



Brain Image Segmentation using Particle Swarm Optimization method.

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Abstract: Brain tumor image segmentation is a play a essential position within the scientific subject or clinical processing. Affected person remedy with brain tumors is the great degree decide on early-degree detection of those tumors. Early degree detection of brain Tumors will beautify the affected person lives. The ailment of brain tumors with the aid of a neurologist frequently uses a manual picture segmentation that may be a tough and time-consuming technique, because of essential automatic picture segmentation. Nowadays, automated photograph segmentation is very popular and may remedy the problem of tumor mind picture segmentation with higher overall performance. The principle cause of this research work is to offer a survey of MRI picture based mind tumor segmentation strategies. There are numerous current study papers, focusing on new strategies for cheap Magnetic image-primarily based mind tumor picture segmentation. The principle trouble is considered a complicated process, because of the range of tumor area of the complexity of figuring out the tumor function, size, shape and texture. In this research paintings, in particular worked on interference approach, characteristic extraction, morphological operators, aspect detection methods of gray level and Swarm Ant Lion Optimization based on brain tumor shape growing segmentation to optimize the image complexity and beautify the overall performance. In new algorithm applied an inspiring nature method for segmentation of mind tumor photo the usage of hybridization of PSOA and ALO is also known as a Swarm Ant Lion method. Examine the overall performance metrics with picture first-rate thing (PSNR), error price (MSE), and actual price (Accuracy fee). In studies paintings, enhance the overall performance metrics with PSNR and Accuracy charge and decrease the mistake fees and as compared with the existing approach (PNN).

Index Terms - Brain Image Segmentation, Probabilistic Neural Network, Ant Lion and Particle Swarm Optimization method.

I. INTRODUCTION

The mind is the imperative portion of the apprehensive gadget that has manage of the whole body gadget.. Brain is the maximum complicated organ of the frame [1]. The brain tumor is the development of a mass of anomalous cells of the brain. Numerous type of mind tumors is observed among people. A brain tumor may be cancerous or non-cancerous tumor [2]. The tumor disorder starts as the principle tumor and might unfold to different elements of the brain. Generally, the maximum number of humans stricken by a cancerous brain tumor [3] [4]. It's been researched by using America cancer business enterprise that estimation amount of the 24000 sparkling instances has been gradually increasing with maximum dying rate up 17000 instances [5]. It's been investigated by using global health enterprise that mind tumor primarily based on several levels which might be –stage 1 is the stage where there's slow boom price known as pilocytic astrocytoma , in level 2, there's production of the tissues which might be laid low with different tissues and referred to as low-grade astrocytoma , level 3 tumor is cancerous tumor where there may be duplicate of cells and the cells are affected by the tissues which referred to as anaplastic astrocytoma stage four is cancerous tumor and at final stage in which the duplicate of cell tissue takes vicinity at quicker rate and additionally influences the closest brain tissue is known as glioblastoma tumor [6] [7] . Segmentation of mind tumor is a technique for division of a photo right into a one-of-a-kind place like because the pixel within the region have the same capabilities [8] [9]. At some stage in magnetic resonance brain imaging, departure of various tumor tissue from normal tissue is marked as a segmentation technique [10]. Almost, the segmentation process of brain tumor is ready thru the guide method [11] [12]. This technique might also provide incorrect experimental effects with a most processing time period. As a result, wide studies has been achieved with the aid of extraordinary scientists and researchers primarily based on diagnosed strategies of mind tumor [13]. Although, segmenting of brain tumor is a difficult problem, so, there is a need to do investigation on diverse segmentation techniques of brain tumor. Scientific imaging plays an important role inside the diagnosis of the patients having mind tumor [14] [15] . Diverse new methods advanced for the analysis of the brain tumor sickness which can be defined as ultrasonography, magnetic resonance imaging, automatic tomography [16] the interference via segmenting technique.

