

A Survey of Segmentation of Colored Images based on Impressive Algorithms

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ABSTRACT: Image Segmentation is a very important aspect of perception and it still a very thought provoking subject for machine and computer perception. Studies in computer vision proves that the segmenting an image into various understandable regions for subsequent post processing (e.g., scene understanding, pattern recognition) is an ambitious task. This paper discusses the major colour image segmentation approaches. Then we review various algorithms with their advantages and disadvantages which try to increase class distinguishability. We are using the Berkeley Segmentation dataset BSD300 for segmentation which contains natural colour images. Lastly summarize the image segmentation methods, developed to integrate more feature information with high accuracy.

KEYWORDS: image segmentation, computer perception, scene understanding, pattern recognition, etc.

I. INTRODUCTION

Image Segmentation is a fundamental and at the same time very thought provoking subject in computer vision and perception. Segmentation refers to division of image into various disjoint regions in order to have meaningful and defined regions. The color segmentation is a very crucial step in image processing and application like object detection, image editing, and medical image processing pattern recognition. Still segmentation of natural images are still very challenging because natural images have no uniformity in color, texture, effects of shadow and they are highly complex.

Over the course of time, researchers have studied and developed numerous approaches for image segmentation so that negligible input is given by the user side for segmentation. Science and technology has been developing constantly over the course of year have has given fruitful result where segmentation performance is greatly improved. But the accuracy and reliability is still a topic of concern for the researchers.

Fast development in the field of image technology has given rise to different types of digital images. Every site in the multivariate image depicts distinct aspects of the same scene. The number of vector elements also called feature space dimension in the image provides high levels of information contained in the image. Every pixel has a RGB value and its own coordinates due to which high information is retained. The cluster of pixels belongs to a region(class) and such collection of region gives rise to object or objects in the image along with the background. Segmenting such images into distinct region or regions and background is a challenging task. Intraclass variation is present in the semantically meaningful regions. These regions are not often homogeneous. This inhomogeneity is caused by image environment, noise or the characteristics of the scene. Large intraclass variation reduces the segmentation performance. Also the cost of computation increases with robustness of algorithm which often tries to increase the feature space sparseness and solution space complexity. A region-level MRF based algorithm is proposed called as multivariate Iterative Region Growing Using Semantics which deals with colour images. This algorithm is sensitive to initial conditions and thus a region-level k-means (RKM) is used to provide robust initialization at low cost.[1]

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II. RELATED WORK

Huisi Wu et al. [2] proposed a new framework for segmentation of cartoon images using an improvised SLIC (simple linear iterative clustering) algorithm to generate more super-pixels. The proposed algorithm produces super-pixels with regular size and the best part of the algorithm is, it also clings well to the boundaries of the image. Problem arises when the super-pixels have colour that is similar to the background and are on the image boundaries. The pivotal point of this algorithm is the inner connectivity between all the generated super-pixels. To tackle the inner connectivity issue of colour, we grow the region in such a way that the original super-pixels are divided into two or more new super-pixels. These super-pixels are merged together with adjacent super-pixels to obtain meaningful object. The author proposes Adaptive Region propagation merging which has a sophisticated parameter setting for the merging threshold which takes into consideration both the spatial and colour domain. The merging algorithm takes into account the adaptive center selection to determine which pixels to select first for merging. Also it determines how the merging regions need to be selected first. The experiments showed that the cartoon image segmentation is as good as the human visual perception. Also the algorithm is not limited to just cartoon image but also can be used for texture substitution, local brightness adjustment, target detection, etc.

