COLOR BASED IMAGE SEGMENTATION AND OBJECT DETECTION FOR COLOR CONTENT BASED FEATURE EXTRACTION

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Abstract

Image is a representation of visual information. Objects and its shape are important aspect as image contains information about various useful structures during information analysis. Segmentation of image is one of the necessary task in image processing. It involves generation of various useful parts called segments as set of selected pixels belong to image. One of the objective of such division is to provide an ability to have automation in identification of various objects in image and analyze relevant information image contains. During the process of object extraction there is a need to separate image background and foreground in efficient and accurate manner. Image segmentation provides easy and more meaningful way to represent an image. In this paper CIE L*a*b* Color Segmentation using Green and Yellow Colors was implemented which can be extended to any other dominant color in image. Boundary extraction along with color segmentation implemented in this paper aims towards identification of various objects and their region color.

Keywords: Color Quantization, Color Segmentation, Boundary Detection, Object Detection, Color of Region Segments, CIE L*a*b* Color Space.

I. INTRODUCTION

Object content based image retrieval aims to provide a solution to the problem of finding an image containing an object of user interest [1]. Effectiveness of performance of content based image retrieval system aligns with its ability to access image object contents as per user interest. As there is an enough kind of togetherness between appearances of set of several regions of image various region based retrieval methods have been proposed [2]. These regions are called as different objects of image. In general an object in image processing is an identifiable portion of an image which is represented as a single unit. Object detection deals with identification of distinct real objects like vehicles, specific buildings, flowers, birds, animals and anything with a finite shape and structure within an image. These are treated as unique feature contents of images which are extracted as a set of structured pixels during image retrieval and matching process. Object detection algorithms and techniques take these features as input and analyze category of individual objects. Such detection and differentiation between object categories is quite difficult and intelligent task [1]. Various edge detection techniques such as Sobel, Prewitt, Roberts, Canny and many deals with image segmentation. Segmentation algorithms are applied to process edges which extracted through edge detection algorithms.

For situations where an image contains regions with homogeneous D. Comaniciu, P. Meer [3] developed clustering methods for color image segmentation. Still the problem lies in if an image contains variety of rich colors and textures. For example in natural scene images difficulty level is in identification of regions of images which contain multiples of similar color-texture patterns. Lindeberg and Li [4] developed an integrated part based image segmentation process to partition edges in image into

segments which are appear straight and curved for object recognition. Their approach was based on utilization of a criterion based on minimum description length. As there is a tremendous growth in capabilities of color imaging computer processing applications researchers concentrate more and more on the color image segmentation as an open problem [3].

In this paper, we focus on detecting various regions as different connected components and their associated colors with help of CIE Lab color image segmentation.

II. IMAGE SEGMENTATION

Image segmentation is a problem where an image is divided into multiple homogeneous meaningful structures. Homogeneous color region represents an object with similar structured color under white point. Several image processing applications intend to find a group of pixels that show a kind of togetherness. In such situations we require to find meaningful group of pixels that are used to determine object contents and its information [5]. Consider an image containing a car and there is a need to determine structure and length of the same. Major task involved to find a solution to this problem is identification of set of pixels which builds a car like structure. This kind of groups of pixels may or may not represent physical object are treated as objects in image. This is an image interpretation task involved in automated object recognition. Image segmentation is based on various properties of images such as grey level, color and texture such that these features of images are used to locate objects and boundaries [6]. Image segmentation involves a process which assigns a label to individual pixel. Pixels which have same label share certain common characteristics.

III. METHODOLOGY

A. *Color-Based Segmentation Using Conversion in CIE L*a*b* Color Space*

CIE L*a*b* color space gives a provision to do quantitative analysis of visual differences based on color value contents of images. The L*a*b* color space is a field color space obtained from CIE XYZ tristimulus values [7]. In L*a*b* space L* denotes brightness, a* is a color layer gives chrominance. It is an indicator for where actually a color belongs to on green to red axis. Color layer b* also denotes chrominance which indicates where color falls along the yellow to blue axis. In this work we proceed with image conversion from RGB image into the CIELAB color space. This color space was explicitly selected for conversion due to its perceptual uniformity characteristic [8]. Then we perform color segmentation as per steps mentioned below [9].

a) Take an image as input
b) Find sample colors in L*a*b* space for each RGB space
c) Apply nearest neighbor rule to classify every pixel
d) Display classification results
e) Display 'a*' and 'b*' values of the pixel colors.

