Brain MRI Image Segmentation Using Principle Lion Optimization Algorithm

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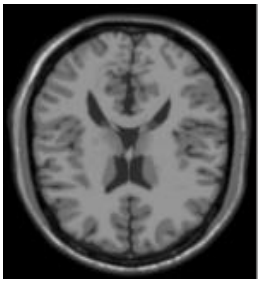
Abstract- In medical image processing, brain tumour segmentation is an essential approach. Hence, the early detection of the brain tumour helps to diagnose the patient at correct time. Generally, neurologist utilise manual picture segmentation method to detect the brain disease. This method is complex and time consuming process. The main goal of this research presents the investigation of the MRI picture based on brain segmentation method. Number of the research has been done, novel tumour segmentation methods have been observed. The main issue determined is complex procedure due to change of tumour space based on area, shape and position. This proposed research focused on interference method, feature extraction, morphological operatives, and edge detection technique of grayscale image. Principal lion image segmentation depends on brain tumour shape to optimise the picture complexity and improve the performance. In novel approach, an inspirational technique is developed for segmentation of the brain tumour image through hybridisation of PCA and ALO. It is also called as Principle lion optimisation technique. Experimental analysis improves the picture quality (PSNR), Fault rate (MSE), accuracy rate. In this research, enhance the performance parameter using PSNR, accuracy rate and decrease the fault rate and comparison analysis is done with existing technique (PNN).

Keywords- Brain Image Segmentation, PNN (Probabilities Neural Network), PSNR, PLO (Principle Lion Optimization) and MSE (Means Square Error Rate).

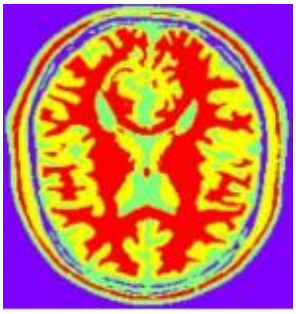
I. INTRODUCTION

Digital image processing is the method used in a variety of applications like as analytic picture analysis [1], object recognition and object matching, location of pictures, and so forth. Image processing method improves the quality of the film. Digital imaging is the method of the processing of the data in the digital formulation through an image processing technique. The digital image relies on three benefits, which are development among human and computer interface, automated data conversion, and multiple images of data subdivision[12].

Brain segmentation is the method of the image segmentation of the tissue in the brain such as activate cell, necrotic core different from normal brain tissues [13][14]. Image segmentation based on the statistic classifier of the image. Segmentation is based on the various characteristics (color or area) that present in the picture. It is necessary to retrieve the actual picture before demolishing an image [2]. The main goal of the segmentation is to decrease the resource for simple analysis of data. Image segmentation is the separation of an image into a various separate non-overlap area like as a pixel that relates to various area based on the feature of an image such as the value of a grayscale image, color, and texture of the pixel [3]. Brain image segmentation is an essential diagnostic tool for the treatment of brain disease[15].



(i)



(ii)

Fig.1: (i) Brain MRI image and (ii) Segmented MRI brain Image [16][17]

In existing research method implemented distortion reduction method, feature extraction of grayscale image, Discrete Wavelet Transformation Method based on brain tumor region developing image segmentation to mitigate the complexity and enhance the performance. PNN classification method was utilized to train database and test database the performance analysis such as accuracy in the detection cancer position in brain MRI images[18]In proposed research method, has implemented a novel method which is Principle Lion optimization to find the region and selected features with the help of convergence function. Evaluate the performance metrics with PSNR, MSE, and Accuracy Rate and compared with the existing metrics.

Section I describe the overview of the brain image segmentation, existing work with PNN method and proposed

work with PLO optimization method. II and III section elaborate the prior work and Research methodology of the proposed work. Section IV describes the result analysis and Comparison analysis. Section V elaborates the proposed conclusion and Future Scope.

II. RELATED WORK

Hazra A., Dey A., Gupta, S. K and Ansari, M. A. et al.,2017 [4]focused on detection and localization of brain tumor area utilizing magnetic resonance pictures. This research-based three phases, which are brain image pre-processing method, data edge recognition, and brain image segmentation. This research works on the conversion of real picture to black and white picture and extraction of interference. Detection of the edge was done through edge recognition through Sobel, Prewitt, and Canny algorithms with image enhancement techniques. In the next procedure, determine the degraded area of brain MRI picture through segmenting. In the final approach, brain pictures grouped utilizing k mean approach. **Jayasuriya, S. A., and Liew, A. W. C. et al.,2013 [5]** presented research on new fuzzy c mean approach through symmetrical data for reducing the effect of interference in segmented brain tissues in MRI imaging. They differentiate dual symmetrical brain by mean of predictable c mean cluster approach to examine the reliability against the intrusion. In this research, planned techniques linked through conventional fuzzy c mean clustering approach.**Kobashi, S, and Udupa, J. K. et al., 2013 [6]**proposed research on a connection using a fuzzy object method. This method used for training of database and provide fuzzy level related to the position and strength of the image. Fuzzy clustering computed duplication of the object represented by the fuzzy object method. This research leads to the division of white substance and after that, segmenting the nearest cortex. The proposed work was emphasized on the observation of brain images of children from age up to eight months. Experimental analyzed about parameters which are average false positive rate up o 1.34%, average false negative rate up to 2.9% and geometrical average up to 1.43%.

