University of Hacettepe

BBM 415

Image Processing Laboratory

Problem Set 5

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Contents

Introduction

Clustering can be considered the most important unsupervised learning problem; so, as every other problem of this kind, it deals with finding a structure in a collection of unlabeled data. A loose definition of clustering could be the process of organizing objects into groups whose members are similar in some way. A cluster is therefore a collection of objects which are similar between them and are dissimilar to the objects belonging to other clusters. Feature is point of interest for image description.

1 Pixel Level Features

Two different features for each pixel in the image obtained; RGB colors feature and RGB colors and spatial location feature in a vector like [R G B] and [R G B x y]. It was used for the K-means clustering. Color and location values have different range of numbers.Special attention was paid for it.

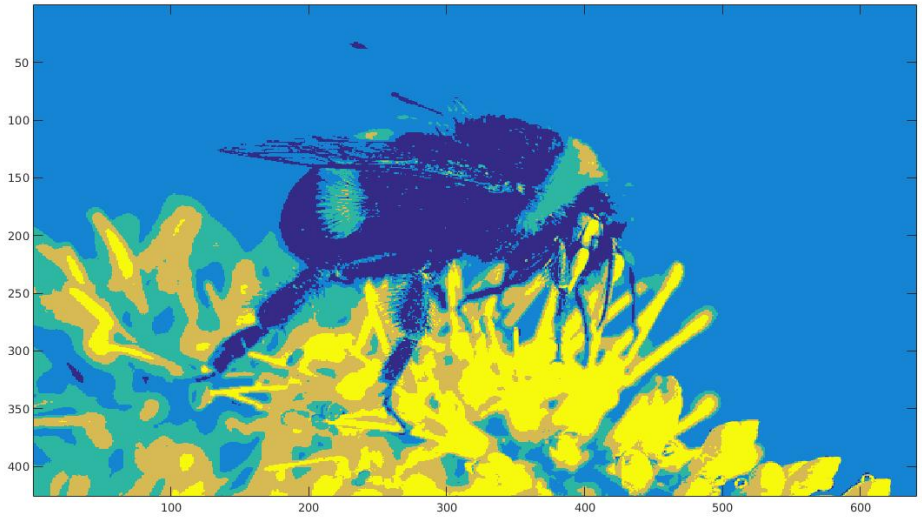
1.1 Effects of Parameters

We used mxnx3 matrix for RGB color feature. We used mxnx5 matrix for RGBxy. For RGB color feature, we were interested in just color information. However we had color and location values for RGB color and spatial location feature. We can say about k that if it is increased, the results show us details of image. When we compare two steps, in the second step we used location information too.

