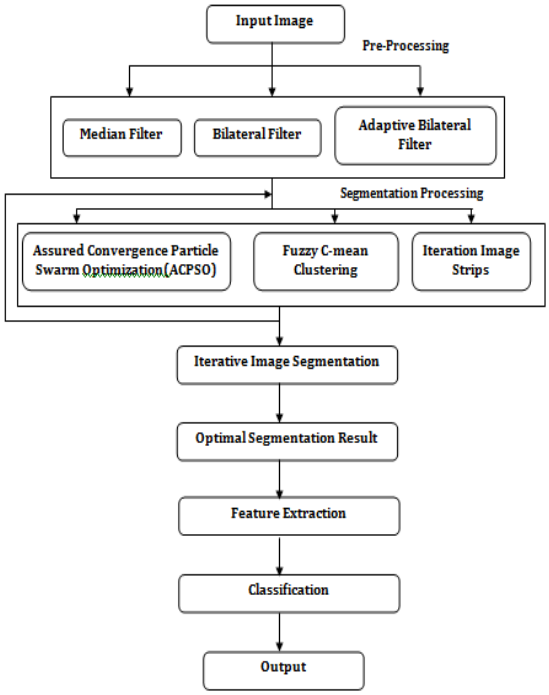


***Figure 1**: Proposed Methodology*

B. Hybrid Assured Convergence PSO and Fuzzy C-mean Clustering

In image processing, the segmentation techniques are used to partition a medical image into multiple segments. It's going to find the image locate an object and boundaries like a lines, curves, etc. The Proposed algorithm hybrid FCM-ACPSO applies Fuzzy C-Mean to each particle to every number of generations/iterations so the fitness value of all the particles to improved. The Algorithm hybrid ACPSO-FCM for fuzzy clustering as follows:

a. To initialize the parameter of AGPSO and Fuzzy c-mean clusters.
b. To initialize the size of the population P, c1, c2, m and w
c. Create particle P (X, gbest, pbest and velocity are n*c matrices).
d. AGPSO:
   i. Calculate the cluster centers for the entire particles
   ii. Calculate the fitness value of all the particles
   iii. Evaluate pbest for all the particle
   iv. Evaluate gbest for swarm
   v. Upgrade the velocity of the entire particle
   vi. Upgrade the position of the entire particle
e. Fuzzy C-Mean:
   i. Calculate cluster center for the entire particles
   ii. Euclidian Distance method dij , the i values are 1,2,…n; and the j values are 1,2,…c;
   iii. Upgrade the function μij , i values are 1,2,…n; and the j values are 1,2,…c; for the entire particle.
   iv. Evaluate pbest for all the particle
   v. Evaluate gbest for swarm
   vi. If Fuzzy C-mean terminating state is not met, goto step 5.
   vii. If ACPSO terminating state is not met, goto step 4.

III. EXPERIMENTAL RESULTS

I found the performance of proposed image de-noising quantitatively and visually. The input noisy image was de-noised using various filtering methods and the MSE and PSNR results were calculated.

***Table 1** A comparison of MSE value using various methods.*

Sample Image	Median [5]	Bilateral [1]	Proposed
Image_1	79.218	64.08	62.377
Image_2	80.135	68.374	67.319
Image_3	83.724	61.192	59.427
Image_4	80.239	66.135	65.194
Image_5	82.192	70.493	69.196

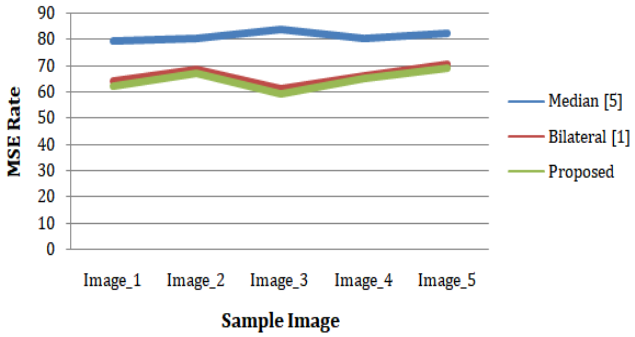


***Figure 2:** Comparative results of MSE*

***Table 2.** A comparison of PSNR value using various methods.*

Sample Image	Median [5]	Bilateral [1]	Proposed
Image_1	32.47	32.89	33.96
Image_2	32.97	33.41	33.53
Image_3	31.63	32.27	34.51
Image_4	32.81	33.01	33.89
Image_5	31.77	33.61	34.77