Ranran Dong et al. [3] propose a novel approach for image segmentation. The interactive image segmentation is a region based approach in which the initial segmentation is done by Super Linear Iterative Clustering (SLIC) super-pixels, which gives relevant regions which are represented based on colour features and texture features. These regions are merged based on their region similarities. The region similarities are determined based on the Normalized Cross correlation which used as an guidance for region merging process. This region merging takes assistance from user markers. The author proposes SLIC algorithm which uses 5 dimensions [LABXY] for colour similarities and distance proximity by initializing the super-pixel cluster centres. The pixels surrounding the above mentioned super-pixels forms clusters of pixels until they converge iteratively till few pixels that have same label in large segment are not connective to each other. The region similarities are by Normalized Cross Correlation using LBP(Local Binary Pattern) histogram and indexed colour histogram. The region merging is done until the labelled and adjacent unlabeled region are merged with most similar neighbouring region. This is done iteratively until all regions are labelled as foreground or background. Experiments were done on Berkeley dataset and results found were accurate and reliable.

Rostom Kachouri et al. [4] proposed a new unsupervised image segmentation method called Unsupervised Image Segmentation (UIS) which segments image into primitive regions which is done by local adaptive k-means. Together with centroid initialization, this method collects homogeneous regions. Hierarchical linkage is used for feature merging in the above mentioned region. It tackles the issue of over-segmentation by removing outlier region by post processing stage. The author proposes to form clustering of local image blocks using k-means algorithm. It forms small data blocks and each data block has one single semantic meaningful subject. Local k-means sets two set of centroid. Author selected 9 pixels out of which one pixels belongs to second region if there is one. We initialize two farthest pixels after which each blocks block is clustered with k-means until convergence. For merging we have similarity criteria to determine which regions are similar. We have taken a combination a combination of color and texture features to obtain a sharp boundaries and homogeneous regions. There is a possibility that the merged image may contain outlier region. We eliminate this region by merging them with appropriate regions. The experiments were conducted on both Corel and Berkeley datasets. Performance evaluation was done according to visual accuracy comparison and Liu's factor measuring.

Tingting Lan et al. [5] proposes a novel object contour extraction method based on salient region detection and an automatic region growing method. Here the original image is partitioned into super-pixels using hexagonally Arranged Iterative clustering (HAIC). The salient objects in the image were located by super-pixel global contrast (SGC) so that the centroid and colour set of the background could be determined. Contour Plot was obtained by doing post processing which included open operation and isolated region elimination. HAIC generates super-pixels centers and we take centroid of these super-pixels as seed and search for similarities in the neighbouring pixels. After which we calculate each super-pixels contrast. The author mentions the separating of the object from the background is a challenging task. To tackle this issue, an automatic region growing combined with scanning line to select the seed is used. Region merging of background will give greater regions of segmentation which will separate our target object.

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Post processing method like morphological process can remove smaller structure and eliminate isolated areas. The experiment was conducted on natural images with simple background and natural images with complex background which comes from MSRA10K dataset and results found were good.

Mohamed Ben Gharsallah et al. [6] propose a new segmentation method for detection of defects in the surface that contains small shapes present in the image. These images have low levels of contrast and are easily affected by uneven illumination. The method is based on level set active contour in which primarily we use Off-center saliency map whose goal is to select the interesting parts of sensory input data due to which the data is to be processed is reduced. In this method, the dark regions are surrounded by bright regions are identified first because that is the nature of the images (defects have low-level contrast). Secondly, the Off-center saliency map obtained is used in the segmentation process because it provides statistical information for level set active contour energy formulation. Experiments were performed on the different industrial images contained different types of deformities. These defects could be used for finding slag inclusion, unfinished penetrations, porosities, gas cavities, etc. The future work for this project is to be used for analysis medical images.

Mona A. S. Ali et al. [7] proposes an approach for segmenting and removing the interphase cells from the images of chromosomes. The interphase cell is a condensed mass of chromosome. This decreases the efficiency of the process by which the geneticist diagnose the genetic factor responsible for the genetic disease. This process is called karyotyping in which chromosome in the dividing cells are identified and displayed in a standard format. The method proposed is called Bit-Slicing in which the image are represented by pixels that happens to be sequence of bits, therefore every bit gives a binary image. This means that the original image is made of sub images containing 8 planes after using bit-slicing method. This means that 8-bit image contains 8 planes of 1-bit where plane 1 has the lowest order and plane 8 has the highest order bit from all pixels. After applying the method, image arithmetic is applied on the selected slices and filtered by region. Experiments were performed on chromosomes of 54 rat bone marrow. The image obtained from chromosomes where sliced into 8 place of gray levels. The planes from 0 to 3 did not give clear image hence the last three planes were selected. To extract the chromosome from the image, arithmetic operations were used. The filtering was done by region properties. The accuracy was found to be 90% on good quality images.