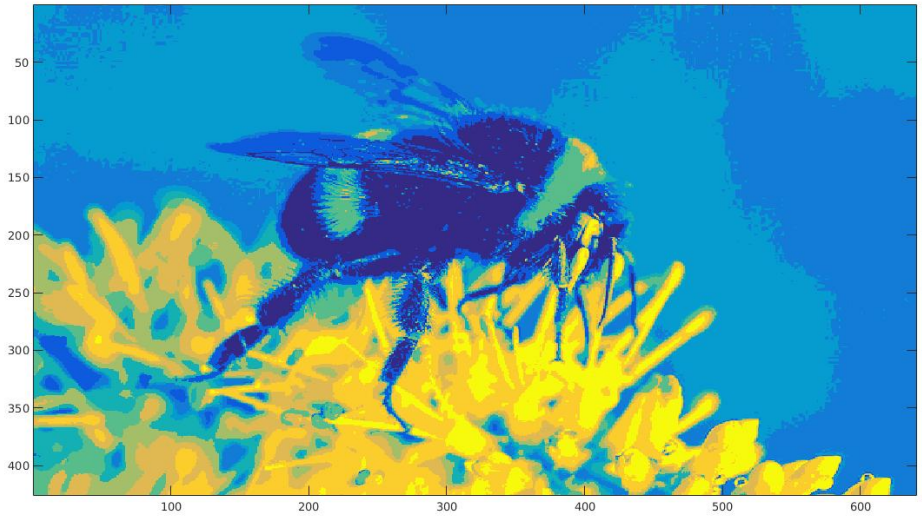
1.2 Inputs Outputs

1.2.1 RGB Color Feature

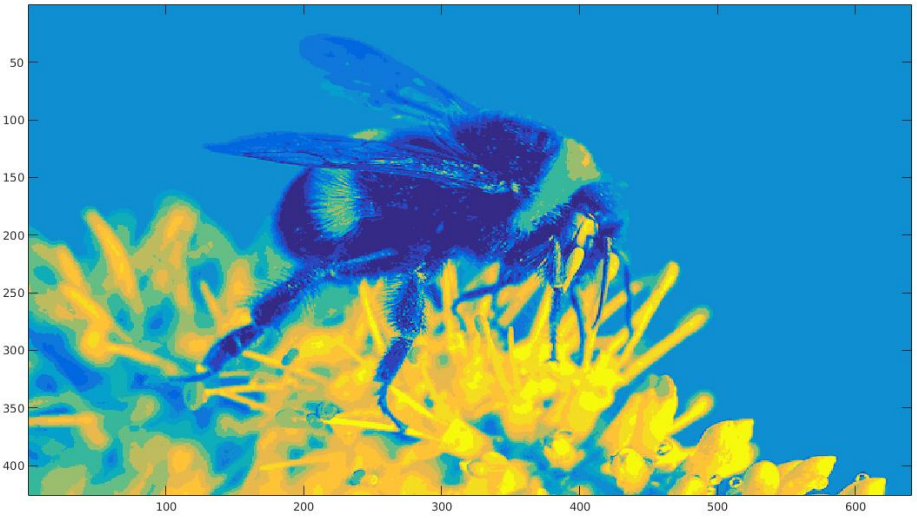
Results for k=5;



Results for k=10;

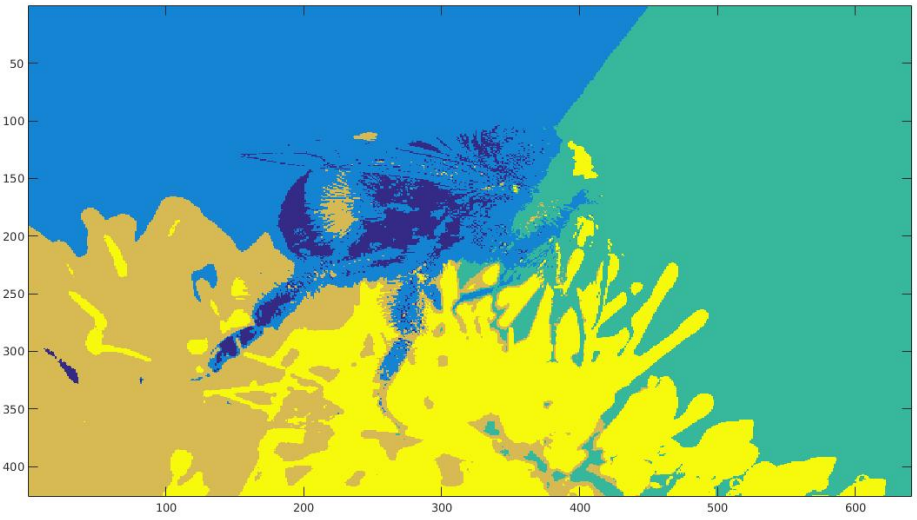


Results for k=15;

