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COLOR IMAGE SEGMENTATION BASED ON QUAD TREE DECOMPOSITION AND COLOR MODEL.

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Abstract: In human communication, voice is the preferred method. But in order to fit a band limited storage space or some transmission channel, speech signals have to be converted to formats using various techniques called as speech coding techniques. Today, speech coders have become an essential component in cellular communications, video conferencing, multimedia applications and computer based games. In the past decade, progress has been made towards the development of low-rate speech coders to be used in various applications which led to the development of new speech coders capable of producing high-quality speech reconstruction at low data rates. In order to optimize the performance, most of these coders employ the mechanisms to represent the spectral properties of speech, provided for speech waveform matching and hence achieve improved compression as compared to direct quantization. A number of these coders have already been adopted in national and international cellular telephony standards. This paper presents a review of various speech coders based on various parameters, their merits, demerits, types and applications.

Keywords: Vocoder, Excitation signal, Codebook, Encoder, coding technique

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INTRODUCTION

Color image segmentation is a method of extracting from the image domain one or more connected regions satisfying equivalence (homogeneity) criterion which is based on features derived from hidden components (statistical data) in image. These components are defined in a chosen color space model. It has long been recognized that human eye can distinguish thousand of color shades and intensities but only two dozen shades of gray. Compared to gray scale, color provides information in addition to intensity. Color is useful or even necessary for pattern recognition and computer vision. Color image segmentation attracts more and attention mainly due to following reasons.

- Color Images can provide more information than gray level images.
- The power of personal computer is increasing rapidly, and PC's can be used to process color images more effectively.

Our main focus of work is on development of an optimized approach for the color image segmentation, where we will explore the concept of thresholding by referring the color image statistical data. To achieve the aim of the proposed work, we will develop the thresholding mechanism. To achieve thresholding, local and global analysis, and evaluation of the color image data will be explored. Main aim of the work is to develop a segmentation approach for color images based on an automatic thresholding and color models. To achieve the main aim of the work focus is on Quad-Tree decomposition[Yuan and Chen, 2009]. and automatic thresholding by representing image into different color models [Rafika and Ezzedine, 2012].

Finally, formulate an approach which will provide the better experimental results for the color image segmentation and image fusion.

Motivation

Accurate image segmentation is one of the key problems in computer revelation. Before high-level interpretation can be applied to an image, it must be broken down into its major structural components. Now days the computing power is increasing so it need to produce complex image processing tools. Hundreds of segmentation techniques are proposed now days, but there is no single method which can be considered to be good for all images, nor are all methods uniformly good for a specific type of image. Moreover, technologies developed for one domain of image may not apply to other domains of image. Most of the image processing applications found on binary or gray image but very few on color image segmentation. Color image processing area grows faster in theoretical point of view rather than practical point of view.

The work in this paper is motivated from a practical point of view by several disadvantages of existing methods. The first problem is the incapability of all known methods to appropriately segment objects from the background exclusive of interference from object shadows and highlights. There is inadequate research on the combination of basic automatic thresholding and color model based segmentation similarity measures to improve color similarity calculations given the advantages of improving the performance of each color images. There are many challenging issues for the development of a unified approach to image segmentation that can be applied to all kinds of images. Even the choice of a suitable technique for a specific type of image is a complex problem up to current study; there is no universally adopted method of quantification of segmented output. The selection of the threshold is very crucial as for same part of the image low intensity variation may correspond to edges of interest, while the other part may require high intensity variation.

Literature Survey

Before we consider each of the methods in detail, we briefly look at the field of image segmentation overall. [Fue and Mui, 1981] classified segmentation techniques for image segmentation into three broad categories: characteristic feature thresholding or clustering, edge detection, and region extraction methods. This survey was done from the point of view of cytology image processing. A critical appreciation of several methods of thresholding, edge detection and region extraction has been done. This includes some graph theoretical approaches. For color image thresholding, only a brief mention about it has been given.