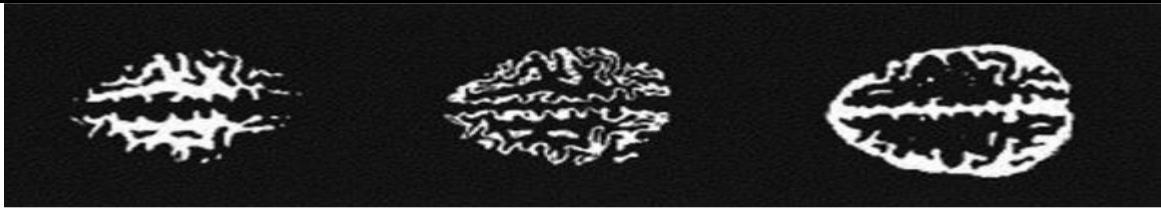


Fig 1 Tissue In Human Brain (A)White Matter (B)Gray Matter (C) Cerebrospinal Fluid

The viable neural network method (PNN) applied for the education and trying out motive to understand the position of brain tumor magnetic resonance snap shots. Overall performance metrics collect most accuracy rate for identity of irregular tissue from the brain magnetic resonance snap shots. Inside the proposed technique, proposed paintings applied a unique technique which is Particle Swarm and Ant Lion optimization to discover the area and decided on capabilities with the help of fitness characteristic. Evaluate the performance metrics with PSNR, MSE, and Accuracy fee. As compared with the existing overall performance parameters.

II. RESEARCH METHODOLOGY

In this section, elaborate the image segmentation problem statement in brain images (MRI). Surveyed the various paper 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 this research work, implement a PSO and ALO optimization to segment the brain images. The main problems are whether it is possible and, if yes, how to choose an acceptable threshold or several inceptions to separate one or more desired objects from their background. In many applied cases the simple thresholding is unable to segment objects of interest. The problem of this research work is to enhance the accuracy and acceptance rate as well as to reduce the rejection rate of the detection using hybridization of nature-inspired techniques named as Particle Swarm Optimization and Ant Lion Optimization Algorithm. Lastly, we calculate the Performance Parameters like Mean Square Error, Peak signal to noise ratio, and Accuracy rate. First of all, upload the MRI image from the dataset folder. Resize the brain images to reduce the image size or dimensionality of the image. Find the distortion in the uploaded image (MRI). Filtration method implemented to remove the noisy data in the uploaded image.

Morphological operations used are:

- (i) Dilate and
- (ii) Inerode

These operators are used to process image based on the shape and area. The edge detection methods are used:

- (i) Sobel and
- (ii) Canny

In Sobel edge detector or operation detects the edges on by one. Canny edge detector extracts the regions based on multiple sides, one at a time. Feature extraction phase, extract the unique properties in the form of eigenvalues and vectors. After that, proposed work implemented a novel method which is Particle Swarm and Ant Lion optimization to find the region and selected features with the help of the fitness function. Evaluate the performance metrics with PSNR, MSE, and Accuracy Rate. Compared with the existing performance parameters.

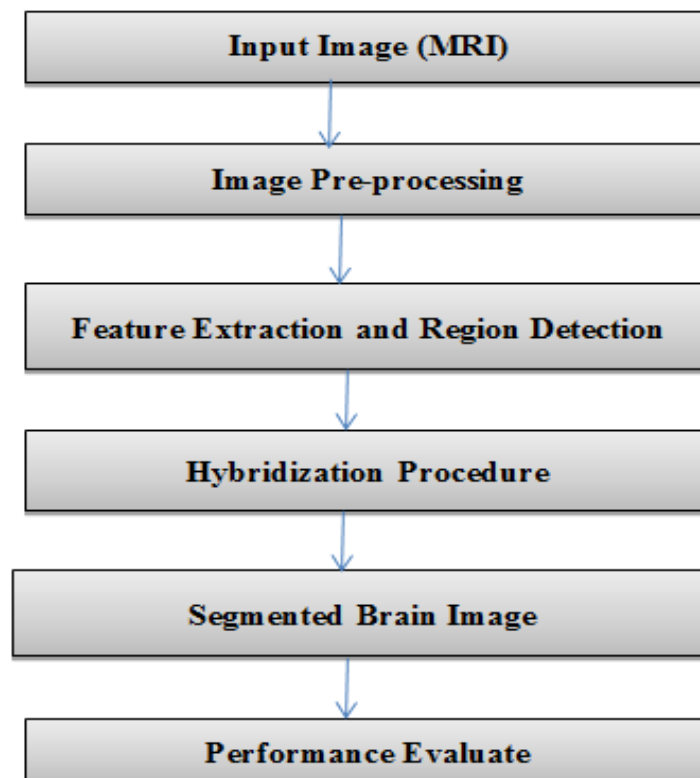


Figure 2. Proposed Flow Chart

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III. RESULT DISCUSSIONS

In this section, describe the dataset in brain MRI images. Mathematical equation elaborates with formula and arithmetic equations. Research result and discussion with a new optimization method based. Detect the brain image segmented image. After that, all performance metrics show in graph format. Comparative analysis with various methods and parameters.

