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SURVEY ON IMAGE SEGMENTATION TECHNIQUES

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Abstract

Digital image processing techniques allow for computer-assisted alteration of digital images. Pre-processing, augmentation and presentation, and information extraction are the general processes that all sorts of data must go through when employing digital technology. In image processing, image segmentation is a critical step. Image segmentation approaches such as thresholding, edge detection, colour based binary image segmentation, and particle swarm optimization are examined in this research.

Keywords: Image Segmentation, Thresholding, Edge Detection, Clustering, PSO, BBO etc.

Introduction

Image processing is a technique to enhance the input image to provide a clearer data. Digital image processing, where the digital images are processed using the computer. Digital images are composed of large number of elements called pixels, each pixel represents the image detail. Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. Image processing basically includes the following three steps:

- a) Importing the image via image acquisition tools
- b) Analysing and manipulating the image;
- c) Output in which result can be altered image or report that is based on image analysis.

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers.

Image Segmentation is the process of dividing colour or grey level images into different regions or segments as per the area of interest. Segmentation is used for object recognition, boundary estimation, image compression, image editing. The main objective of image segmentation is to divide the image for further image analysis and arrange pixels into high level representation for further analysis. Multiple segmentation algorithms are exits, choice of particular segmentation technique is depend upon for which application it is useful and type of image which is being processed for extracting information from the image.

Applications

1. Intelligent Transport Systems – This technique can be used in Automatic number plate recognition and Traffic Signal recognition.
2. Remote Sensing - For this application, sensors capture the pictures of the earth's surface in remote sensing satellites or multi-spectral scanner which is mounted on an aircraft. These pictures are processed by transmitting it to the earth station. Techniques used to interpret the objects and regions are used in flood control, city planning, resource mobilization, agricultural production monitoring, etc.
3. Moving object tracking – This application enables to measure motion parameters and acquire visual record of the moving object. The different types of approach to track an object are Motion based tracking and Recognition based tracking.

Segmentation Techniques

Segmentation based on Thresholding

Image segmentation based on Thresholding is quite simple than other segmentation methods. Here single value is selected as threshold and used to segment the image mostly into foreground and background segments. Value taken as Thresholding is T and image is I, for any pixels I(x, y) intensity value greater than T replace that pixel intensity value by 1 otherwise replace it by 0. There are two methods namely global Thresholding and local Thresholding When there is intensity distribution between the foreground pixel intensity value and background pixel intensity value which are very distinct from each other then global Thresholding method is used.



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Otsu method is one of the common methods of global Thresholding. In Multilevel Thresholding by using Otsu method multiple threshold values are used to segment the input image.

Segmentation based on Edge Detection

Edge detection method is used to solve image segmentation by detecting the edges or pixels between different regions that have sudden transition in intensity values are extracted and linked to form closed object boundaries. The result is in a binary image. Edge detection having three steps namely Filtering, Enhancement and Detection. Most commonly used edge detection methods are Canny, Sobel, Prewitt, Robert these all are first derivative operators. When there is sudden change in intensity value near edge and there is little noise in image then gradient based method works well. This method involves roll together gradient operators with the image. High value of the gradient magnitude is possible place of rapid transition between two different regions. These are edge pixels, they have to be linked to form closed boundaries of the regions. Common edge detection operators used in gradient based method are Sobel operator, canny operator, Laplace operator, Laplacian of Gaussian (LOG) operator, canny is most promising one, but takes more time as compared to Sobel operator. Morphological operations are also used to extract the shape of images. It is mostly apply on binary images Dilation and erosion are one of the morphological operations. In dilation operation edges of objects in binary image are becoming broad or thick. In erosion operation edges of objects in binary image shrinks or thins.

Region based Segmentation

Segmentation method based on region is relatively easy as compare to edge detection method and more effective to noise. In edge detection method image is segmented based on changes in intensity near edges at great rate and in region based methods, image is partition into regions that are similar according to a set of predefined condition or seed point. Region based segmentation include two methods Region growing, region Splitting and Merging.

