Brain Tumor Analysis Using Various Evolutionary Segmentation Techniques

K. Subhashini, K. Kowsalya

Abstract: Recently, the medical image diagnosis is important field in this current situation. We have different methods to diagnosis an image such as Computed Tomography (CT), Positron Emission Tomography (PET), Magnetic resonance imaging (MRI) etc. these methods are allowed to find the smallest disease in the human body. An abnormal growth of the cell to distress a proper brain functioning is considered as brain tumor. The main aim of this research to detect an image information with minimum error possible. The MRI scan is to get the image information and to detect the cancerous tissues accurately because its better quality and high resolution of image compared with other technologies. Different type of techniques is implemented and executed to detect a cancerous and non-cancerous image. In this process of identifying a cancerous image can be categorized into different level; pre-processing, segmentation, feature extraction and classification. In this present study, using four optimized algorithms like Particle Swarm Optimization, Fuzzy c-mean clustering and hybrid particle swarm optimization-Fuzzy C-mean (PSO-FCM), to extract the tissues from the brain has been analyzed and implemented. In Pre-processing, mean, median and adaptive median was compared and proved that the proposed adaptive median filter are gives better accuracy rate to denoising image. A sample MRI images of brain using MATLAB and proved the hybrid PSO-FCM gives highest accuracy rate of 95.79%.

Index Terms: Adaptive median, K-mean, PSO, Fuzzy C-mean, MRI image.

1 INTRODUCTION

Medical image segmentation is important research areas which deal with the crisis in diagnosing medical image. There are various segmentation approaches has been proposed hence, the main purpose of image segmentation is to accomplish superior accurateness by understanding the anatomical structures, therefore, to diagnose the pathology and the learning progression of the corresponding progression. The study of medical imaging is a challenging area which is accomplishing their insight value to diagnose the exact disease. Therefore, it is determined that enhancement of medical image segmentation techniques by improving the accuracy value and by reducing the loss rate are employed for the feasibility of MRI system is a big challenge and an open research. In this result, [5] the proposed methods to detect cancer cells is more accurate rate when it's compared to existing methods. Smoothing input image and also blur using the methods of median filter to reduce noise and enhancing the original image to histogram equalization. In segmentation using marker watershed algorithm, the image is converted to grayscale and compute the segmentation function of gradient magnitude. We find foreground and a background point in the image. The image is extracted in the function area, perimeter and standard deviation, entropy and kurtosis. The extracted feature is detected tumor and use supervised and un-supervised classifier to classify the tumor identification. The proposed method performance to measure 72.2% and the proposed method developed by Md Rashidul Hasan and Muntasir Al Kabir.

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2 RELATED WORK

The comparative study [7] of this proposed, the different color images are used to evaluate the different color regions. It reduces noise and also blur using median filter. The next stage, enhancing image are dividing and separate the number of clusters and then the minimum number of distances have found the clustering techniques. The comparative two segmentation methods are k-mean clustering and thresholding approach has performed in this proposed. The performance of five different color images was segmented and measures MSE, SSIM and PSNR. By using threshed method some images are performed MSE and SSIM are better value, but most the color images are measures high accuracy rate in k-mean clustering and the proposed development by Preeti Panwar, Girdhar Gopal, Rakesh Kumar. In this article focused various image segmentation are used to detect the cancer cell. The segmentation is classified into various categories: Edge based, region based, thresholding, cluster based, feature based and neural network. The clustering techniques are one of the best techniques used for the segmentation. Furthermore, the feature extraction to extract the smallest unit of the image to detect tumor and the clustering methods is classified better accuracy rate compared to other. The segmentation images to measures the maximum rate of true positive and minimum rate of false positive [8].

3 METHODOLOGY

In image segmentation, the accuracy rate is foremost significant, as it deals with human survives.