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Figure 3. Input Image



Figure 4. Pre-processed Image

The above Fig 3 show that the uploading image from the database folder. Uploading image calculates the histogram of the image concerning frequency count and input data. After that, histogram creation resizes the brain images as well as 256 to 256 size. Then check the noisy data in the resize image. In case noise present in the image then filtration method implements to resolve these issues in the brain images. Filter image calculated then evaluate the histogram of the smooth image. That is pre-processed image as shown in above figure. Above figure 4 shows after the filtration process, it converts the Binarize image. In the binary image is a digital image that is two possible values for individual pixel. Usually, the two-colors used for a binary image are black and white. All colors used for the object in the brain image is the foreground color, while the left of the MRI image is background color. It is also called Bi-level and 2-level. It means that individual image pixel is stored as a single bit that is 1 and 0 the name is black and white.

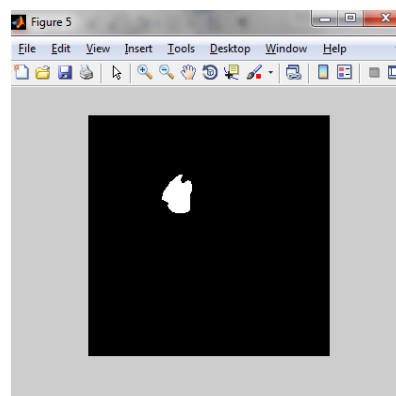


Figure 5. morphological operation

The above figure 5 defines that the dilate image calculated with the morphological operators. 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. 5 (ii) shows that the in erode image amount of output image pixel is the lower value 0 of all image pixels in the close. In the binary image, image pixel is morphological in erode creates and small image objects, so that essential purposes continue.

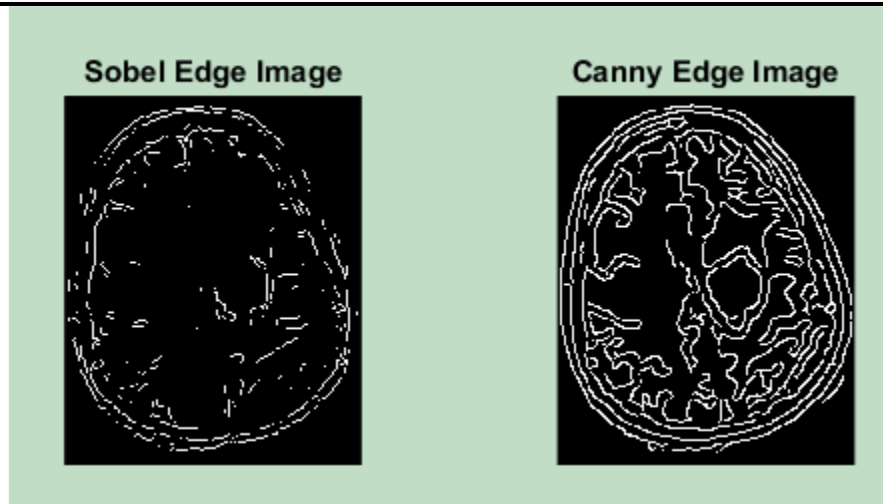


Figure 6. Edge Detection, Image (i) Sobel and (ii) Canny

Above figure 6 shows that the edge detection output images (i) Sobel and (ii) Canny Image. Sobel edge image refers to calculating the gradient magnitude (GM) of a brain MRI image using the 3*3 filter. Where GM is for individual image pixel, several giving the absolute value of the rate of modifying the intensity of light in the direction that improves. Canny edge image is going a bit further by deleting noise with a low-pass filter first, then implemented sobel methods, and then doing non-maximum suppression to pick out the best brain image pixel for edges when there are various outcomes in the local neighbourhood. 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. All features are saving in workspace and feature set created based on the brain image properties.

