Color Histogram

(CH)

Hariom Verma (CS171026)
[hariom18599@gmail.com]

Sahil Babani (CS171066)
[sahilbabani1997@gmail.com]

Abhiti Darbar (CS171005)
[darbarabhiti@gmail.com]

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Introduction

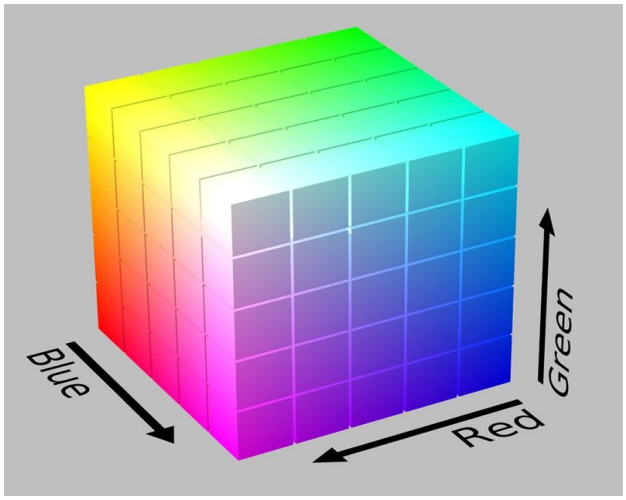
1.1 What is Histogram

The histogram is the most commonly used structure to represent any global feature composition of an image. It is invariant to image translation and rotation, and normalizing the histo- gram leads to scale invariance. Exploiting the above properties, the histogram is very useful for indexing and retrieving images

1.2 Color Histogram

color histogram is a representation of the distribution of colors in an image. For digital images, a color histogram represents the number of pixels that have colors in each of a fixed list of color ranges, that span the image's color space, the set of all possible colors.

Typically, images are represented as a 3-tuple of Red, Green, and Blue (RGB). We often think of the RGB color space as “cube”, as shown below:



A color histogram focuses only on the proportion of the number of different types of colors, regardless of the spatial location of the colors. The values of a color histogram are from statistics. They show the statistical distribution of colors and the essential tone of an image.

Mathematical Formulation

2.1 Calculating center of image

The center of the image can be calculated as :

(px,py)=height/2,width/2

2.2 Calculating center of ellipse

The center of the ellipse can be calculated as :

x^2/a^2 + y^2/b^2 = 1

(a, b) = (int(w * 0.75) // 2, int(h * 0.75) // 2)

2.3 Segments

The image segments can be divided as :

[(0, cX, 0, cY), (cX, w, 0, cY), (cX, w, cY, h),(0, cX, cY, h)]

Algorithm

Region based Color Histogram Algorithm

Input: `Image`

Output: `1D-Array having 85 features`

```
1.read image in rgb mode

2.store its height and width

3.Find its center points i.e cX,cY=(int(w/2),int(h/2))

4.devide image into sections:

     4.1 divide image into left-top,right-top,left-bottom,right-bottom
          and center ellipse:


     4.2 create mask for every section

5. For every section:

     5.1 calculate histogram in 3 channel i.e red,green and blue, with
          (8,8,8) as bins and provided mask

     5.2 flatten this histogram into 1-D array

     5.3 normalized this histogram

6. Append this list into feature array

7. Return feature
```

Documentation of API

Calculate histogram of red, green and blue with masking dividing image into 5 parts top-left, bottom-left, top-right, bottom-right and center ellipse.

Syntax : Regional(image)

Parameters :
image : Image for which descriptors to be calculated. (use opencv or any other library to read image)

Return type :
1D Array

Example

```
import cv2 as cv
from package.color_histogram import color_histogram as ch
image = cv.imread('lines.jpg')
color = ch.ColorHistogram((8,8,8))
features = Color.Regional(image)
```

Learning Outcome

- Extracting the colour descriptor.
- Representation of images in RGB format.
- Normalization of histogram.

References

[1]: https://onlinelibrary.wiley.com/doi/pdf/10.4218/etrij.02.0102.0103