

2D Image segmentation by Hybridization of PSO and BBO

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Abstract— Image segmentation is an important research issue in image processing. In this paper, hybridizing of the PSO and BBO algorithm for 2-D image segmentation is implemented. The common features from PSO and BBO algorithm are used and then hybridized for the segmentation. The results are evaluated on the basis of parameters; PSNR and SSIM. The results depicts that the proposed hybrid algorithm performed well and produce better segmented 2D images .

Keywords— Segmentation, PSO, BBO, 2D, Hybrid, PSO-BBO, Fitness function, habitat, crossover.

INTRODUCTION

It is widely used in analyzing the exactness and dimensions of an image. The slices of 2D images have like shapes which gives clue for segmentation of 2D image [1]. Image segmentation is used to recognize the each segment of the image more clearly. In this paper we are representing the 2D image segmentation by combined approach of PSO and BBO [2]. Also comparing the results of 2D segmentation from PSO, BBO and Hybrid algorithm.

PSO and BBO algorithms come under the category of swarm optimization. The concept of swarm optimization has arrived from the activities of social insects and birds. Social birds are characterized from their self organizing behavior and by finding the optimum paths through minimum communication. They can get information about surroundings and can interact with other birds indirectly through stigmergy. These all features characterise swarm intelligence. The two widely used swarm intelligence techniques are Particle Swarm Optimization and Biogeography Based Optimization.

I. METHODOLOGY

For this work, simulation based work has been performed on 2-D images. The 2-D images were collected from the online database.

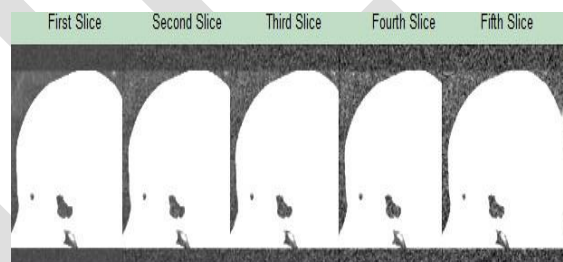


Fig.1: Slices of face obtained from MRI image

PARTICLE SWARM OPTIMIZATION

PSO is a computational optimization technique developed by Kennedy and Eberhart in 1995[3]. The impression of Particle Swarm Optimization has been originated from the behaviour of particles of swarm and the social interaction between particles [4]. While finding for the food, the birds get scattered here and there for searching of food or they move together to find for the food [5]. When the birds hunt for food from one place to another, there is a bird which can smell the food. The basic algorithm of particle swarm optimization consists of “n” swarm particles, and the position of each of the particle stands for the possible solution. The swarm particles may change its position according to the three principles: (1) keep its inertia (2) to update the condition with respect to its

optimal position (3) to update the condition with respect to the most optimal position of swarm. The position of each of the particle presented in the swarm is affected by the optimal position during the movement of individual and the most optimist particle position in the surrounding near to it [6]. Thus it is called PSO when the complete swarm is surrounding the particle then the optimum position of the individual is equal to the whole optimum particle.

BIOGEOGRAPHY BASED OPTIMIZATION

BBO is a new and advance biological – inspired and optimizes the population based technique developed by the Dan Simon in year 2008. and it is inspired by the mathematical models of the biogeography developed by Robert and Edward [7]. The Biogeography-based optimization is one of the main and evolutionary technique which mainly optimizes a function by the stochastically and repeatedly improving the candidate solutions with the regard to a given quality measurement. BBO is the study which relates to the concept of distribution of species in the nature. Island is referring to as each possible solution and its features that add up to a habitat is known as Suitability Index variables. Also the habitat suitability index which contain all the goodness of every solution. BBO basically works on migration and mutation. Migration means moving of species into some different habitat that is better to survive than already existing [8]. The place where these species is moving is referred to as immigrating. Mutation is used to upgrade diversity. In BBO, habitat H is initialized randomly vector of SIV. While the migration the information is passed between different habitats that depend upon the emigration rates and immigration rates of every solution. A problem is given and a way to find the possible solution to that exists in the firm of HIS value.