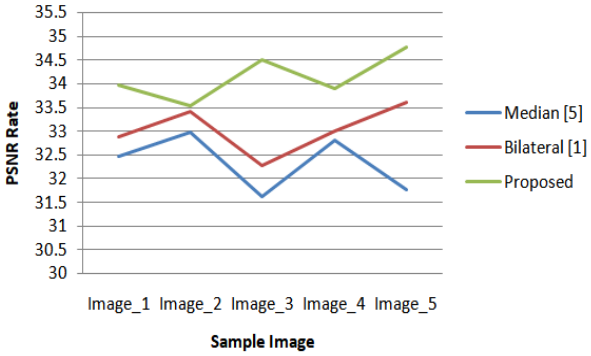
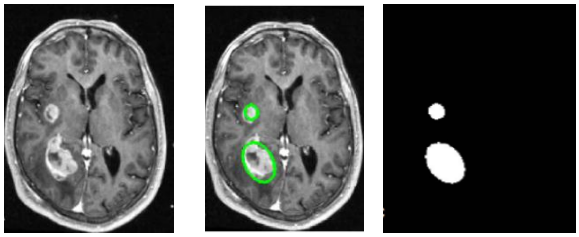


Figure 3: *Comparative results of PSNR*

In the pre-processing, an evaluation of both filter methods was done and measures the performance of median filter, bilateral method and adaptive bilateral filter. The MSE and PSNR rate are shown in Table 1 and Table2. Comparative results are shown in The Figure2 and Figure3. From the filtering results, the adaptive bilateral method has given better accurate rate compared with median filter and bilateral filter.



(a) (b) (c)

Figure 4: *(a) Input Image (b) Segmented Image (c) Extract tumor*

The comparative results of various segmentation results the proposed method of hybrid Assured Convergence Particle Swarm Optimization (ACPSO)-Fuzzy C-Mean (FCM) were more accuracy rate to find the tumor detection.

Table 3: *Statistical Comparative Result of Accuracy*

Sample Image	FCM	PSO	FPSO-FCM	Proposed
Image 1	89.3672	89.0624	88.9813	95.8079
Image 2	88.5622	88.9689	86.1018	94.4204
Image 3	79.8186	84.9967	83.0334	93.6473
Image 4	82.4514	81.8114	83.2876	93.6473
Image 5	79.9876	82.0954	81.2033	91.9531

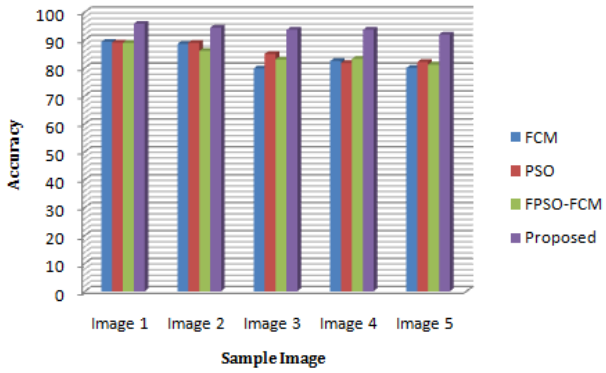


Figure 5: *Comparative results of PSNR*

In the proposed method, accuracy was measured using the TP (True Positive), TN (True Negative), FP (False Positive), and FN (False Negative) by comparing the results from the other segmentation algorithm with manual results. The results of the proposed segmentation method are shown in Table 3 and graphical view of the segmentation accuracy was calculated using the TP (True Positive), TN (True Negative), FP (False Positive), and FN (False Negative) shown in figure 5 and the comparative Results algorithm shown in Table 3.