Zhiganag Li et al. [8] proposes an unsupervised algorithm for segmentation of Synthetic Aperture Radar(SAR) images which contains the homogeneous region and is based on the likelihood difference function. This function is derived from the Gamma distribution function. The over-segmentation region in the image is joined together with the help of similarity criteria. There are two steps involved for the segmentation, first is the rough segmentation in which the likelihood difference function is used as a similarity criterion and the second is a fine segmentation in which pixel level segmentation is done. So that a smooth edge can be obtained. The problem with SAR images is the back-scattering intensity which gives arbitrary variation due to interference multiple scattering within resolution cell of SAR images. This gives different changes to different gray values of SAR image for same object, therefore affects segmentation of SAR images. Using rough segmentation, the SAR images are divided into grids which follows fine splitting to separate border between homogeneous region. The fine segmentation which is based on similarity distance algorithm is used to approach edge of homogeneity region. We need pixel-level segmentation and suitable similarity criterion to measure the commonality between two pixel and regions. The experiment were conducted on two SAR images with initial window size of 7x7 and the algorithm is consistent with the real boundary.

Jungeng Wu et al.[9] proposes a segmentation algorithm based on wavelet transformation and fuzzy clustering to characterize the infrared images of electrical equipment. Fuzzy C-means(FCM) clustering algorithm is very sensitive and gets easily affected by the initial clustering centers and also with the number of clustering which results in numerous problems like improper segmentation, etc. In FCM, the pixels with same characteristics are clustered together, so that their classification, number of cluster and fuzzy membership function can be found out. The wavelet transform is used because it can deal with analysis of images with different resolutions and gives the characteristics in plurality of scale space. This gives the feature information. The multiple scales obtained by wavelet multi-resolution analysis helps to reduce the amount of computation required by FCM. The DB4 wavelet family image wavelet decomposes the infrared images and the types of fuzzy clustering are automatically found. The clustering centers and the clustering number are found using a 2-dimentional histogram sampling which takes the FCM initialization sensitivity. The experiments show the accurate separation of the target object from the background.

Qiyao Yu and David A. Clausi et al.[10] proposes Iterative Region Growing Using Semantics(IRGS), an image

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segmentation method which focuses on two aspects. First is Graduated increased edge penalty (GIEP) functions which are used in the traditional Markov Random Field (MRF) context model for deriving objective functions. Second, it uses a region growing method for finding the solutions for the above mentioned objective functions. The IRGS focuses mainly on the edge strength information and is more stable for estimation of model parameters. It also provides a hint of possibility for the representation of image information which can be done hierarchically. This allows the feature information of various region and domain knowledge to be used in the segmentation process. IRGS gives a transition from standard Gaussian model to the MRF model hence providing more elegant and accurate estimation of the feature model. The region growing techniques are used to generate a hierarchical organization of pixels to give efficient optimization. This method was tested on several artificial images and Synthetic Aperture Radar(SAR) images.

III. CONCLUSION

The Objective of this paper is to understand and identify different methods used for the segmentation of images, on the basis of colour and to investigate how the future of the research for segmentation will proceed. After evaluating the papers, it was found that the procedures were application specific and much development is needed to be done. The segmentation of images can lead to understanding of various computer vision application like scene understanding, object detection etc. Also they are very important in the medical field like tumour detection, cancer detection using medical images which have similarities with other cancer or tumour cells. Challenging task of the algorithms is to separate the target region with the surrounding background. The segmentation of image based on colour presents another challenge that is the target region often contains one or more regions with different colour and texture features. To club such regions together with high accuracy is a challenge that needs to be tackled. The algorithms mentioned here are performing with high accuracy and are able to obtain satisfactory results.

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