[Haralic and Shaprio, 1985] classified image segmentation techniques as: measurement space guided spatial clustering, single linkage region growing scheme, hybrid linkage region growing scheme, centroid linkage region growing scheme and split and merge schemes. According to them, the difference between clustering and segmentation is that clustering involves grouping in measurement space: while in image segmentation the grouping is involved in the spatial domain of the image. Segmentation tries to do the groupings in the measurement space, particularly for multispectral images. For multispectral data, instead of clustering in the full measurement space [Haralic and Shaprio, 1985] suggested to work in multiple lower order projection spaces, and then refelect these clusters back to the full measurement space.

[Carron et. al., 1994] applied the Sobel operator to each component of the HSI space and the individual results were combined using a trade-off parameter between hue and intensity. An interesting feature of this trade-off parameter was its dependence on the level saturation. The results of this combination are not convincing given the test images used (there are only minor differences between results where hue information is used as compared to those where it is not). Color image scenes containing shadows might have provided a better indication of the capabilities of combining the information contained within the individual HSI planes.

For color images, a number of approaches have been proposed from processing individual planes [Carron et. al., 1994] to true vector-based approaches [Dony and Haykin, 1999]. The computational load of computing edges on individual planes can be much smaller than that of computing edges on the color vector. However, this seems to be a trade-off between speed and algorithm performance. The vector-based approaches exploit the correlation between the color planes much more effectively than the computation on single planes. This is why most researchers have concentrated on the vector-based approaches.

[Yuan and Chen, 2009] develops an image segmentation method based on the modified edge-following scheme where different thresholds are automatically determined according to areas with varied contents in a picture, thus yielding suitable segmentation results in different areas. They proposed a robust segmentation method that is suitable for nonspecific image fike format. The techniques are based on the hierarchical segmentation under quad-tree decomposition [Chen et. al., 2007], an image is adequately decomposed into many blocks and sub-blocks according to the image contents. Simulation results demonstrate that the proposed method is superior to the conventional methods to some level. Due to avoiding human interferences and reducing operating time, the proposed method is more robust and suitable to various image and video applications than the conventional segmentation methods.

[Maia and Hongpeng, 2010] to improve the performance of image segmentation investigated a new image segmentation techniques based on Grey Graph Cut which integrates grey theory and graph cut theory methods. In the methods, first the image is taken as a weighted undirected graph. After then, the relationships of grey-levels and locations in local regions are discussed via grey relational investigation, a grey weighted matrix is recognized, based on which a grey partition function is derived. After, the image is transformed to binarized with the gray-level that corresponds to the minimum value of the grey panel function. Investigational results on visible light image and SAR image indicate that the proposed technique, being better to some existing methods like Otsu and Normalized Cut etc., not only that can segment the images with obvious difference among targets and backgrounds, but also hold back image noise effectively.

[Harrabi and Braiek, 2012] presented a new color image segmentation technique, based on multilevel threshold and data fusion techniques which aim at combining different data sources associated to the same color image in order to increase the information quality and to get a more reliable and accurate segmentation effect. The projected segmentation approach is conceptually different and explores a novel strategy. In fact, in its place of considering only one image for every application, the method consists in combining many realizations of the identical image, together, in categorize to increase the information quality and to get an best segmented image. They used an optimal multi-level thresholding is based on the two-stage Otsu optimization approach and The notion of mass functions, in the Dempster-Shafer (DS) evidence theory technology, is linked to the Gaussian distribution, and the final segmentation is realized, on an input image, that is expressed in different color spaces.

A major problem in the field of color image segmentation area, and even image segmentation in universal, has been what is known as 'the lack of ground truth' [Deng and Majunath, 1999]. Up to recently with the creation of the segmentation dataset, each paper's authors would use completely different images to test their algorithms and techniques. Therefore, it was extremely difficult to judge the class of a segmentation technique or even to compare it with its peers. The choice of dataset is a first step in trying to create a sort of standard for segmentation result. Though, segmentation is immobile a very subjective task in nature and even within the dataset, there are numerous discrepancies. For this reason, comparisons of algorithms have been traditionally quite problematic task. In this survey, as an alternative of trying to draw direct comparisons between algorithms, they attempted to list out the comparison between automatic thresholding using quad-tree decomposition and color image segmentation based on different color models techniques.