PROPOSED ALGORITHM

As per the earlier discussion in above sections, the concept of BBO and PSO was learnt. In the hybrid algorithm, it will take over the common properties of BBO and PSO algorithm [9]. Like in BBO algorithm, it involves: fitness function, migration of species, and immigration of species [10]. In PSO algorithm, it involves: fitness function, particles tend to acquire best position i.e., cross of position takes place, the optimum path is obtained. So, mixture algorithm of both these will contain common properties of both these algorithms: the fitness function, crossover of particles and get optimum path[11][12]. The particles tend to migrate or move to the best possible solution such as in PSO, the particles moves to the secure position that means they are changing their positions and in BBO, the individuals transfer to best environment [13][14]. In both the cases, the positions of individuals tend to change. So all these common properties are inherited in hybrid algorithm which increases its performance and efficiency.

In the hybrid algorithm, firstly the fitness function of the pixels is evaluated since in PSO and BBO the fitness value is evaluated. The pixels are selected on the fitness function.

$$\text{Fitness function} = \sum_{i=0}^n [A_i(B_i - C_i) / A_i]^{1/2} \dots\dots\dots(i)$$

Where A_i =habitat

B_i = Migrate or immigrate rates of i_{th} species

C_i = Crossover of i_{th} species.

Now describe a certain threshold value for the pixels and on the basis of the respective threshold value the new image is generated. The threshold value is assumed 0.1. Since in BBO and PSO, the solution which is best is achieved. So in hybrid algorithm, two habitats are generated randomly according to fitness function. Now crossover the pixels or check the pixels from the image earlier generated on basis of threshold value with these two habitats. The pixels which suits best between these are included in Region of Interest and are thus extracted. Now with this algorithm the segmentation gets improved to a large extent.

Input: Dicom images are given as input for working of algorithm.

Step 1: Initialize the particles to the population.

Step 2: For all particles, a fitness function for finding the best position of particles is defined.

Step 3: A certain threshold value for the segmentation of region of interest is defined

say threshold value in present work =0.01

Step 4: Generate an image on the basis of threshold value and generate two habitats randomly from the original image for the crossover.

Step 5: Crossover the position which suits best from the habitats and set it as area of interest that is to be segmented

Step 6: Iterate this process until best solution is obtained. Output: Segmented image is obtained as final output

II. IMPLEMENTATION AND RESULTS:

The implementation of the proposed algorithm is done using MATLAB Version. R2012a (7.14.0.739). For 3D, the execution time for PSO algorithm is 00.00.04 sec, for BBO 00.00.03 sec and for hybrid algorithm 00.00.02 sec

PARAMETERS FOR COMPARISON

The proposed algorithm had been tested successfully on different types of medical images. We are presenting the result and conclusions obtained from Particle swarm optimization and biogeography based optimization algorithms. Comparing the different segmentation algorithms to each other was difficult task because they totally differ in their properties. In our work, we had compared our results of hybrid algorithm of 2D and 3D image segmentation with results of PSO algorithm and BBO algorithm. Parameters are evaluated for checking the performance PSNR and SSIM has been taken in this work.

$$\text{PSNR} = 10 \log_{10} [R^2 / \text{MSE}] \quad (i)$$

where, R is error or fluctuation in the image given as input. SSIM is calculated by the inbuilt MATLAB function `ssimval`.

Table 1. Comparison of 2D Image Segmentation Results

Imag	PSO		BBO		PSO-BBO	
	PSNR	SSIM	PSNR	SSIM	PSNR	SSIM
1	27.554	0.120	28.196	0.074	53.525	0.207
2	30.983	0.084	31.633	0.017	50.406	0.269
3	27.553	0.001	28.350	0.030	59.081	0.669
4	26.683	0.062	27.468	0.034	57.795	0.171
5	27.639	0.067	28.436	0.003	61.529	0.276

The comparison of SSIM and PSNR of 2D images between PSO, BBO and Hybrid algorithm PSO-BBO The results shows that Hybrid algorithm is better algorithm than PSO and BBO.