The optimization process and convergence curve with PSO and ALO optimization algorithm used. In swarm optimization algorithm is a metaheuristic method, as it creates few or no assumptions about the issue being filtered and can find a considerable amount of spaced of CSs (Candidate Solutions). It selects the features with the fit value from the extracted properties. After that, implemented that Ant Lion Optimization method. It is a new meta-heuristic that numeric structures the interaction of features and selected features in nature. It has been applied to solve the issues considering the random calculation of features, constructing traps, entrapment of features, finding preys, and re-constructing traps are developed.

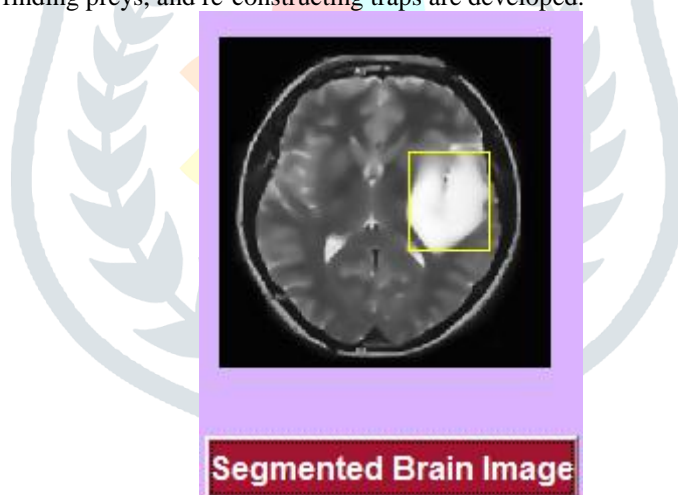


Figure 7. Segmented Image

Above figure 7 shows that the 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. It is a usually to locate objects and curves, etc. in MRI images. Its more precise brain image segmentation is the procedure of evaluating the image label to all image pixels. Image pixels has a similar name shared specific properties.

The comparison shows that the swarm 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. The comparison shows that 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. The comparison shows that the swarm 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 1: Performance Analysis In Proposed Work

Parameters	Values
Peak Signal to Noise Ratio	59.358
Means Square Error Rate	14.876
Accuracy Rate	99
PNN	176.663

Table 1 shows that the proposed parameter PSNR value is 59.358, the MSE value is 14.876, and Accuracy Rate value is 99 and the comparison between swarm ant lion 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.

IV. CONCLUSION AND FUTURE SCOPE

In this conclusion, brain image plays an essential role in the recognition of segmented brain tumor area. Brain recognition and segmentation help in presenting data related to functional arrangement and possible abnormal tissue in the brain, which is compulsory for diagnosis of brain disease. The primary objective of the segmentation of brain tumor is to locate the digital pixel in the estimated module that may be standard or non-standard tissues. Several performance metrics also describes that the research method gives better result by enhancing particular parameters like Image Quality (PSNR), Error Rate (MSE) and Accuracy Rate (ACC). Experimental analysis shows that the research work can aid in the accurate and timely detection of brain tumor along with the verification of its feature extract position. The proposed method is essential for brain image segmentation from MRI image. Hybridization of Particle swarm optimization (PSOA) algorithm and Ant lion optimization (ALO) or Swarm Ant Lion method implemented to improve the PSNR value. Experimental analysis emphasis on performance metrics which are peak to signal noise ratio (PSNR), Error Rate (MSE) and Exact value (Accuracy Rate). The evaluated results from parameters are image quality factor (PSNR) value with 59.358, Error Rate (MSE) value with 14.86, and exact value (Accuracy Rate) value with 99 %. The final result improves the performance metrics with PSNR and Accuracy Rate and reduce the error rates and compared with the existing method (PNN). In research work conclusion is suitable for verifying clinical decision support systems for primary screening and disease finding by the radiologist's experts. In future, extraction of features will be based on the energy, compactness and regularity to determine the shape and location of brain tumor area. Although, most of the brain tumors are cancerous, some novel algorithms must be developed based on deep learning to detect and segment brain tumor area image.

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