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Including the Size of Regions in Image Segmentation by Region Based Graph

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ABSTRACT

Segmentation on color images improves the quality of segmentation process. But this improvement is obtained at the expense of computational complexity. So, in order to overcome this problem in color image segmentation, we introduced a new class of cost functions in this paper. According to the proposed method, an efficient color image segmentation can be obtained by applying the segmentation process on region based graph images by using N-Cut. Some undesirable effects have arisen by using N-Cut in region based graph since it is meant to be used in pixel based graph. These undesirable effects have been reduced by using an over segmentation algorithm. So, applying an over segmentation algorithm on region based graph and doing partitioning using N-Cut is an efficient approach for reducing computational complexity in color image segmentation process.

Keywords: N cut, mean shift algorithm, Region based graph, Pixel based graph

INTRODUCTION

Image segmentation is a process of dividing an image into different regions such that each region is nearly homogeneous, whereas the union of any two regions is not. It serves as a key in image analysis and pattern recognition and is a fundamental step toward low-level vision, which is significant for object recognition and tracking, image retrieval, face detection, and other computer-vision-related applications.

Figure1. *Segmented image*

Color Image Segmentation

Color images carry much more information than gray-level ones. In many pattern recognition and computer vision applications, the color information can be used to enhance the image analysis process as shown in fig1 and improve segmentation results compared to gray-scale-based approaches. As a result, great efforts have been made in recent years to investigate segmentation of color images due to demanding needs.

Graph Based Image

A weighted graph, where each vertex corresponds to n image pixel or a region, and the weight of each edge connecting two pixels or two regions represent the likelihood that they belong to the same

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segment. The weights are usually related to the color and texture features, as well as the spatial characteristic of the corresponding pixels or regions. A graph is partitioned into multiple components that minimize some cost function of the vertices in the components and/or the boundaries between those components. So far, several graph cut-based methods have been developed for image segmentations.

N-Cut in Region Based Graph

Makrogiannis *et al.* developed an image segmentation method that incorporates region based segmentation and graph-partitioning approaches. This method first produces a set of over segmented regions from an image by using the watershed algorithm, and a graph structure is then applied to represent the relationship between these regions. Not surprisingly, the overall segmentation performance of the region-based graph-partitioning approaches is sensitive to the region segmentation results and the graph grouping strategy. The inherent over segmentation effect of the watershed algorithm used in and produces a large number of small but quasi-homogenous regions, which may lead to a loss in the salient features of the overall image and, therefore, yield performance degradation in the consequent region grouping. To overcome these problems, we propose in this correspondence a novel approach that provides effective and robust image segmentation with low computational complexity by incorporating the mean shift (MS) and the Ncut methods. In the proposed method, we first perform image region segmentation by using the MS algorithm , and we then treat these regions as nodes in the image plane and apply a graph structure to represent them. The final step is to apply the Ncut method to partition these regions.By applying the Ncut method to the preprocessed regions rather than the raw image pixels, the proposed method achieves a significant reduction of the computational cost and, therefore, renders real-time image segmentation much more practically implemental. On the other hand, due to some approximation in the implementation of the Ncut method, the segmentation processing of a graph exploiting the lower dimensional region-based weight matrix also provides more precise and robust partitioning performance compared to that based on the pixel-based weight matrix.

RELATED WORK

Survey on Image Segmentation Using Graph Based Methods

Authors such as **Mo Chen, Pedro F. Felzenszwalb and Daniel P. Huttenlocher, Daming Zhang** have proposed methods for high quality of image segmentation with improved speed and stability.

Pedro F. Felzenszwalb and Daniel P. Huttenlocher, 2004 it works Based Krusal's Algoritham drawback of this paper is Low Variability image regions while ignoring detail in High variability regions. It is very difficult for users to choose an appropriate value for an expected segmented size. One reason for this interest is that the segmentation quality of Ncuts and other graph-based segmentation methods is very good. The recently-developed isoperimetric method of graph partitioning has demonstrated that quality partitions of a graph may be determined quickly and that the partitions are stable with respect to small changes in the graph (mask). Additionally, the same method was also applied to image segmentation, showing quality results.

Mo Chen et.al. In paper "isoperimetric cut on a directed graph". In this paper, we propose a novel probabilistic view of the spectral clustering algorithm. In a framework, the spectral clustering algorithm m can be viewed as assigning class label to samples to minimize the Byes classification error rate by using a kernel density estimator (KDE).From this perspective, we propose to construct directed graphs using variable bandwidth KDEs. Such a variable band width KDE based directed graph has the advantages that it encodes the local density information of the data in the graph edges weights. In order to cluster the vertices of the directed graph, we develop a directed graph portioning algorithm which optimizes a random walk isoperimetric ratio. The portioning result can be obtained efficiently by solving a system of linear equations .We have applied our algorithm to several benchmark data sets and obtained promising result.