Segmentation based on Clustering

There are two types of learning task unsupervised learning task and supervised learning task, clustering is unsupervised task, there is no need of training set required to cluster the input data here data is pixels of input images. Clustering is done on the basis of similarity criteria defined between pixels. The pixels are grouped into clusters in such manner that intra cluster similarity is maximum and inter cluster similarity is minimum. K-means clustering and fuzzy clustering these two methods are basically used to cluster the input image

Color based Binary Image Segmentation

In color based binary image segmentation the brightness of the input color images are removed by adjusting the thresholding values. Then the color image is converted to binary image and the edge detection is applied. The color inversion is done to identify the defected parts. Finally, the binary image is converted to color image and the defected parts are easily identified.

Particle Swarm Optimization

PSO is a computational method that optimizes a problem by iteratively improving a candidate solution with a proper quality measurement. PSO optimizes a problem by having a group of solutions and moving these particles around the search-space by simple mathematical formulae. Each particle's movement is influenced by its local best known position, but it is guided towards the best known positions in the search space which are updated as better positions are found by other particles. This is expected to move the swarm toward the best solutions.

BIOGEOGRAPHY BASED OPTIMIZATION

Biogeography based optimization a type of evolutionary algorithm. As its name implies, BBO is based on mathematical study of biogeography. Biogeography is the study of the distribution study of animals and plants over time and space.

BBO is an evolutionary process that achieves information sharing by species migration. It is modelled after the emigration and immigration of species between habitats to achieve information sharing. BBO operates by migrating information between individuals, thus resulting in a modification of existing individual. Individual do not die at the end of generation One characteristic of BBO is that the original population is not discarded after each generation, rather it is modified by migration. BBO is a population based optimization algorithm it does not involve reproduction or the generation of "children". In 1960, the first mathematical equations were discovered and developed that govern the distribution of organisms. Therefore, mathematical model of biogeography describe how species migrate from one island to another, how species arises, and how species become extinct. Biogeography technique is based basically on two criteria-HSI and LSI. Geographical area that are well suited and more compatible residence for biological species are said to have highly suitability index (HSI). Features that correlate with HSI include factors such as rainfall, diversity of vegetation,



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diversity of topographic features, land area and temperature. The variables that are characterized habitability are called suitability index variables (SIV). Habitats with HSI tend to have large number of species, while those with LSI have a small number of species. HSI are more static than LSI. LSI has a high species immigration rate because of their sparse population.

Related Work

Chih-Tang Chang et al. [1] in this paper presented a fuzzy k-means clustering algorithm using the cluster centre displacement between successive iterative processes to reduce the computational complexity of conventional fuzzy k-means clustering algorithm. The proposed method, referred to as CDFKM, first classifies cluster centres into active and stable groups. This method skips the distance calculations for stable clusters in the iterative process. To speed up the convergence of CDFKM, author present an algorithm to determine the initial cluster centre for CDFKM.

Mittu Mittal et al. [2] in this paper proposed a Biogeography Based optimization approach for automatically grouping the pixels of an image into different homogeneous regions. Biogeography is the study of the geographical distribution of biological organisms. BBO is basically an optimization technique it does not involve reproduction or the generation of “children.” From many years Image segmentation are done with many techniques like PSO, ACO, clustering algorithms, GA, ABC etc. This paper elaborates BBO approach for image segmentation i.e. partitioning an image into multiple segments.

M.R. Lohokare et al. [3] in this paper demonstrated the performance of BBO for block motion estimation in video coding. Motion compensated video coding technique, which predicts current frame from previous frame, has been used to exploit the temporal redundancy between successive frames. The proposed technique is compared with existing search techniques.

Surbhi Gupta et al. [4] proposed a color Quantization in document images algorithm based on Biogeography Based Optimization (BBO).

BBO is a population-based optimization algorithm primarily focused on the distribution of species among neighbouring islands and follows similar steps as evolutionary algorithms to find near-optimal solutions. The purposed module for Color Quantization has the purpose of reducing the number of colors to decrease its storage requirement and this reduction must not affect the quality of the image, so that human eye cannot differentiate between the original and the modified image. In this paper BBO technique used to determine the close colors and far off colors are dropped such that the modification is least perceptible by the user.