Lang, R., Zhao, L. and Jia, K. et al., 2016 [7] implemented a novel deep learningconvolutional neural network and linked multi-modal picture through segmenting of brain pictures. The convolutional neural network helps to enhance the rate of accuracy. CNN helps in the classification of the lower contrast and distorted brain images. Convolutional neural network catches a non-linear map among internal and external data through training approach. Also, multiple modal brain tumor pictures characteristics are extracted using the segmenting process in the convolutional network. In this research, segmentation of tumor brain images in numerous forms as Training1, Training2, Training3, and flaring pictures.**Lu, S., Lei, L., Huang, H and Xiao, L. et al.,2016 [8]** presented research on two-phase hybrid technique to differentiate normalized brain tissue through region depends on training 1mass and training two mass magnetic resonance pictures of a similar arrangement. In the principal organize, healthy cerebrum tissue was divided utilizing an iterative Otsu's thresholding strategy, which is separated from T1-weighted MR pictures, and sore locales were removed from T2-weighted MR pictures. In the second stage, the MRF–Guide approach was utilized to characterize territories dually distinguished as expected mind tissue in T1-weighted and regions in T2-weighted images. The methodology was approved using manufactured and genuine MR pictures to illustrate its capacity to recognize ordinary cerebrum tissue from sore areas unmistakably.**Lv, W., Peng, Y., Yang, C and Li, X et al., 2015[9]** explored mind tissue division systems and concentrate the attainability of making 3D mind models utilizing a general-purpose 3D printer, and the 3D mind model is made out of paired 2D picture sets. The first parts of this examination were the division of cerebrum and other head tissues, smoothing of the fragmented mind tissue, what's more, picture group transformation for 3D printing. At last, they receive 3D paired model as the aftereffect of the handling of dim dimension attractive reverberation (MR) pictures. Results demonstrated that the nature of the 3D cerebrum tissue remaking was the adequate and straight insertion of the 3D model improved the representation of the cerebrum surface morphology. They presume that picture division and reproduction of mind tissue dependent on the 3D T1-weighted X-ray is plausible for quick 3D prototyping and it might support neurosurgeons for the medical procedure arranging. **Menze, B. H., Jakab, A., Bauer, S and Kalpathy-Cramer, J et al., 2014[10**] reported the set-up and consequences of the Multimodal Cerebrum Tumor Picture Division Benchmark (Minxes) sorted out related to the MICCAI 2012 and 2013 gatherings. Twenty best in class tumor division calculations were connected to a lot of 65 multi-differentiate MR checks of low-and high-grade glioma patients – physically commented on by up to four raters – and to 65 similar sweeps created utilizing tumor picture recreation programming. Quantitative assessments uncovered significant contradiction between the human raters in portioning different tumor sub-locales (Shakers scores in the go 74-85%), representing the trouble of this assignment. They found that various calculations worked best for various sub-districts(achieving execution similar to human between rate inconstancy), be that as it may, that no single calculation positioned in the top for all sub regions at the same time. Intertwining a few decent calculations utilizing a various leveled higher part vote yielded divisions that reliably positioned over every individual calculation, demonstrating remaining open doors for further methodological enhancements.**Shen, H. and Zhang, J et al., 2017[11]**presented a novel technique for cerebrum tumor division in MR pictures given completely associated CRF (FC-CRF) model that sets up pairwise possibilities on all sets of pixels in the pictures. They utilize a progressive way to deal with separate unique structures of the tumor and further figure an FC-CRF model with information-driven earlier learning of tumor centre. The strategies were assessed on the testing and leader board set of Mind Tumor Picture Division Benchmark (Whelps) 2013 challenge. The exactness of portioned tumor limits was improved substantially and the outcomes are aggressive thought about to the beginning of expressions of the human experience.

III. RESEARCH METHODOLOGY

Surveyed the various papers regarding brain image segmentation and found a lot of issues on this topic. After the problem found, design research objectives with new methods to improve the performance of the brain images. Research methodology defines the flow of the research proposal in brain image segmentation.

