Review Paper of Segmentation of Natural Images using HSL Color Space Based on K- Mean Clustering

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ABSTRACT

Image segmentation is one of the important part in image processing. Image segmentation is a process that divides the image into several parts according to its shape, pixel intensity, region formation or by other features. Image segmentation is the process which comes after the image compression and is followed by the various description parameters. The basic goal of image segmentation is to convert the given sample image into somewhat more meaningful and understandable. It is one of the challenging problem to efficiently segment the image into multiple segments as well as in understanding high level process such as robotics, face recognition, leaf structure study etc.

INTRODUCTION

Segmentation is a process which involves deviding the image into various segments to have isolate area of interest. Segmentation enable us to have high level of knowledge from given sample of image. Image segmentation is basically used to locate objects and boundaries (lines, curves, etc.) in images. More simply, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

An RGB color model has three basic colors Red, Green and Blue which merge together in various proportion to produce various range of colors. Zero intensity for each component gives the darkest color which means black color, and full intensity of each gives a white; the quality of this white depends on the nature of the primary light sources, but if they are properly balanced, the result is a neutral white matching the system's white shade point. When the intensities for all the components are the same, the result is a shade of gray, darker or lighter depending on the intensity. When the intensities are different, the result is a colorized hue, more or less saturated depending on the difference of the strongest and weakest of the intensities of the primary colors employed.

COLOR MODELS

A color model is an abstract mathematical model describing the way colors can be represented as tuples of numbers, typically as three or four values or color components.

CIE XYZ color space

This model is Devloped in 1931 by international comission on illumination. Initially it is used for measurement for human beings and to give 2 degree view later in 1964 it is modified to give 10 degree view.

RGB color model
Media cover light that is mostly consisting of three colors Red Green and blue. This three colors mixes in definite proportion to give different color combination. These colors cover a huge part of human colors space and his most of experiences. Value of the each color produced varies from 0 to 255.

**HSV and HSL representations**

Geometry of RGB is poorly matched with the original human perception.

![HSV and HSL representations](image)

So researchers devolped a way to convert the color cube representation of rgb into representation of hue saturation and Luminance

**CMYK color model**

A large no of human seen colors can be obtain by mixing cyan magenta and yellow colors on white substrate. Often sometime black ink is added to it for reproduction of some black color.

**COLOR MAP**

A colormap is matrix of values between 0 and 1 that define the colors for graphics objects such as surface, image, and patch objects. MATLAB draws the objects by mapping data values to colors in the colormap. Colormaps can be any length, but must be three columns wide. Each row in the matrix defines one color using an RGB triplet. An RGB triplet is a three-element row vector whose elements specify the intensities of the red, green, and blue components of the color. The intensities must be in the range [0, 1]. A value of 0 indicates no color and a value of 1 indicates full intensity colormap name sets the colormap for the current figure to the built-in colormap specified by name. The new colormap uses the same number of colors as the current colormap. The figure colormap affects all axes in the figure, unless you set an axes colormap separately. Colormap (map) sets the colormap for the current figure to the colormap specified by map. The figure colormap affects all axes in the figure, unless you set an axes colormap separately. Use this syntax if you want to use a built-in colormap with a specific number of colors or if you want to use a custom colormap.

- For a built-in colormap with a specific number of colors, specify map as one of the built-in colormap functions and pass it an integer value as an input argument. For example, colormap (summer (10)) uses 10 colors from the summer colormap. If you do not specify the number of colors, such as colormap (summer), then the colormap contains the same number of colors as the current colormap.

- For a custom colormap, specify map as a three-column matrix of values in the range [0, 1] where each row is an RGB triplet that defines one color of the colormap. An RGB triplet is a three-element row vector specifying the red, green, and blue intensities for a color.

**COLOR GAMUT**

Color gamut is complete subset of colors. It may define as colors which are find in image for a given time. It is basically used in the hue-saturation plane where system can produce large variety of intensity range within its color gamut. When particular colors are not defined in given color model then it is said to be out of gamut. Pure red color is example of it. Pure red color can be applied in RGB model whereas it is not available in CMYK model.

General description of segmentation

1. **Compressed image** image which is compressed by various compression algorithm are given as input to the image segmentation step.

2. **Image segmentation** image produced is segmented by the various algorithms based on various properties of the image. Segmentation aims to partition the image into constituents parts on basis of various properties discussed as
(a) Line detection: in this method the image is segmented on the basis of the boundary lines of the images. Thus the image is partition on the criteria of boundary lines produced in image.

