THINK INDIA JOURNAL

ISSN:0971-1260
Vol-22-Issue-14-December-2019

An Optimize Learning Approach For Brain Tumor Classification In Medical Applications

[1]Pallak, [2]Brahamleen Kaur Sidhu

[1] M.Tech Student, Dept. of Computer Engineering, Punjabi University, Patiala
[2] Assistant Professor, Dept. of Computer Engineering, Punjabi University, Patiala

Abstract: Brain tumour is one of the main concerns in the medical applications. It can be noticed that the most of the cancers are related to the brains and are very serious concerns in the medical applications. So a lot of work is done using segmentations of the cancerous regions but very less work is done for the classification of the cancers that the patient is having cancer or not. So this paper put light on the automatic classification of the brain tumour in the medical applications which is taken place in the MATLAB environment. The proposed approach is able to achieve satisfactory results in terms of high accuracy rate, high peak signal to noise ratio and low error rates which is the desired output for the high efficiency of the system.

Keywords: Classification, Segmentation, Brain Tumour, Medical applications

I. INTRODUCTION

Medical images segmentation has the significant benefit that operational and intensity appearances are well recognized up to a natural organic variability or the existence of pathology. Brain tumour segmentation is having objective to separate the dissimilar tumour tissues like active cells, necrotic core from normal brain tissues. Image segmentation rely on statistical classification with a symmetrical processes deals with increase strength and reproducibility. Division may likewise rely upon different highlights that are contained in the picture. It may be either color or surface. Before de-noising an image, it is segmented to recover the original image. The main motto of segmentation is to reduce the material for easy analysis. Segmentation is beneficial in Analysis of the image and Compression scenarios. Image Segmentation is the process of unscrambling an image into multiple disjoint, non-overlapping regions such that pixels that belongs to the same region will be same based on some image property like grey scale value, color, texture etc. of the pixels. Segmentation is considered to be a medium level activity in an image processing system. When an image is segmented mainly five conditions should be satisfied.

1. First, the segmentation process must be complete that means each pixel belongs to at least any one of the region.
2. Second, the pixels in a region must be connected i.e. each region is a connected set of pixels.
3. Third, two regions cannot intersect with each other. This condition may be violated in case of fuzzy segmentation.
4. Fourth, each region of the segmented image must gratify a predicate based on the grey scale value, texture etc.

ISSN:0971-1260
Vol-22-Issue-14-December-2019

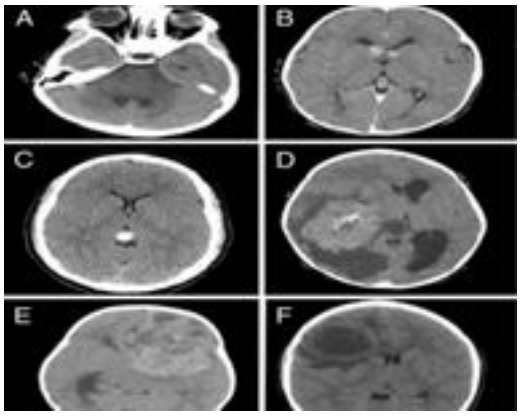


Fig 1: Tumour stages

II. Optimize Algorithms

1. Cuckoo Search

In intelligent research, cuckoo search deals with the optimization algorithm which is inspired by the brood parasitism of various cuckoo species using lying of their spawns in the shells of other species or birds. Some birds can involve direct struggle with the interfering cuckoos. For instance, if a crowd bird determines the spawns are not their individually, it will throw these eggs far away or simply unrestraint its house and build a new house away. Some species have changed in such a method that female cuckoos are often actual specialized in the imitation in standards and decoration of the spawns of a few selected host species. Cuckoo search flawless like breeding behaviour which can be functional for numerous optimization difficulties

CS is based on three idealized rules:

1. Each cuckoo lays one egg at a time, and dumps its egg in a randomly chosen nest
2. The best layers with high class of eggs will convey over to the next group.
3. The number of available host's nests is fixed, and the egg laid by a cuckoo is discovered by the host bird with a probability (0, 1). Discovering operates on some set of worst nests, and discovered solutions dumped from farther calculations.