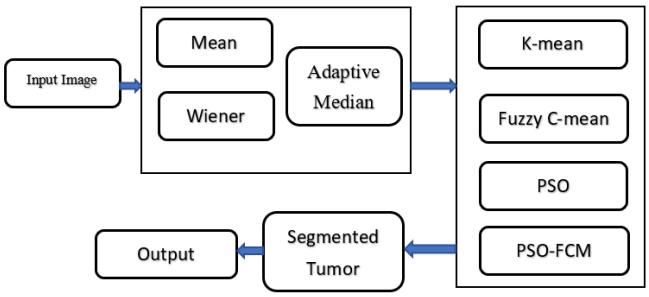

Figure 1: *Proposed Method*

3.1 Pre-Processing

a) Mean Filter:
This type of technique is processed to denoising an image is based on average value of the image pixel. The main advantage of this filter to reduce an efficient Gaussian noise and quick response time. An image boundaries and edges are distorted in this filter disadvantages.

b) Wiener Filter:
Denoising an image filter is based on the inverse method in the frequency domain. To reduce an image in the form of blur is more efficient and eliminating noise in this filter main advantages. Its low speed rate because of working in the frequency domain so it's not suitable for spackle noise.

c) Adaptive Median Filter:
The median filter is used to eliminate noise and sharpening an input image and its working based on each pixel is replaced by median value from the neighborhood pixels. A kernel size is 3x3[3]. The median filter is one of the best filters to remove noise. The proposed pre-processing an adaptive median filter to preserve the image edge detail and to ignore image non-impulsive noise. An adaptive median filter has been efficient implementation to compared and proved better performance measures of MSE and PSNR value.

3.2 Segmentation

a) Fuzzy C-mean Clustering:
In these techniques are using a set of objects is divided into number of clusters in dimensional space with fuzzy clusters with centroids. The clustering of fuzzy objects is described fuzzy matrix n rows is number of data objects and c columns is number of clusters. First initialize the membership function and to compute the cluster centroid and compute to Euclidian distance.

Finally, update the membership function is:

$$\mu_{ij} = \frac{1}{\sum_{k=1}^{c} \left(\frac{d_{ij}}{d_{ik}}\right)^{\frac{2}{m-1}}}$$

To terminate an algorithm when the related changes in the cluster center values are small. The Fuzzy C-mean algorithm is complex to initial values and local optima.

b) Particle Swarm Optimization (PSO):
Its more efficient segmentation algorithm using medical image diagnosis [4]. The particle swarm optimization is communicating and sharing image information. In this method allocate initial position of each particle and initialize velocity. The fitness value is based on updated velocity and position. The related between these two equations are updated velocity and position as follows [9][12].

$$v(t+1) = v(t) + c_1 r_1 [\text{pbest}(t) - x(t)] + c_2 r_2 [\text{gbest}(t) - x(t)], \quad (2)$$
$$x(t+1) = x(t) + v(t+1),$$

Where the random numbers are r1 and r2, coefficient c1 and c2 these two coefficients are positive constants. In this present study the fitness function is:

c) Hybrid PSO-FCM:
The proposed method of image segmentation particle swarm optimization, fuzzy c-mean to refined position and velocity of each particle. The hybrid PSO-FCM algorithm as follows:

1. Initializing parameters includes P, c1, c2, w of population size and iterative count.
2. Create a swarm particle P such as X, gbest, pbest, n*c matrices and V.
3. Initialize each particle like X, V, pbest and swarm gbest.
4. Calculate for each particle cluster centroids
5. Calculate for each particle fitness value
6. Calculate for each particle pbest
7. Calculate for swarm gbest
8. Update each particle velocity matrix
9. Update each particle position matrix.
10. The conditions are terminating is not met, goto step 4.

4 EXPERIMENTAL RESULTS

The methods results are implemented and developed MATLAB software. The results were executed and verified. In pre-processing, as compared and proved the performance of mean, wiener and adaptive median filter. To measure the image quality using Mean Square Error (MSE) and Peak Signal Noise Ratio (PSNR)
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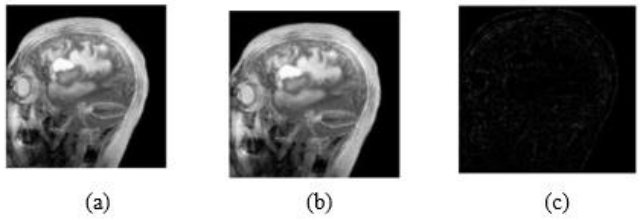