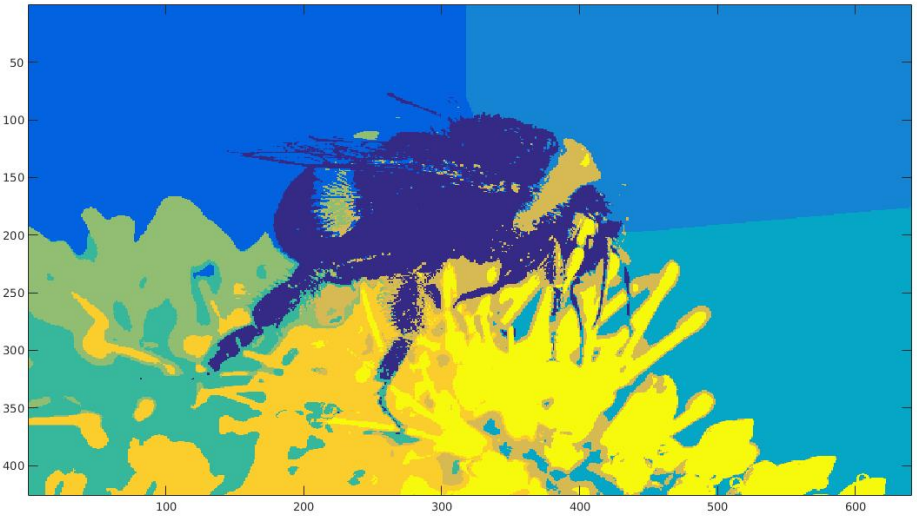


1.2.2 RGB Color And Spatial Location Feature

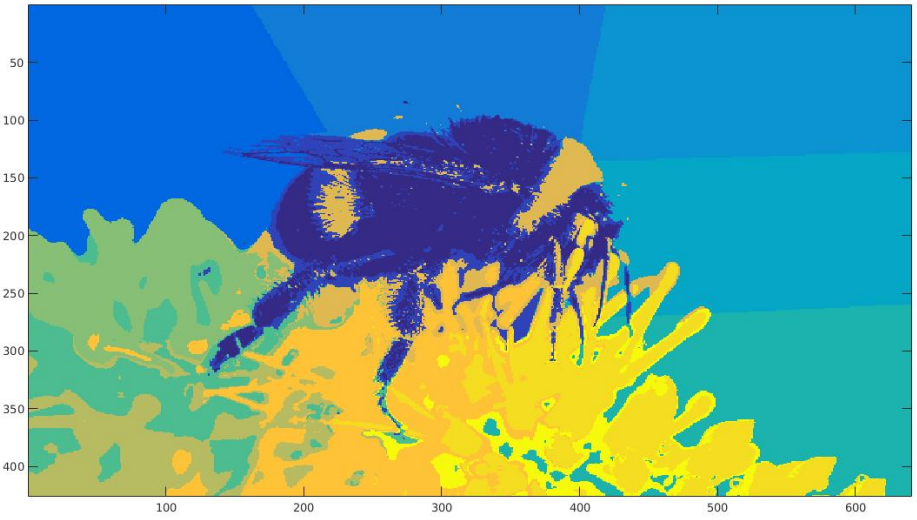
Results for k=5;



Results for k=10;



Results for k=15;



2 Superpixel Level Features

2.1 Problem Definition

In this part we introduce a novel algorithm called SLIC (Simple Linear Iterative Clustering) that clusters pixels in the combined three-dimensional color and image plane space to efficiently generate superpixels.There are three case; mean of RGB color values, RGB color histogram and mean of Gabor filter responses.For first step, it should be gotten mean of RGB color values.For second step, every superpixel should be represented the mean of color values for pixels by RGB color histogram. For last step, it should be created special Gabor filters and they should be kept in a filterbank. Then the image should be filtered with in Gabor filterbank. Each superpixel should be represented mean of Gabor filter response values of every pixel.