2. Linear Discriminant Analysis

Linear discriminant analysis is a generalization linear discriminant, a method castoff in statistics, recognition of the patterns and machine learning to find a combination in the linear form of features that symbolizes or divides two or more courses of objects or actions. The resulting mixture may be castoff as a linear classifier or, additional commonly, for dimensionality decline before later classification.

LDA is thoroughly related to analysis of variance and reversion analysis, which also effort to express one reliant variable as a lined combination of extra features or dimensions. However, ANOVA uses categorical independent variables and a continuous dependent variable, whereas discriminant analysis has continuous independent variables and a categorical dependent variable (i.e. the class label). Logistic regression and probity regression are more similar to LDA than ANOVA is, as they also explain a categorical variable by the values of continuous independent variables. These other methods are preferable in applications where it is not reasonable to assume that the independent variables are normally distributed, which is a fundamental assumption of the LDA method.

LDA is also thoroughlyassociated to principal component analysis (PCA) and feature analysis in that they together look for linear groupings of variables which is the best explanation of the data. LDA explicitly challenges to model the difference among the classes of statistics. PCA does not take into version any alteration in class, and factor breakdown builds the feature groupings based on variances rather than similarities. Discriminant analysis isdiverse from factor study in such a way that it is not an interdependence system: a division between independent and dependent variables which is called as criterion variables andshould be made. LDA mechanism when the capacities made on independent system for each opinion are continuous measures. When dealing with

ISSN:0971-1260
Vol-22-Issue-14-December-2019

categorical autonomous variables, the equivalent practice is discriminant analysis.

III Related Works

DivyaKaushikUtkarsha Singh ParidhiSinghal et.al. [1] Proposed methods which use image segmentation to distinguish brain tumour. Tumour cataloguing and segmentation from brain calculated tomography image data is a significant. Discovery of brain tumour is very mutual fatality in present scenario of health care civilization. Segmentation of image is readily used to extract the irregular tumour percentage in brain. Brain tumour is an irregular form of tissue in which cells produce and multiply irrepressibly, apparently unfettered by apparatuses that control cells. Several methods have been established for detection of tumour in human's brain. They have used efficient genetic operators used to provide best possible solutions. TinaleKamble, PrachiRane et.al. [4] Proposed an efficient approach using swarm intelligence approach and shows the intelligent attributes of swarm for tumour segmentation. They have worked on the abnormal growth of tissues which are responsible in bringing such abnormal conditions to detect brain tumours. E. Ben George, M.Karnanet. et.al. [3] proposed exclusive image segmentation procedure that makes use Markov Random Field hybrid with optimization technique Bacteria Foraging Optimization Algorithm for segmentation of brain tumour and have compared the performance with MRF-Genetic approach. They have found that MRF-BFOA has better presentation than that of normal MRF-GA. The most important task is to reduce the effect of abnormal growth of tissues in image processing and medical applications. Mr Snehalkumar A. Patel, Mr Utkarsh V. Shah et.al. [4] Proposed a clustering approach using fuzzy K means procedure in hybridization with ant bee colony optimization approach and proves that their approach is providing well solutions than traditional ones. They have used artificial bee and Fuzzy C-means Clustering approach for brain segmentation. They were having advantage of efficient clustering which helps to partition collection of pixels and reduction of noise. M. C. Jobin Christ, S. Sivagowri, P. Ganesh Babuet.al. [5] Proposed a nature inspired optimize solution for detecting brain tumor. They provide study of different met heuristic systems such as Ant Colony Optimization (ACO), Genetic Algorithm (GA), Bacteria Foraging Optimization Algorithm (BFOA) for brain segmentation based tumour detection. They found advantage of combination of optimize algorithms which produces identification of tissues in easy manner. In medical applications MRI is used to distinguish compulsive tissues from standard tissues, particularly for brain tumours. These days, lots of medical images have shaped routinely in medicinal care centres. Sivaramakrishnan and Dr.M. Karnan et.al. [6] Proposed an intelligent arrangement is designed to identify tumor through mammograms with image processing methods along optimization and classification. They have used Firefly algorithm, Bee Colony optimization for segmentation but the high frequency components and high population increases array complexity. Deepak A. Patil, Prof. S.N.Patil et.al. [11] defined the cell structure in an efficient manner and use modified ant colony optimization approach using that cell structure for segmentation for tumor detection. They have make distribution of pheromone in efficient manner to find the optimize pixel positions. They have used Ant Colony Optimization for the optimization of segmentation approach.