In research proposal, study and analysis the various methods and approaches of image segmentation (MRI). Proposed method (PLO) has Implemented image pre-processing of the image with Graphical User Interface having input uploading image and edge detection.

Steps:

(i) Input Image
(ii) Histogram Plotting
(iii) Compress image and Histogram
(iv) Binraization (Edge Detection)
(v) Morphological Operators and Filtrations.
(vi) Feature Extraction and
(vii) Selection the unique properties
(viii) Segmented Image
(ix) Parameter Calculation
(x) Comparison

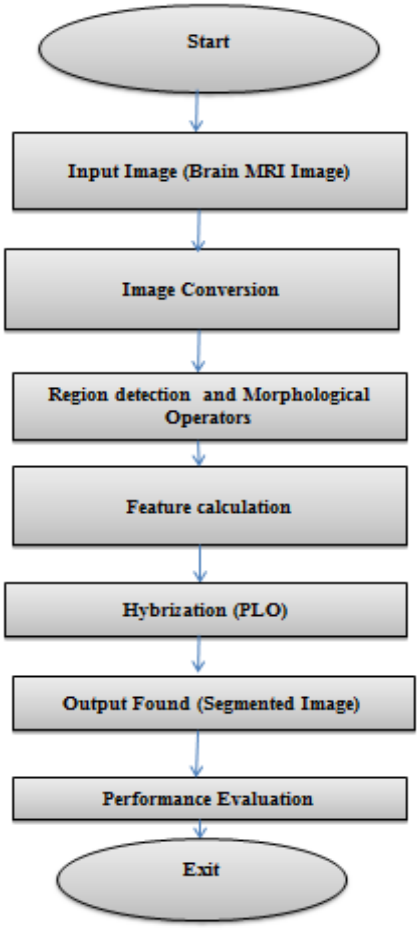
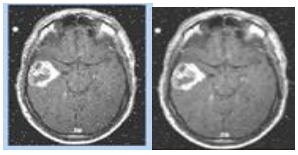


Fig.2: Research Flow chart in Brain MRI image

IV. EXPERIMENT ANALYSIS

In this section, Mathematical equation elaborates with formula and arithmetic equations. Research result and discussion with new optimization method based. Detect the brain image segmented image. After that, all performance metrics show in graph format and compared it.

(i) (ii)



(iii) (iv)

Fig.3. (i) Input Image (ii) Compressed Image (iii) Interference Image (iv) Smooth Image

Above figure 3 defines the upload input MRI image from the dataset folder. Compress the input image, artificial noise add in the uploaded image and check the external and internal noise show in output image. After that filtration method using 2D transformation method to remove the noise in the MRI brain Image.

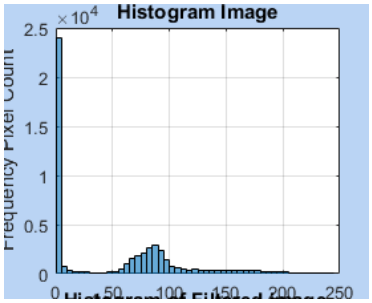


Fig.4: Histogram Image

Above figure 4 shows he image histogram calculate the frequency count in the image pixels and histogram and compress image as well as size 256 *256.

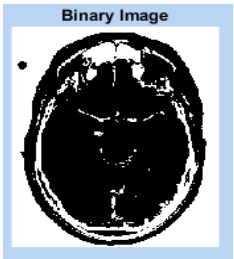


Fig.5: Binarize Image

Above figure define the brain image is basically DI that is twice possibility numbers for single-pixel of image. Normally, the 2-colors utilized for binary image are shown in Black and White Color. In this image shows the object only and background hide.

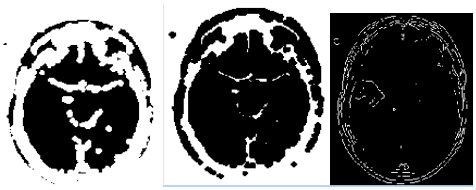


Fig.6: Morphological Image

It shows dilate image amount of output image pixel is the higher value 1 of all image pixels in the close. In the binary image, image pixel is a morphological dilated creates objects shift visible and fills in small circles or holes in image objects. in rode image amount of output image pixel is the lower value 0 of all image pixels in the close.