2.2 Solution

2.2.1 Inputs Outputs

Mean Of RGB

RESULTS FOR K=5;

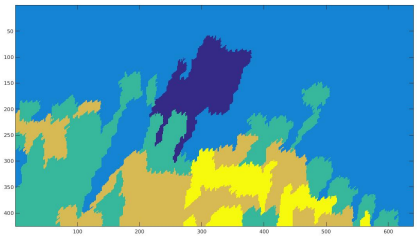


Figure 1: superpixel level=500

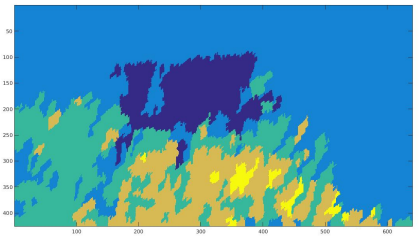


Figure 2: superpixel level=2000

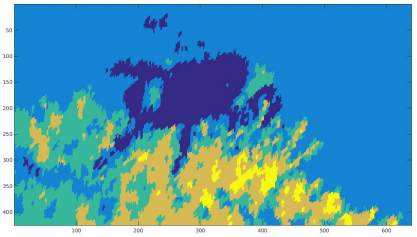


Figure 3: superpixel level=5000

Results for k=10;

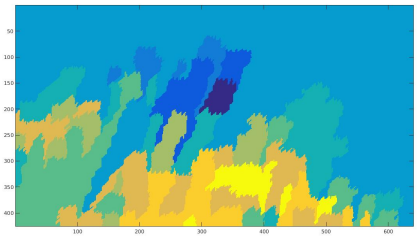


Figure 4: superpixel level=500

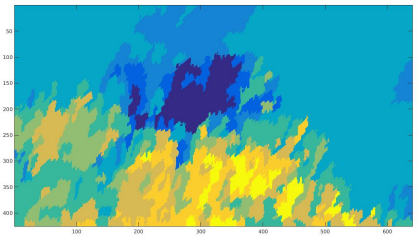


Figure 5: superpixel level=2000

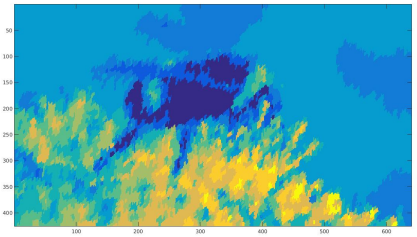


Figure 6: superpixel level=5000

Results for k=15;

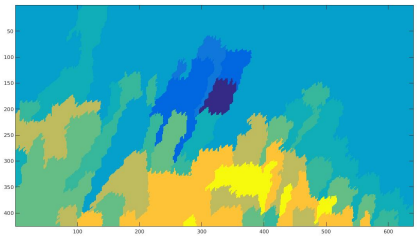


Figure 7: superpixel level=500

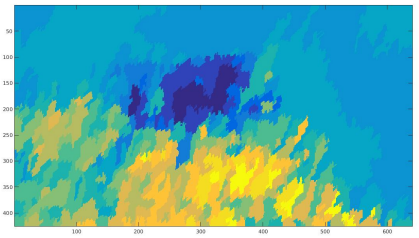


Figure 8: superpixel level=2000

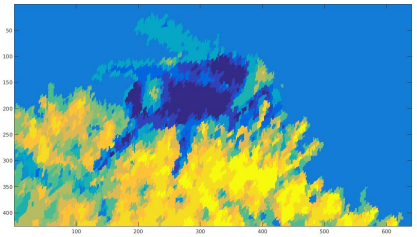


Figure 9: superpixel level=5000

RGB Color Histogram

RESULTS FOR K=5;

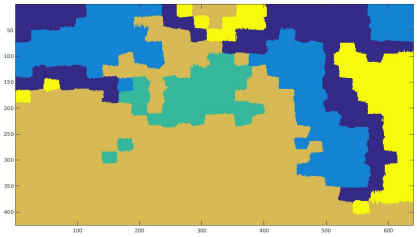


Figure 10: superpixel level=500

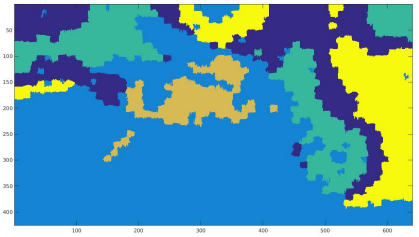


Figure 11: superpixel level=2000

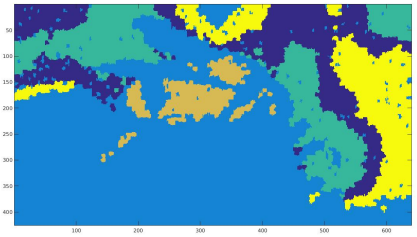


Figure 12: superpixel level=5000

Results for k=10;