IV. Proposed work

This section deals with the proposed approach in which the automatic classification is achieved for high accuracy rates and low error rate probabilities.

ISSN:0971-1260
Vol-22-Issue-14-December-2019

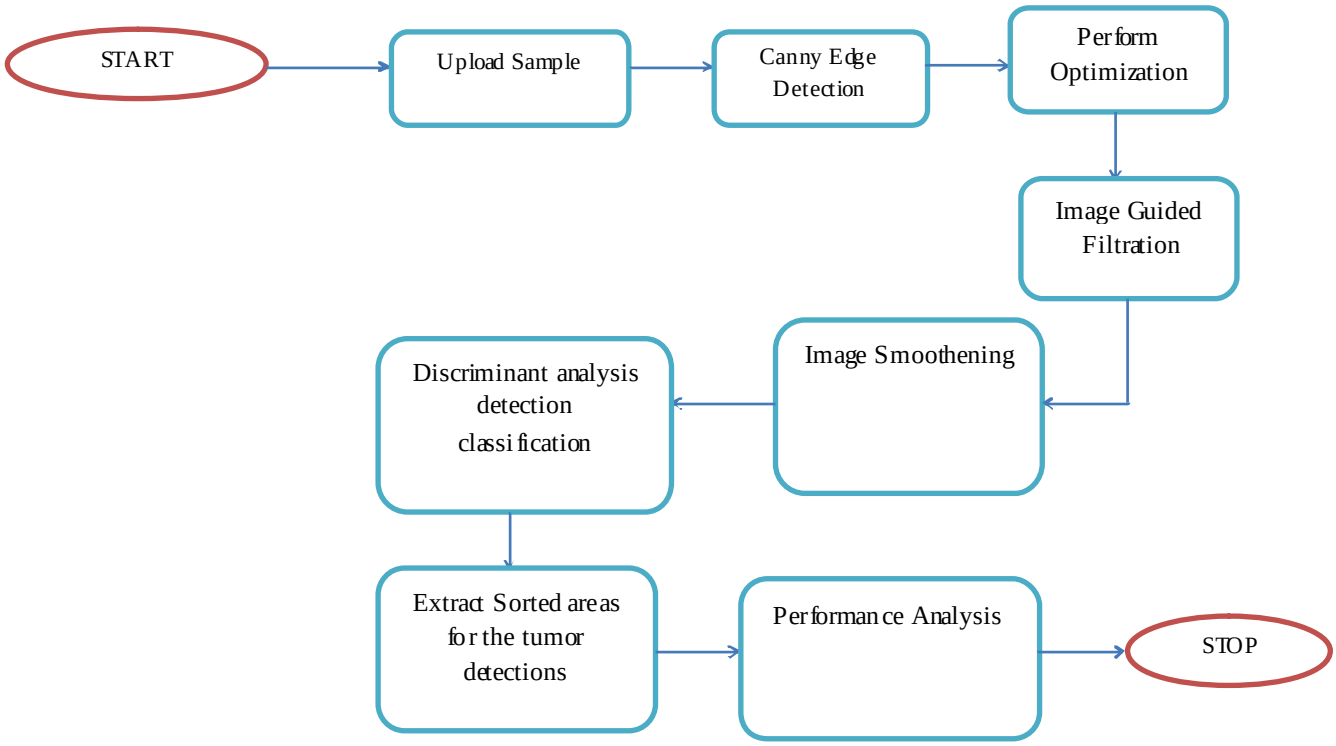


Fig 2: Proposed Diagram

In the proposed approach firstly the GUI is built for the human man made interactions and then the image is uploaded using training process which is one of the crucial parts of the implementations. Once it is done then the pre-processing will be done and filtration will be performed which lead to the smoothing of the system, The training is performed and then classification is done using linear discriminant analysis through which the performance will be evaluated using mean square error rate and accuracy and peak signal to noise ratio.

Peak Signal to Noise Ratio: It computes the peak signal-to-noise ratio, in decibels, between two images. This is often castoff as a quality capacityamong the original and a compressed image. Higher the PSNR, better the quality of the compressed or reconstructed image

ISSN:0971-1260
Vol-22-Issue-14-December-2019

The Mean Square error (MSE) and the Peak Signal toiNoise Ratio (PSNR) the two error metrics used to compare image compression quality. The MSE deals with the cumulative squared error between the compressed and the original image, PSNR represents a measure of the peak error. The lower the value of MSE, lower the error rate.