Proposed System Design

The work is divided into analysis of an image segmentation methods based on the modified edge-following scheme and image segmentation method using thresholds automatically determined from picture contents.

In the first segmentation scheme the focus is on region based segmentation where different thresholds are automatically determined according to areas with varied contents in a picture, thus yielding suitable segmentation results in different areas. First, the iterative threshold selection technique is modified to calculate the initial-point threshold of the whole image or a particular block. Second, the quad-tree decomposition that starts from the whole image employs gray-level gradient characteristics of the currently-processed block to decide further decomposition or not. After the quad-tree decomposition, the initial-point threshold in each decomposed block is adopted to determine initial points. Additionally, the contour threshold is determined based on the histogram of gradients in each decomposed block. Particularly, contour thresholds could eliminate inappropriate contours to increase the accuracy of the search and minimize the required searching time. Finally, the edge-following method is modified and then conducted based on initial points and contour thresholds to find contours precisely and rapidly. By using the Berkeley segmentation data set with realistic images, the proposed method is demonstrated to take the least computational time for achieving fairly good segmentation performance in various image types [Yuan and Chen, 2009].

Second segmentation scheme uses different color models for automatic thresholding. The problem is to separate cells from the background. The initial segmentation maps which will then be fused together are simply given, in our application, by the two-stage Otsu optimization approach (TSMO), applied on an input image expressed by different color spaces and using as input the set of pixel values provided by these images. The multilevel thresholding technique is used to extract homogeneous regions, in each image, to be fused. Once the mass functions are estimated by the assumption of GD, the DS combination rule is applied to obtain the final segmented image. Hence, the main idea of the proposed method is to fuse, one-by-one, the pixels of the input image expressed by six color spaces. In this application, we use Ns segmentations provided by the Ns = 6 color spaces, namely the C = {RGB, HIS, YIQ, XYZ, LAB, and LUV} color spaces. The examples show that the images provided by these different sources are redundant and complementary. In this sense, data fusion techniques appear as an appealing approach for color image segmentation. The purpose of this study is to apply this method for medical images segmentation [Rafika and Ezzedine, 2012]. We aim at providing assistance to automatic thresholding of color image segmentation. The flowchart below illustrates the working of proposed work in figure 1.

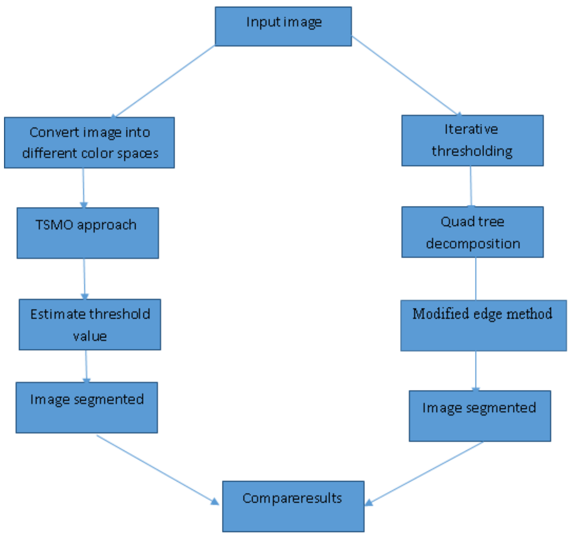

Figure 1: Flowchart of proposed work

The first approach has the following steps to carry out the automatic thresholding based on quad tree decomposition:

a) Modified Iterative Threshold Selection Technique

In this stage, the gradient between the currently processed point and its neighboring point in one of eight compass directions is first determined. The iterative threshold selection technique that was proposed by Ridler and Calvard to segment the foreground and background is modified to calculate the initial-point threshold of the whole image or a particular block from the quad tree decomposition, for identifying initial points [Ridler and Calvard, 1978]

b) Quad-Tree Decomposition Process

In this stage, the whole image is partitioned into many blocks by using quad-tree decomposition. The quad-tree decomposition process starts with the initial-point threshold, mean and standard deviations derived from the entire image on the top level. At each block, the process determines the initial point threshold and whether this block should be further decomposed.