III. CONCLUSION

As Particle swarm optimization and biogeography based optimization algorithms are optimization algorithms, we are using it for segmentation. In our work, we had used it for 3D medical images for segmentation by using Particle swarm optimization and biogeography based optimization This algorithm is flexible, and reliable where the many objective can be used as functions, due to this reason, it can be used for oriented segmentation and has shown better results in 3D segmentation than 2D also the execution time for hybrid algorithm is less than PSO and BBO algorithm. The results of the hybrid algorithm are better than that of PSO and BBO algorithms. For future, we can use better artificial intelligence schemes for higher equality of sufficiency and emphasize on reduction of computational complexity and time. The future work can be also done as increasing the EPI and SSIM parameters to more extent for better segmented image.

REFERENCES:

- [1] Zhi Ding, Yu-ning Dong “An Algorithm for 3D Image Segmentation” International Conference on Image and Graphics, IEEE computer society, Vol 1, Issue 7, 2007.
- [2] Simon Dan, Senior member IEEE, “Biogeography-Based Optimization” IEEE Transactions On Evolutionary Computation, Vol. 2 ,No. 6, Dec 2008.
- [3] Kennedy James and Eberhart Russell Washington, DC , kennedyjim @bls.gov, “Particle Swarm Optimization” IEEE Transaction, Purdue School of Engineering and Technology ,1995.
- [4] Udupa Jayaram, R. LeBlanc, et al. “ A framework for evaluating image segmentation algorithms” Computerised Medical imaging and Graphics 30 , Elsevier, pp 75-87,2006.
- [5] Bai Qinghai “Analysis of Particle Swarm Optimization Algorithm” Computer and Information Science, Volume 3, No. 1, Feb 2010.
- [6] Tandan Anita, Raja Rohit, Chouhan Yamini “Image Segmentation Based on Particle swarm Optimization Technique” International Journal of Science, Engineering and Technology research (IJSETR) , Volume 3, Issue 2, Feb 2014.
- [7] Zhang Y.J. “ A Survey on Evaluation Methods for Image Segmentation”, Science Direct ,Pattern Recognition, Vol. 29, No. 8,pp. 1335-1346, Elsevier Science Ltd, 1996.
- [8] Kumar Narender, Bedi R P S, “New Technique For Image Segmentation”, Journal of Bio-Technology and Research (JBTR) Vol.2, Issue 2 pp 8-16, June 2012 .
- [9] Sara Saatchi and Chih-Cheng Hung, “Swarm Intelligence and Image Segmentation” Southern Polytechnic State University USA.
- [10] Kaur Rajwinder, Khanna Rakesh, “Medical Image Quantization using Biogeography based Optimization”, International Journal of Computer Applications (0975 –888), Volume 48– No.12, June 2012.
- [11] Jzau-Sheng Lin and Shou-Hung Wu, “A PSO-based Algorithm with Subswarm Using Entropy and Uniformity for Image Segmentation”, International Journal of Computer, Consumer and Control (IJ3C), Vol. 1, No.2 ,2012.
- [12] Mohsen Fahd, Hadhoud Mohiy, Mostafa Kamel, Khalid Amin, “A New Image Segmentation method based on Particle Swarm Optimization”, The International Arab Journal Of Informational Technology, Vol 9, No. 5, 2012.
- [13] Kaur Gaganpreet, Dr. Dheerendra Singh ,Harpreet Kaur, “Detection of Abnormal Tissue Growth in MRI Imaging using Biogeography Based Optimization”, International Journal of Application or Innovation in Engineering & Management (IJAEM) Volume 2, Issue 8, August 2013.
- [14] Mittal Mittu, Gagandeep, “A New Evolutionary Algorithm developed for Global Optimization (BBO)”, International Journal of Science, Engineering and Technology Research (IJSETR) Volume 2, Issue 2, February 2013.