Image Analysis Object Recognition
Digital Engineering MSc
Bauhaus University Weimar
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Assignment 5 Group 13

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1 K-Mean

a Introduction

In this assignment, K-mean algorithm implemented using RGB space and RGBXY space. In RGB space, each pixels Red, Green, and Blue colors channels are considered. Where as in RGBXY space, along with Red, Green, and Blue color channels, spacial information (X and Y) of the each pixels is considered. To test the implemented algorithm, one test image is considered, see Fig. 1.

K-Mean method algorithm steps.

1. k Number of clusters are considered randomly.
   (a) In case of RGB feature space, Red, Blue, and Green channels of each pixel are considered for feature space. k clusters with 3 coordinates.
   (b) In RGBXY feature space, along with red, blue, green channels, X coordinate and Y coordinate of each pixel are considered for feature space. k clusters with 5 coordinates.
2. Calculate the each pixel distance from every cluster points in feature space.
3. Allocate the each pixels to respective closest cluster point.

Figure 1: Sample image to test the K-mean implementation

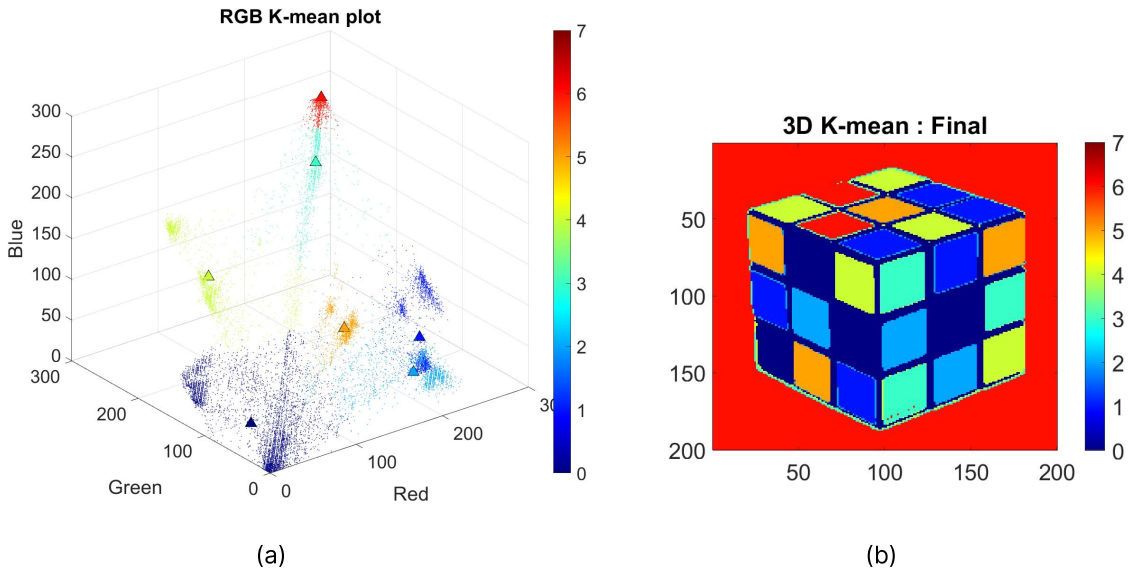

Figure 2: RGB feature space ($k = 7$) and cluster image.

4. Calculate the center of mass of each cluster set.
5. Move cluster point to center of mass of respective pixels.
6. repeat steps 2-5 until cluster point remain unchanged.

b RGB feature space

RGB color channels are considered for feature space hence it is a 3D feature space. The algorithm created clusters based upon RGB color information of the each pixel. In the image, similar colour regions associated with single cluster.

When number of clusters k=7 is considered, Fig. 2(1) is the corresponding feature space. Each feature spread across the image. Cluster centers are represented with Δ symbol. similar colour feature points have same cluster center. In Fig. 2(b) Cluster segmentation visualized on the sample image.

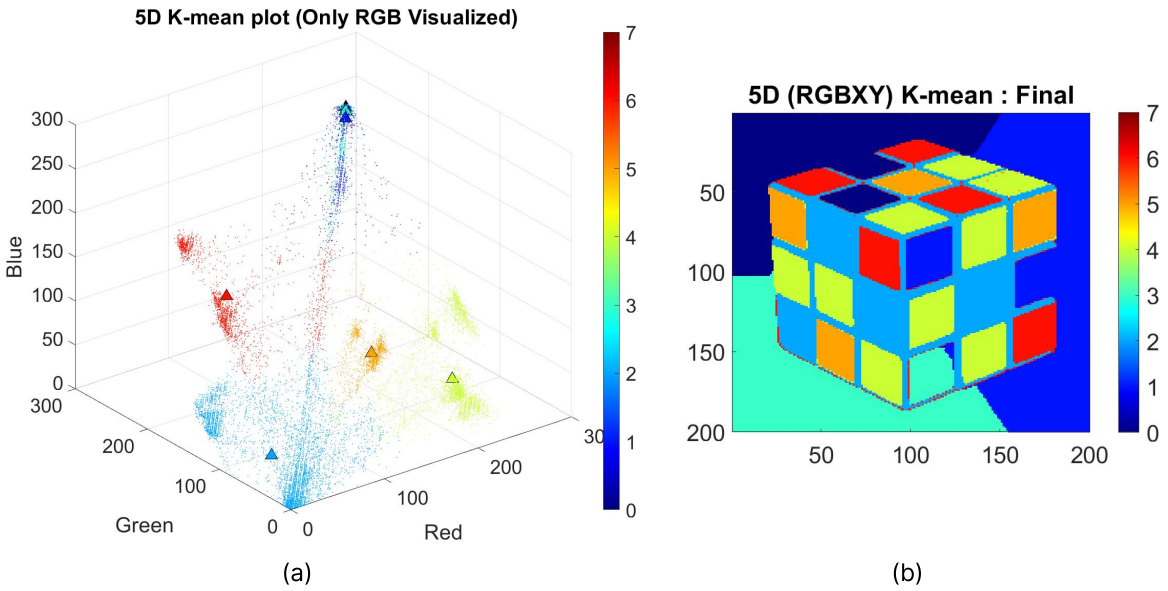

Figure 3: RGBXY feature space ($k = 7$) and cluster image

c RGBXY feature space

Considering spacial coordinates into the feature space along with RGB channels categorised the image based upon both color and region. In this problem number of cluster considered as 7 ($k = 7$), same as Section b. See Fig. 3(a) for visualization of only RGB coordinates from 5D feature space. In the figure we can see that the same color pixels are accumulated in different cluster category. It is due to consideration of spacial coordinates of the pixels in feature space. Fig. 3(a) the top pixels (white color pixels) are divided into 3 different cluster categories. Same is visualised in Fig. 3. While background is in three different cluster set.

d Results Discussions

The implemented K-Mean algorithm working well with the provided low resolution images. If high resolution are given as input the algorithm will take significantly more time to process.

For the given image, 7 clusters categorized the image into reasonable clusters. from Fig. 2 and Fig. 3 It is evident that RGB feature space provided better results than RGBXY feature space. RGB feature space considered images based upon their color and RGBXY feature space considered pixels position and categorised same color pixels into three different regions.

Following are remarks in current implementation :

1. In the both 3D and 5D feature space implementation , whenever there is a color transition in the image, those pixels considered into new cluster set the its neighbouring pixel cluster set.

2. Pixel clustering is heavily depending upon the initial guess of the cluster centers.

3. If one pixels doesn't have any closest pixel in the initial loop, that pixels position remained unchanged through out the clustering process.