(b) Thresholding: this is method of image segmentation which turn grey scale image to binary image on the basis pf predefined thresholding value.

(c) Clustering: in this method the sample image is segmented into different clusters either randomly or by some predefined method. The pixels in particular belong to a similliar set of properties.

(d) Compression based method: - This method provides way to find minimum set of possible segmentations on the basis of any pattern in image or any regularity in the image.

(e) Histogram method: - this method proves to be one of best as this method require processing of the image pixels once the histogram produces contain peak which give information about various clusters.

(f) Region growing method: - this method picks up different regions in image , in which every region has same set of pixels having similliar properties. In this each pixels in compared with its neighbour pixel and if the pixel properties matches then it belong to given region otherwise next.

(g) K Mean Clustering Method -K mean clustering is vector quantization method which partition image into different cluster on the basis of mean of similliar pixelset whereas no of cluster are pre defined. In this each cluster have a centriod which represent mean of the cluster. The particular group is obtain is by substracting the square distance between items called Euclidean distance and correspoding centriod.commonly used initialization method are Forgy and random partition. Forgy method selects k observations from the given pixelset and uses it as initial mean. Forgy method tries to spread initial mean out whereas random partition put them close of the pixelset

**HSL COLOR SPACE**

HSL stands for Hue, Saturation, and Lightness. This is one of most accepted cylindrical coordinate system in RGB color model. In each cylinder the angle surrounding the central axis is Hue, the distance from the axis is shown by saturation and the distance along the axis described by lightness. HSL color is simply device transformation of the RGB color model so the physical color they define depend on the amount of Red Green Blue color described by the RGB color

![HSL Color Space Diagram](image)

Space and gamma correction used to represent those primaries. In this model hue component having angular momentum, starting at the red primary at 0, passing through the green primary at 120 and blue at 240 and then wrapping back to red at 360. In each geometry, the central vertical axis comprises the neutral, achromatic, or gray colors, ranging from black at lightness 0 or value 0, the bottom, to white at lightness 1 or value 1, the top.

**K-means Clustering and Segmentation**

Ms. Bhakti N. Palkar (2014) introduced a vector quantization supported segmentation approach that was specially designed to segment low-altitude, high resolution, aerial images, a preprocessing step to 3D reconstruction. The main approach used vector quantization algorithms-K-Means clustering to form segments. The criteria used to merge the adjacent region are the color simillarity and volume difference. This algorithm give better result as compared to conventional on-the-fly watershed algorithm.Sheetal Thorave et al. (2014) introduced a new method for fabric defect detection using automatic visual analysis. The K-mean clustering method has highly efficient and accurate defect detection keeping in fous the efficient computing
time. Naina Pal et al. (2014) put forward idea of K-means and fuzzy logic for clustering processes concluding that the k-means clustering was consider as hard clustering and fuzzy k-means was soft clustering. Also it stated that Fuzzy K-means took lesser time to cluster the images than K-means. Soumya D. S et al. (2013) suggested a method that ran faster than the Improved Fuzzy C-Means Clustering (IAFCM) algorithm. The author proposed that a filter can be applied with this k-means clustering for de-noising. The author dictated that Fuzzy C-Means Clustering was a soft version of K-means, where each data point has a fuzzy degree of belonging to each cluster. Ms. Chinki Chandhok et al. (2012) expressed new approach for image segmentation by applying k-means algorithm. It suggests a color-based segmentation method that used K-means clustering technique. The k-means algorithm was an iterative technique used to partition images into k clusters. According to the author the standard K-Means algorithm only gave correct segmentation results when applied to images supported by regions with homogeneity in texture and color, since no local rules were imposed to give spatial continuity. At first, the pixels were clustered on the basis of spatial and color features, where the clustering process was accomplished. Then the clustered blocks were joined to a specific number of regions with improved quality of segmentation in terms of precision and computational time. T. Kanungo et al. (2002) discussed an efficient K-Means Clustering Algorithm. Author assumed the set of k points, called centers, in d-dimensional space „Rd” minimizing the mean squared distance of each data point from its nearest center, given the set of n data points in Rd,. Lloyd's k-means clustering algorithm,that is also known as filtering algorithm, was implemented in simple and efficient manner. The practical efficiency of the filtering algorithm was established in two ways. Firstly, by presenting a data-sensitive result of computational time of algorithm; secondly a number of empirical studies both on data generated synthetically and on real data sets from applications in data compression, color quantization and image segmentation.

REFERENCES