IV. CONCLUSION

In The aim of this research, reducing noise and improve the image quality using various filtering technique. I proposed the extension of adaptive bilateral method to apply the low frequency sub-bands of signal decomposed using a wavelet transform. The wavelet thresholding is combined with adaptive bilateral filter. This technique is very efficient to eliminate noises in original noisy images and then to detected block boundary and texture regions discontinuities to adapt or control the parameters of spatial and intensity in bilateral method. Analyzing four segmentation techniques, the better accuracy result of the tumor detection is enhanced proposed method with maximum accuracy rate of 95%. The proposed method is more accurate when compared to the existing segmentation algorithm. In future studies, various segmentation algorithm will be integrated and to improve the better accuracy rate.

REFERENCES

[1] Ayushi Shukla, Chinmay Parab and Pratik Patil “Brain Cancer Detection using Image Processing Techniques” International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 04 | Apr-2018.

[2] P.Kavitha, S.Prabakaran “Adaptive Bilateral filter for Multi-resolution in Brain tumor Recognition” International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-8 June, 2019.

[3] Emre Dandıl “A Computer-Aided Pipeline for Automatic Lung Cancer Classification on Computed Tomography Scans” Journal of Healthcare Engineering Volume 2018, Article ID 9409267, 12 pages

[4] Emre Dandıl “A Computer-Aided Pipeline for Automatic Lung Cancer Classification on Computed Tomography Scans” Journal of Healthcare Engineering Volume 2018, Article ID 9409267, 12 pages

[5] Lavanya M, Muthu Kannan P “Lung cancer segmentation and diagnosis of lung cancer staging using MEM

(modified expectation maximization) algorithm and artificial neural network fuzzy inference system (ANFIS)" ISSN 0970-938X Biomed Research 2018 29 (14): 2919-2924.

[6] Shraddha G. Kulkarni, Sahebrao B. Bagal "Lung Cancer Tumor Detection Using Image Processing and Soft Computing Techniques" International Journal of Science Technology and Management Volume 05 ISSN 2394-1537, May 2016

[7] Ada, Rajneet Kaur, "Early Detection and Prediction of Lung Cancer Survival using Neural Network Classifier", IJAIEM volume 2, Issue 6, June 2013

[8] Rashidul Hasan and Muntasir Al Kabir "Lung Cancer Detection and Classification based on Image Processing and Statistical Learning" DOI:10.13140 / RG.2.2.29499.46887

[9] Ayushi Shukla, Chinmay Parab and Pratik Patil "Lung Cancer Detection using Image Processing Techniques" International Research Journal of Engineering and Technology (IRJET) Volume: 05 Issue: 04 | Apr-2018.

[10] Rashmita Sehgal, Saurabh Gupta "Lung Cancer Detection Using Neural Networks" International Journal of Advanced Research in Computer Science and Software Engineering Volume 6, Issue 10, October 2016.

[11] A. Asuntha1, A.Brindha1, S.Indirani1 "Lung cancer detection using SVM algorithm and optimization techniques" Journal of Chemical and Pharmaceutical Sciences Volume 9 Issue 4 ISSN: 0974-2115.

[12] Bariqi Abdillah, Alhadi Bustamam, and Devvi Sarwinda "Image processing based detection of lung cancer on CT scan images" The Asian Mathematical Conference 2016 (AMC 2016) IOP Conf. Series: Journal of Physics: Conf. Series 893 (2017) 012063.

[13] Raviprakash S. Shriwas, Akshay D. Dikondawar "Lung Cancer Detection And Prediction By Using Neural Network" IPASJ International Journal of Electronics & Communication (IIJEC) Volume 3, Issue 1, January 2015