To compute PSNR, the block first calculates the mean-squared error using the following equation:

$$MSE = \frac{\sum_{M,N} [I_1(m,n) - I_2(m,n)]^2}{M * N}$$

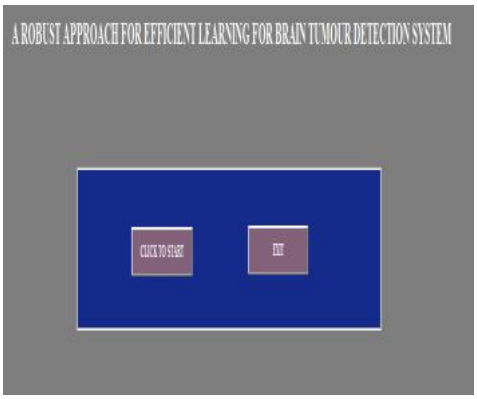
In the previous equation, M and N is the number of rows and columns in the input images, respectively. Then the block computes PSNR using following equation:

$$PSNR = 10 \log_{10}\left(\frac{R^2}{MSE}\right)$$

Accuracy: It is the difference between the true value and the mean of the underlying process that generated the data

V. Result and Discussion

The proposed system is simulated in MATLAB environment where we have used morphological and optimization process for segmentation of brain tumour.



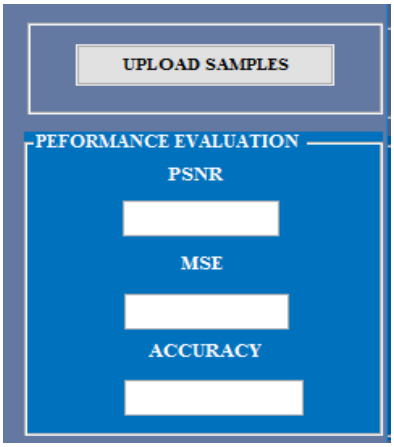


Fig 3: Main panel

Fig 3 shows the main panel which consists of the user interface controls consists of pushbuttons, panel, and static and edits texts. This is made for human machine interactions.

Fig 4: Training sample

ISSN:0971-1260
Vol-22-Issue-14-December-2019

Fig 4 shows the uploaded sample after clicking on the upload button. This is the image sample which is taken from BRAT dataset and uploaded using graphical user interface in the main panel. We will segment this image and then detect the regions of interest after performing segmentation.