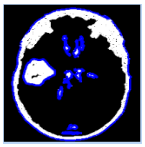


Fig.7: Segmented Output Image

It shows feature extraction method using the principal component analysis method to extract the features based on image pixel data. It derives the unique properties of the MRI images in the form of eigenvalues and vector. the feature extraction method using the principal component analysis method to extract the features based on image pixel data. It derives the unique properties of the MRI images in the form of eigenvalues and vector. segmented image is an outcome with swarm antlion optimization algorithm based. It is a procedure of division a DIs into various segments. The main motive of segmentation is easy or alter the representation of an image.

Table 1: Performance Analysis in Proposed Work

Parameters	Values
Peak Signal to Noise Ratio (db)	23.6
Means Square Error Rate	2.5234
Accuracy Rate (%)	97.8

Table 1 shows that the proposed parameter PSNR value is 23.66 in db, the MSE value is 2.5234, and Accuracy Rate value is 97.8 %.

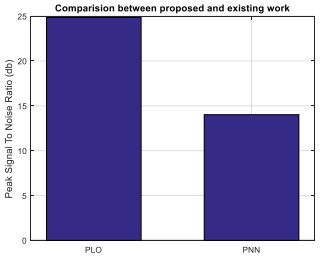


Fig.7: Comparison – PSNR (db)

The comparison fig 7 shows the principle lion optimization method and PNN classifier in PSNR. Peak Signal to Noise ratio is defined as the segmented image quality. In proposed work improve the performance parameters as compared with the existing classifier.

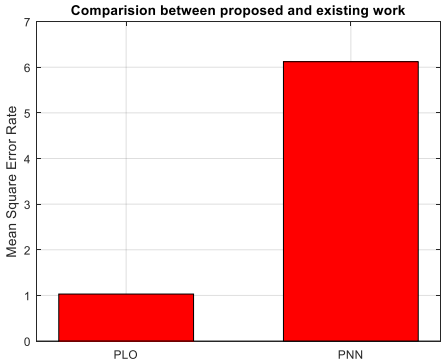


Fig.8: Comparison – MSE

The comparison figure 8 shows the swarm lion optimization method and PNN classifier in MSE parameter. Mean Square Error Rate is defined as the total sum of error rate in the segmented image. In proposed work MSE value is reduce the performance parameters as compared with the existing classifier.

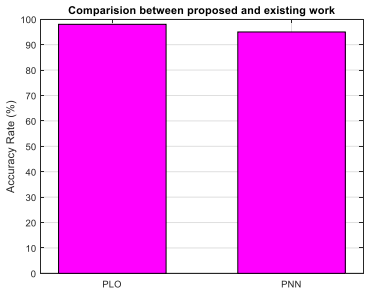


Fig.9: Comparison – Accuracy Rate

The comparison figure shows the principle lion optimization method and PNN classifier in ACCURACY rate parameter. Accuracy Rate is defined as the exact classifier value in the segmented image. In proposed work, Accuracy value enhanced the performance parameters as compared with the existing classifier.

Table 2: Comparison of Performance Metric

Metrics	PLO	PNN
PSNR (db)	23.6	14.011
MSE	2.5234	6.12
ACC (%)	97.8	65

Table 2 shows the comparison between swarm antlion optimization method with PNN classifier. It proposed method has implemented in brain image segmentation improve the PSNR rate, Accuracy Rate, and reduce the value is error rate.

V. CONCLUSION AND FUTURE WORK

The analysis of the image is a main area of research in medical image segmentation. Generally, anatomy structure of the brain is analysed through segmentation of brain image in picture examination. The method of the division of the digital picture in to multiple areas or group of the pixels is known as picture segmentation. It is determined from existing work that modification in region of tumour in brain depends on location, pattern and size which may cause an issue in detection of the segmented area of MRI images brain tumour. The different performance parameters are Image Quality (PSNR), Error Rate (MSE) and Accuracy Rate (ACC). It was determined from the experimental analysis that detection of brain tumour is done by extracting the features of the image. The proposed approach helps in brain picture segmentation from MRI pictures. In addition PCA(Principle Component Analysis) and ALO (Ant Lion Optimization) method is hybridised to enhance the PSNR rate. The parameters used for improving the performance are peak to signal noise ratio (PSNR), Error Rate (MSE) and Exact value (Accuracy Rate). Experimental outcomes gives image quality factor (PSNR) as 23.6 db, Error Rate (MSE) value with 2.5, and Exact value (Accuracy Rate) value with 97.8%. The final outcome enhances the performance parameters using accuracy rate and PSNR rate and reduces the fault rate and then compared with the existing methods (PNN).

The extraction and classification will be utilised to segment the region of brain tumour. It will be based on power, compression and constancy to detect the shape and position of the brain tumour region. Though, brain tumour are malignant, various new approaches are required to be developed depends on deep learning to detect and segment brain tumour region picture.

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