FarhadSoleimanian Gharehchopogh et al. [5] in this paper author investigate k-means fuzzy and k-means algorithm in order to recognize Intrusion detection in system which both of the algorithms use clustering method. One of the most effective techniques is Intrusion Detection System (IDS). This system is created to make a complete security in a computerized system, in order to pass the Intrusion system through the firewall, antivirus and other security devices detect and deal with it. The Intrusion detection techniques are divided into two groups which includes supervised learning and unsupervised learning. Clustering which is commonly used to detect possible attacks is one of the branches of unsupervised learning. Fuzzy sets play an important role to reduce spurious alarms and Intrusion detection, which have uncertain quality.

Er.KrishmaBhuchar et al. [6] in this Paper elaborate a global optimization method Biogeography-based optimization for automatically grouping the pixels of a color image into disjoint homogenous regions. Biogeography is the study of the distribution of animals and plants over time and space. It generates different clusters from a desired input image that share certain visual characteristics such as colours, intensity or texture pattern. The proposed algorithm computes performance evaluation in terms of migration rate such as 0.4 as compared to other evolutionary algorithm.

Surbhi Gupta et al. [7] in this paper proposed a Biogeography Based optimization approach for automatically grouping the pixels of an image into different homogeneous regions.

Biogeography is the study of the geographical distribution of biological organisms. BBO is basically an optimization techniques it does not involve reproduction or the generation of “children.” From many years Image segmentation are done with many techniques like PSO, ACO etc. This paper elaborates BBO approach for image segmentation i.e. partitioning an image into multiple segments.

SoumiGhosh et al. [8] in this proposed two important clustering algorithms namely centroid based K-Means and representative object based FCM (Fuzzy C-Means) clustering algorithms are compared. These algorithms are applied and performance is evaluated



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on the basis of the efficiency of clustering output. The numbers of data points as well as the number of clusters are the factors upon which the behaviour patterns of both the algorithms are analyzed. FCM produces close results to K-Means clustering but it still requires more computation time than K-Means clustering.

PROBLEM STATEMENT

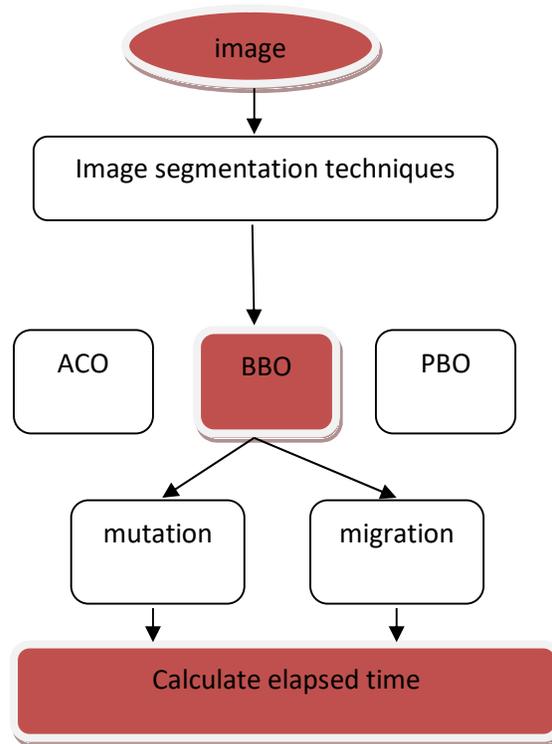
Image segmentation using BBO (biogeography based optimization)

OBJECTIVES

1. Study various image segmentation techniques.
2. Study various optimization techniques like BBO, ACO, and PBO etc.
3. Implement image segmentation using BBO.
4. Calculate elapsed time for BBO.

Methodology

- Understanding of BBO (biogeography based optimization and image segmentation, & neural network.
- select population size,fitness element and lambda in BBO
- select size of area in BBO
- selection of lambda using BBO in segmentation
- Calculation for contour point and fitness value in segmentation
- Calculate elapsed time by using BBO technique.



Conclusion

We have explored the useful approaches of picture segmentation such as threshold based, edge based, region based, cluster based, and colour based in this work. Individual researchers conducting image segmentation research will benefit from this comparison study. We conclude from our examination of the various methodologies that picture segmentation is a critical component of the image processing model.