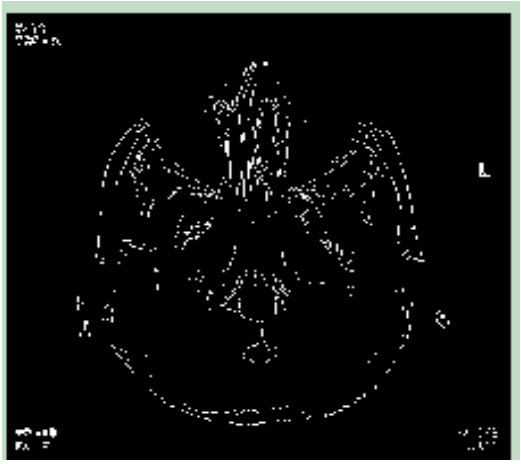


Fig 5: Edge sample

Fig 5 shows the edges of the uploaded sample. Before performing edge detection we have to perform gray scaling on the image and then detection of the edges takes place from the sample. We have used sobel edge detection method for detecting edges.

Fig 6: Dilated Gradient Masking

The fig 6 shows the gradient masking with dilation of the image. Dilation is one of the operations of morphology which is applied to especially on binary images. It will obtain the same output size image by applying structural component. Suppose A is the group of Euclidean coordinate's equivalent to the response binary image sample, and S stands for the group of coordinates for the constructing component.

Let S_x signifies the conversion of S so that its source is at A. Then the enlargement of A by S is basically the group of all points i in such a way that the intersection of Ai with X is non-empty.

The fig 7 shows the segmented tumour sample using hybridization of particle swarm with firefly algorithm which is used to perform optimization and localization in obtaining the segmented tumour region of interests.

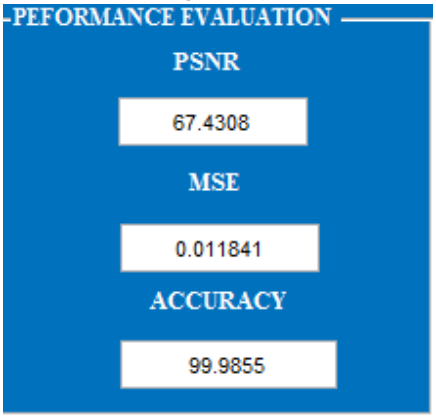


Fig 8: Performance results

Fig 8 shows the peak signal to noise ratio and mean square error rate which shows that our proposed approach is able to perform segmentation in an efficient manner. For the less complexity of the signal the mean square error rate should be less and peak signal to noise ratio

ISSN:0971-1260
Vol-22-Issue-14-December-2019

must be high. The peak signal means the signal is inversely proportional to noise. As the noise or distortion is less the signal strength will be high.

Fig 7: Segmented tumour regions

Table 1: Result analysis

SAMPLES	MSE (dB)	PSNR (dB)
1	0.01184	67.4308
2	0.01162	67.1811
3	0.01021	66.8535
4	0.01617	67.2661
5	0.01386	66.1196
6	0.01741	67.1687
7	0.01956	67.1966
8	0.01631	66.1988
9	0.01172	66.1429
10	0.01136	67.8915

Table 1 shows the different test samples performance in terms of mean square error rate and high peak signal to noise ratio and shows that our system is well suited for segmentation of brain tumour using hybridization of the nature inspired in an efficient manner

VI. Conclusion

In this research work, the work is done on brain tumour segmentation using optimized algorithms named as cuckoo search and efficient classification approach using LDA and the performance is measured in terms of mean square error rate and peak signal to noise ratio. The system is designed in various steps. The very first step is image normalization or pre-processing. The next step is the morphological operations and the last step will deal with the optimization using nature inspires swarm intelligence approach. Such traditional methods are employed to achieve less error rate probabilities but our proposed approach is able to evaluate better mean square error rate and high signal to noise ratio in segmentation of brain tumour.