Figure 2: *(a) Original input image (b) Grayscale Image (c) Adaptive median filter*

Table 1.1*: An MSE Rate Performance Comparison of Various Methods*

Sample Image	Mean	Wiener	Adaptive Median
IMG_1	74.118	66.05	61.261
IMG_2	77.195	66.364	61.399
IMG_3	80.224	64.112	62.417
IMG_4	75.299	68.185	63.124
IMG_5	81.162	68.423	61.896

Table 1.2*: A PSNR Rate Performance Comparison of Various Methods*

Sample Image	Mean	Wiener	Adaptive Median
IMG_1	31.27	32.74	38.87
IMG_2	31.86	33.32	34.42
IMG_3	31.52	33.46	36.52
IMG_4	32.71	34.41	36.74
IMG_5	31.65	32.51	34.56

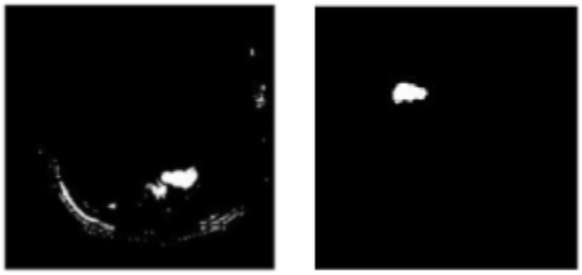
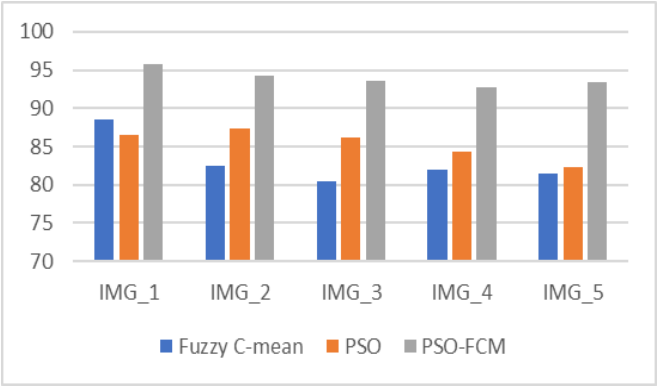


Figure 3: *Segmented Image*

Table 1.3: *Performance comparison of Accuracy value using various algorithms*

Sample Image	Fuzzy C-mean	PSO	PSO-FCM
IMG_1	88.513	86.596	95.792
IMG_2	82.418	87.304	94.278
IMG_3	80.521	86.248	93.512
IMG_4	82.04	84.346	92.827
IMG_5	81.411	82.385	93.471



In Table 1.1 and Table 1.2 shows a various filtering technique was compared and proved a better accuracy rate of the proposed filter method. Pre-processing techniques of a median filter, wiener Filter and adaptive median filter was compared both filtering methods and proved the adaptive bilateral filter is given better MSE (Mean Square Error) rate and Peak Signal Noise Ratio (PSNR). In Table 1.3 shows a various segmentation technique was compared and proved a better accuracy rate of the proposed. The various segmentation techniques were compared both filtering methods and proved the PSO-FCM method is given better accuracy rate 95.79%.

5 CONCLUSIONS

In this present study a various segmentation algorithm has been evaluated and find tumor cells. The pre-processing method adaptive median filter was compared and proved better result. Comparing four segmentation algorithms, the brain tumor extraction was improved in PSO-FCM is better accuracy rate 95.79% compared with other segmentation techniques. In future studies, the various segmentation techniques will be evaluated and improve the accuracy.

REFERENCES

[1]. 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

[2]. 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.

[3]. P. Kavitha, S. Prabakaran "Brain Tumor Image Segmentation Using Hybrid Assured Convergence Particle Swarm Optimization and Fuzzy C-Means" International Journal of Scientific & Technology Research ISSN: 2277-8616, Volume-9 Issue-2 February 2020.

[4]. P. Kavitha, S. Prabakaran "Brain Tumor Analysis in BASF Framework" International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-9S3 July 2019.

[5]. 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

[6]. 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.

[7]. 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.

[8]. 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.

[9]. 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.

[10]. 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