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References

1. Chih-Tang Chang, Jim Z. C. Lai, Mu-Der Jeng, "A Fuzzy K-means Clustering Algorithm Using Cluster Center Displacement", *Journal of Information Science and Engineering* 27, 995-1009, 2011.
2. Mittu Mittal, Gagandeep, "A New Evolutionary Algorithm developed for Global Optimization (BBO)", *International Journal of Science, Engineering and Technology Research (IJSETR)* Volume 2, Issue 2, Feb. 2001.
3. M.R. Lohokare, S.S. Pattnaik, S. Devi, K.M. Bakwad, D.G. Jadhav, "Biogeography-Based Optimization Technique For Block-Based Motion Estimation In Video Coding", *NCCI 2010 -National Conference On Computational Instrumentation CSIO Chandigarh, INDIA*, Pp. 67-71, 19-20 Mar. 2010.
4. Surbhi Gupta 1, DeeptiBhardwaj 2, Parvinder S. Sandhu, "Color Quantization in Document Images Using Biogeography BasedOptimization", 2011 International Conference on Software and Computer ApplicationsIPCSIT vol.9, pp. 72-78, 2011 IACSIT Press, Singapore.
5. FarhadSoleimanianGharehchopogh, NedaJabbari, ZeinabGhaffariAzar, "Evaluation of Fuzzy K-Means And K-Means Clustering Algorithms in Intrusion Detection Systems", *International Journal Of Scientific & Technology Research* Volume 1, Issue 11, pp. 67-72, Dec. 2012.
6. Er.KrishmaBhuchar, ER. Rekha Rani, ER.BhartiJyoti, "Performance Evaluation of Biogeography BasedImage Segmentation", *Proc. of the Intl. Conf. on Advances in Computer Science and Electronics Engineering*, pp. 119-123, 2012.
7. Surbhi Gupta 1, KrishmaBhuchar 2, Parvinder S. Sandhu, "Implementing Color Image Segmentation Using Biogeography BasedOptimization", 2011 International Conference on Software and Computer ApplicationsIPCSIT vol.9, pp. 79-86, 2011 IACSIT Press, Singapore.
8. SoumiGhosh, Sanjay Kumar Dubey, "Comparative Analysis of K-Means and Fuzzy C-Means Algorithms", *International Journal of Advanced Computer Science and Applications*, Vol. 4, No.4, pp. 35-39, 2013.
9. RajwinderKaur, RakeshKhanna, "Medical Image Quantization using Biogeography based Optimization", *International Journal of Computer Applications (0975 – 888)* Volume 48– No.12, pp. 7-10. Jun. 2012.
10. Gaganpreet Kaur, Harpreet kaur, "A Review on Medical Image Segmentation Using Biogeography Based Optimization", *International Journal of Emerging Research in Management &Technology*, Volume-2, Issue-4, pp. 35-38, Apr. 2013.
11. NitikaJearth, Raju Sharma, "Restoration of Gaussian Blur by Biogeography Based Optimization", *International Journal of Advanced Research in Computer Science and Software Engineering*, Volume 3, Issue 6, pp. 1468-1473, Jun. 2013.
12. Ammu P K, Sivakumar K C, Rejimoan R, "Biogeography-Based Optimization - A Survey", *International Journal of Electronics and Computer Science Engineering*, Vol. 2, No. 1, pp. 154-160, 2012.
13. Law Todd, ItohHidenori, et al., "Image filtering, edge detection, and edge tracingusing fuzzy reasoning", *IEEE transactions on pattern analysis and machine intelligence*, vol. 18, no. 5, pp. 481-491, May 1996.
14. Russo F., "Edge detection in noisy images using fuzzy reasoning", *IEEE transactions on instrumentation and measurement*, vol.47, no.5, pp. 1102-1105, 1998.
15. Bellon Olga Regina Pereira, Dhirene Alexandre Ibrahim et al., "Edge detection toguide image segmentation by clustering techniques", *International conference on image processing*, Vol. 2, pp. 725-729, 1999.