B. *Edge detection*

Edge detection is a process which identifies and locates discontinuities which are sharp in nature in an image [10]. Techniques for edge detection concentrates on sufficient reduction in amount of data. It also filters for information which have very low contribution to image as a part of object. It also preserves important structural properties of regions of image. Region boundaries and edges within image have a close relationship due to existence of sharp in intensity adjustments in region boundaries. Many times identified edges have discontinuity. Identification of closed region boundaries is required during edge detection.

1) Boundary Extraction for Binary Image: Consider A as a matrix representing an image and B as its structure matrix. We calculate boundary as per steps mentioned below.

a) Take an image as input
b) Find sample colors in L*a*b* space for each RGB space

Perform subtraction among binary image and output of step b. Here we get boundary of image A.

2) Identification of objects in image: We identify multiple objects that image contains as per steps mentioned below.ned below.

a) Obtain binary image representation for input RGB image.
b) Identify and fill the holes.
c) Identify connectivity among image objects and apply individual label.
d) Label objects in the image based on connectivity 8:

i. Show the images of objects in RGB representation.
ii. Save the (x, y) positions of the object labeled as
1.
iii. Find the object 1 image size.
iv. Subtract highest and smallest y values to find
length.
v. Subtract highest and smallest x values to find
width.
vi. Map the pixel values of new image.

This gives an object in image. Apply above steps for all possible objects in image.

IV. EXPERIMENTAL RESULTS

Color image segmentation and boundary extraction were implemented using MATLAB. Outputs obtained during color segmentation and boundary extraction are mentioned in following sections.

A. *CIE L*a*b* Color Segmentation Results using Green and Yellow Colors*

CIE L*a*b* is mainly used color space for image representation in various imaging applications which aim for image retrievals. This color space is considered as uniform color space [7] as compared to RGB color space. To obtain different regions in image with a particular color we applied image segmentation. In this paper we implemented green color segmentation to separate out green colored regions in input image. We considered this color as input image contains green as dominant color. This was identified from the bin value with highest number of pixels. Color image segmentation can be extended to multiple dominant colors. Dominant color is identified from the highest histogram count for a particular bin color value.

Fig. 4.1.a

Fig. 4.1.b

Fig. 4.1.c

Fig. 4.1.d

Fig. 4.1.a shows input and Fig. 4.1.b represents its associated binary image. Fig. 4.1.c and Fig. 4.1.d show color segmentation using green color and yellow color when converted to CIE L*a*b* color space.

B. *Boundary Extraction Results*

Boundary extraction was applied on Input color image and Binary image is as shown in following figures.

Fig. 4.2.a

Fig. 4.2.b

Fig. 4.2.a shows color image boundary and Fig. 4.2.b shows binary image boundary.

C. *Different Objects Identification Input Image Results*

We have computed all possible objects in input image. Following figures 4.3(a, b, c) show few of major objects among 32 different objects obtained from input image.

Fig. 4.3.a.

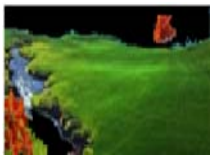

Fig. 4.3.b.

Fig. 4.3.c

Fig. 4.3.d.

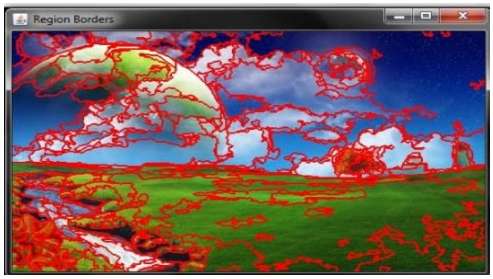

Fig. 4.3.e.

Figure 4.3(d, e) shows results for various region Objects, region boundaries and color of their segments respectively. Region objects give useful information about objects and their locations in image. This is important in image comparisons based on objects similarity which is useful in image retrieval systems.

V. CONCLUSION AND FUTURE SCOPE

We applied individual color segmentation on input image. From experimental results we were able to find various region and its objects which gave useful information about objects and their locations in image. This is important in image comparisons based on objects similarity which is useful in image retrieval systems.

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