c) Determining the Contour Threshold

At the end of the quad-tree decomposition process, the gradients of each decomposed block are computed to determine the contour threshold. This approach not only prevents searching in the wrong path, but also saves on the search time. Additionally, *Counter Threshold* of each decomposed block is independently determined to adapt to the characteristics of each area.

d) Applying the Modified Edge-Following Method.

The initial-point threshold , contour threshold, and initial points are obtained in the previous stages. In this stage, the searching procedure is started from each initial point until the closed-loop contour is found. During the searching process, taking in the left and right neighboring points of the next predicted contour point in computation would significantly reduce the tendency of the edge-following method to deviate from the correct edge due to noise interferences. Only three directions are first searched in the searching process. The searching time is thus significantly decreased, since most searches only need the computation of the gradients in three directions [Yuan and Chen, 2009].

The second approach has the following steps for segmentation based on color model:

a) Represent an image into different color model

In this, we use segmentations provided by the different six color spaces, called the C_{Space} = {RGB, HIS, YIQ, XYZ, LAB, and LUV} color spaces. The best component images used are the R, H, Y, X, A, and L components for the input image expressed in the {RGB, HIS, YIQ, XYZ, LAB, and LUV} color spaces, respectively. To do this, histogram thresholding technique is applied to the 18 redundant features (R, G, B, H, S, V, Y, I, Q, X, Y, Z, L, A, B, L, U, and V) and the feature with the best segmentation sensitivity is selected in each color space.

b) Apply two-stage Otsu thresholding technique(TSMO)

The TSMO is used to find the optimal multi level thresholding in each 18 redundant features (R, G, B, H, S, V, Y, I, Q, X, Y, Z, L, A, B, L, U, and V) that is to be combined. The concept of the two-stage Otsu thresholding technique [Huang and Wang, 2009] is used to find the priori knowledge such as the mean (μ) and the standard deviation (s) of each region of the images to be fused. The idea of the information representation is based on the assumption of a Gaussian Distribution. Once the measures are determined for each component image to be fused, the [Dempster, 1967] and [Shafer, 1976] DS combination rule and decision are applied to obtain the final segmentation.

c) Mass function estimation

The mass function is estimated form the assumption of Gaussian Distribution (GD). The advantage of DS theory is that the evidence can be associated with multiple possible events or sets of events. One of the most important features of DS theory is that the model is designed to cope with varying levels of precision regarding the information. The determination of the mass function does not only take into account the advantage of the Gaussian model, but also considers the neighborhood information of the measures to explore the images features.

d) Combining the information

This step involves the combination of information from six resources C_{Space} = {RGB, HIS, YIQ, XYZ, LAB, and LUV} color spaces. We will apply fusion method to the same image expressed in different six color spaces, and we compare the performance of our proposed algorithm with existing methods [Rafika and Ezzedine, 2012].

Conclusion

This work proposes an automatically threshold detection mechanism to perform a good segmentation. Different start-point thresholds are selected and given to regions with extreme and flat changes in gray-level values of a image. The contour thresholds are selected by analysing the decomposed regions that preventing the search from declining into the incorrect path, and reduction in computational time can be obtained. The contour search process technique also believes the gradients of the left and right neighbouring points of every forecasted contour point, in order to subordinate the possibility of the method being unnatural by the neighbouring noise interferences. Most of the searching procedure requires only the calculation of the gradients of three directions using eight compass directions that reduce the searching time. The planned method can carry out segmentation on objects within another object and objects that are close up to each other. In management of blurry objects from an out-of-focus explosion, the projected method can be also segmenting the essential objects. The planned method could take the smallest amount of computational time to find strong and high-quality segmentation performance than the traditional ones. Therefore, the proposed method can be extensively and successfully working in various segmentation applications.

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