REFERENCES

[1]Kaushik, Divya, Utkarsha Singh, ParidhiSinghal, and Vijai Singh. "Brain tumor segmentation using genetic algorithm."In IJCA Proceedings on International Conference on Advances in Computer Engineering and Applications, no. 5, pp. 13-15.Foundation of Computer Science (FCS), 2014.

ISSN:0971-1260
Vol-22-Issue-14-December-2019

[2] Kamble, Tinale, and PrachiRane. "Brain tumor segmentation using swarm intelligence approach."International Journal of Scientific&Engineering Research 4, no. 5 (2013).

[3] George, E. Ben, and M. Karnan. "MR brain image segmentation using bacteria foraging optimization algorithm." International Journal of Engineering and Technology 4 (2012).

[4] PIET, Vadodara. "Tumor Location and size Identification in Brain Tissues Using Fuzzy C-Clustering and Artificial Bee Colony Algorithm." (2014).

[5] Christ, MC Jobin, S. Sivagowri, and P. Ganesh Babu. "Segmentation of Brain Tumors using Meta Heuristic Algorithms." OPEN JOURNAL OF COMMUNICATIONS AND SOFTWARE 1, no. 1 (2014).

[6] Sivaramakrishnan, A., and M. Karnan. "Medical image segmentation using firefly algorithm and enhanced bee colony optimization."In International conference on information and image processing (ICIIP-2014), pp. 316-321. 2014.

[7] Bodhe, Trupti S., and PrachiMukherji. "Selection of color space for image segmentation in pest detection." Advances in Technology and Engineering (ICATE), 2013 International Conference on. IEEE, 2013.

[8] Sanchez Hernandez, Javier, Estibaliz Martinez Izquierdo, and AguedaArquero Hidalgo."Improving Parameters Selection of a Seeded Region Growing Method for Multiband Image Segmentation." Latin America Transactions, IEEE (Revista IEEE America Latina) 13.3 (2015): 843-849.

[9] Rajitha, B., AnjanaTiwari, and SuneetaAgarwal. "Image segmentation and defect detection techniques using homogeneity."Futuristic Trends on Computational Analysis and Knowledge Management (ABLAZE), 2015 International Conference on.IEEE, 2015.

[10] Shanmugasundaram, P., and N. Santhiyakumari. "Interactive Segmentation of Capsule Endoscopy Images Using Grow Cut Method." Computational Intelligence and Communication Networks (CICN), 2014 International Conference on. IEEE, 2014.

[11] Gopal, N. Nandha, and M. Karnan. "Diagnose brain tumor through MRI using image processing clustering algorithms such as Fuzzy C Means along with intelligent optimization techniques." In Computational Intelligence and Computing Research (ICCIC), 2010 IEEE International Conference on, pp. 1-4. IEEE, 2010

[12]Shokouhifar, Mohammad, and GholamhasanSajedyAbkenar. "An artificial bee colony optimization for mri fuzzy segmentation of brain tissue."In 2011 International Conference on Management and Artificial Intelligence IPEDR, vol. 6. 2011.

[13] Lakra, Anubha, and R. B. Dubey. "A Comparative Analysis of MRI Brain Tumor Segmentation Technique."International Journal of Computer Applications 125, no. 6 (2015).

[14] Alsmadi, Mutasem Khalil Alsmadi, and Mutasem Khalil. "A hybrid firefly algorithm with fuzzy-C mean algorithm for MRI brain segmentation." Malaysian Journal of Library & Information Science (2014)

[15] Reddy, Kishore K., BerkanSolmaz, Pingkun Yan, Nicholas G. Avgeropoulos, David J. Rippe, and Mubarak Shah. "Confidence guided enhancing brain tumor segmentation in multi-parametric MRI",In 2012 9th IEEE International

ISSN:0971-1260
Vol-22-Issue-14-December-2019

Symposium on Biomedical Imaging (ISBI), pp. 366-369. IEEE, 2012