Daming Zhang et.al in paper "Image Threshold Selection with Isoperimetric Partition". In this paper we deduce the unified form of the normalized cut (Ncut) algorithm and the Isoperimetric algorithm, and then a new Isoperimetric based thresholding algorithm is proposed. Unlike Tao and Jin's Ncut-based thresholding algorithm, the proposed algorithm need not to search all possible thresholds, nevertheless yields similar results. A large number of examples are presented to show the effectiveness of the proposed algorithm.

SIMULATION RESULTS

As we know either by subjectively or objectively, a color image gives much more information when compared to gray level ones. But this improvement is obtained at the expense of computational complexity. So in this paper, we propose methods to reduce the computational complexity of color image segmentation.

Overview of Paper

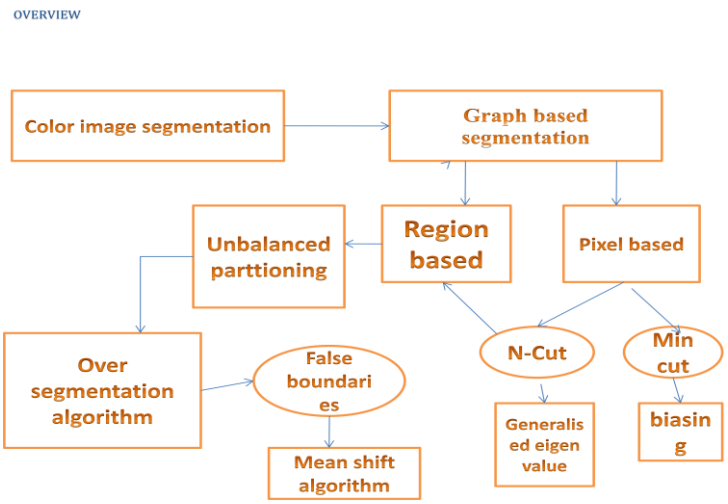

Figure2. *Overview of paper*

Algorithm of Code

- Reading the image
- Grid based sampling
- Key-point based sampling
- Segmentation based sampling

Reading an Image

It means importing an image from any supported graphics image file format, in any of the supported bit depths. We use the command "imread" for reading any type of an image. "imread" reads a true color image into the MATLAB workspace as the variable.

a = imread (filename,fmt);

a= imread ('*.*');

Figure3. *Readed image*

Grid Based Sampling

Sampling means converting the continuos form of an image into digitized form spatially. Grid based sampling can also be called as patch based estimation. Since, at a time sampling is difficult on the image as a whole, we used this process. This process also increases the processing power.

The commands used mainly in this step are as follows:

- a= imread (: , : , 'x');

Where x= 1; red color

x= 2; blue color

x= 3; green color

b = cat (dim, a1, a2, a3, a4,...);

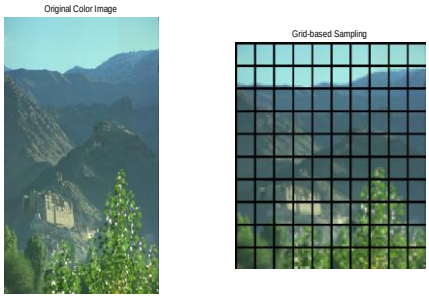

Figure4. *Grid based image*

Keypoint Based Sampling

This step is used to measure the intensity values of different layers present in that image in order to extract the key points in the image. So that the edges are highlighted which is important in identifying different objects in the image.

Figure5. *Ketpoint sampled image*

The commands for this step are:

- b=ordfilt2(a, order, domain);

where each element in A is replaced by the order-th element in the sorted set of neighbors specified by non zero elements in domain.

- [rows, cols ,vals] = find(zeros(b));
- rectangle('position', [x y]);

Segmentation Based Sampling

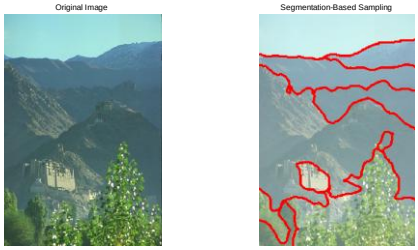

Figure6. *Segmented image*

On the key point based sampled image, we apply the N-cut criterion for the partitioning purpose.This approach tends to balanced partitions while following the general common sense principle.It also reduces computational complexity when applied on region based graphs.

Limitation of Proposed Method

As in the proposed method, the usage of over segmented algorithm will leads to some false boundaries in the segmentation process. We can reduce this problem to some extent by selectively choosing the over segmented algorithm. But we cannot overcome this problem completely.

CONCLUSION AND FUTURE SCOPE

In the existing method, N-Cut partitioning technique is directly implemented on the read image which increases the computational complexity and simulation time to some several hours. So, in this paper, we overcome this problem by proposing a new class of cost functions such as applying MS algorithm on read image and working on a region based graph by applying N-Cut method. This proposed method reduced computational complexity and total simulation time taken is only 2 minutes.

In future, the proposed method can be further enhanced for the videos. Such as the keypoint extraction which we used here can be further modified for the extraction of moving objects in videos. Also, the segmented object in an image can be extracted and the surrounding environment of that image can be modified for animation purpose.

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