Effective method of Initial Seed Selection Used for Color Image Segmentation

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Abstract

We propose a method of initial seed selection used for color image segmentation. In this paper Initial seed selection is a starting stage of color image segmentation. This method is based on HSV color model. Here we use two details; one is non-edge pixels and second is smoothness feature of the pixels. The non-edge pixels and smoothness at pixel’s neighbor are used as criteria to determine initial seeds in the color image. No-edge information provide those pixels are not on the edge and smoothness provides pixels have high similarity to its neighbors. This method is applied to many color images and experimental results show the effectiveness of the method.

Keywords-image segmentation; seed selection; non-edge; smoothness.

1. Introduction

Seed selection often serves as a crucial in initial step before performing high level task such as color image segmentation. It should be noted that there is no single standard approach to seed selection for color image segmentation. The appropriate seed selection technique is select on the basis of type of image and applications.

Ugarriza et al. [2] proposed a technique of initial seed selection. This technique uses vector field for edge detection and RGB to L*a*b conversion of image pixels to calculate the threshold by using adaptive threshold generation method. This method uses approximate calculation of threshold. The problem is that approximate calculation does not lead proper conclusion.

Fan et al. [3] presented an automatic color image segmentation algorithm by integrating color edge extraction and seeded region growing on the YUV color space. Edges in Y, U, and V are detected by an isotropic edge detector, and the three components are combined to obtain edges. The centroids between adjacent edge regions are taken as the initial seeds. The disadvantage is that their seeds are over-generated.

In this paper a method of initial seed selection is proposed in HSV model. This method is useful for color image segmentation. The non-edge pixels and smoothness at pixels neighbor are used as criteria to determine initial seed.

2. PROPOSED WORK

The proposed method is produce conversion from RGB to UVL this color model is used to determine non-edge pixels and HSV model for smoothness at pixel’s neighbor. These non-edge and smoothness are criterion to obtain initial seeds.

1.1. Initial seed selection

On the side, we are using the relative Euclidean distances (in terms of Luv) of a pixel to its eight neighbors is calculated as

$$D = \sqrt{\frac{(L_i - L)\Delta_1}{\sqrt{i}}}$$

Where $i = 1, 2, ..., 8$.

From the experiment, the performance of using relative Euclidean distance is better than using normal Euclidean distance. For each pixel, the maximum distance to its neighbors is calculated as

$$D = \sqrt{\frac{(L_i - L)\Delta_1}{\sqrt{i}}}$$

A seed pixel candidate must have the maximum relative Euclidean distance to its eight neighbors less than a threshold value. If the pixel satisfied above condition it means that the pixel satisfied no-edge criteria.

For a pixel at $(i, j)$ the color value at location $(i, j)$ is $(h(i, j), s(i, j), v(i, j))$. We compute distance between original color value and average value as following equation.

$$d(i,j) = \sqrt{(v-x)^2 + (scosh-s^{-1}h)^2 + (sinh-s^{-1}h)^2}$$

The D-image of I(i, j) is defined as

$$D = \{d(i,j)\} \quad 0 \leq i \leq m$$
The value of $d(i, j)$ over $N(i, j)$ can be viewed as a measure of smoothness. Calculate the average and the standard deviation of $d$-value in the $D$-image, denoted by $t_d$ and $\sigma_d$ respectively.

The threshold is defined as:

$$T_d = \begin{cases} 
  t_d - 0.1\sigma_d, & (t_d - 0.1\sigma_d) < 0 \\
  t_d, & \text{otherwise}
\end{cases}$$

An initial seed pixel must have the $d$-value which is less than $T_d$.
A pixel is classified as seed pixel if it satisfied both above conditions. Fig.1 gives an image and the detected seeds.

I. EXPERIMENTAL RESULTS

The algorithm has been implemented in MATLAB-7 in Window XP and run on CPU 2.80GHz PC. The input images are obtained from Internet. The size of images are 481×321 or 321×481. We obtain following results.

![Initial seed selection results of “church”: (a) Original image, (b) The LUV image, (c) Non-edge image, (d) Smoothness considered image, (e) Seed pixels in red color](image)

II. CONCLUSION

A method of initial seed selection for color image segmentation is proposed. The non-edge and smoothness at pixel’s neighbor are used as criteria to determine seed pixels. Experimental results show that our method can get good seed selection results for next process of color image segmentation.

REFERENCES