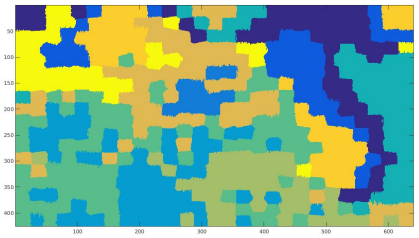


Figure 13: superpixel level=500

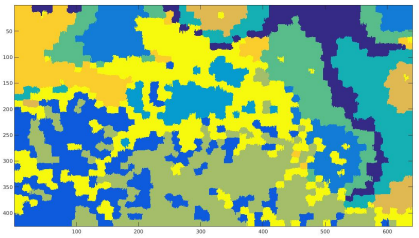


Figure 14: superpixel level=2000

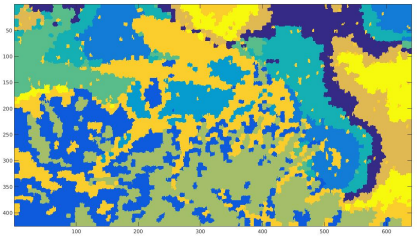


Figure 15: superpixel level=5000

Results for k=15;

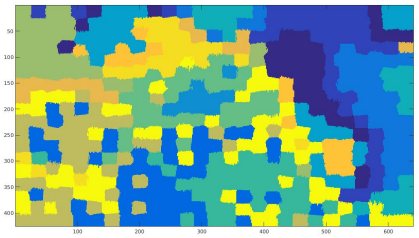


Figure 16: superpixel level=500

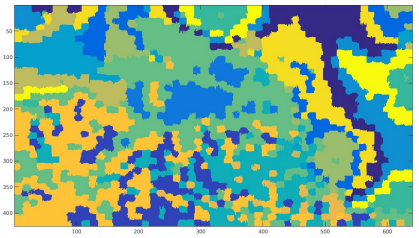


Figure 17: superpixel level=2000

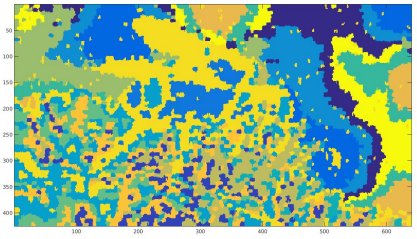


Figure 18: superpixel level=5000

Mean Of Gabor Filter Responses

2.3 Effects of Parameters

We used numofSuperPixelx1x3 matrix for mean of RGB color values. We used all intensity values in RGB channels to divide image to segments by RGB color histogram procedure. We used numofSuperPixelx1x256*3 for RGB color histogram. We didn't generate a Gabor filter bank that why we didn't finish this step.

3 K-means Clustering

K-means clustering is the easiest way to fix clustering problem. The main idea is to define k field, one for each cluster.

Steps for K-means Clustering

1. Randomly place K points into the space represented by the objects that are being clustered. These points represent initial group fields.
2. Assign each object to the group that has the closest field.
3. When all objects have been assigned, recalculate the positions of the K field.
4. Repeat Steps 2 and 3 until no more longer move..

K-means function should be get two parameters(feature matrix, k). It should be generate k number of field. Then in the fields the mean should be changed recursively while it is same point for each field. It should be used for pixel-feature level features and superpixel-level features.

3.1 Solution

3.2 Effects of Parameters

k parameter: k parameter is defining the number of field.We are randomly choosing k point and trying to find the most close pixels for these point. When the definition of field is completed, for each field we are trying to find point of the mean of the field recursively. If we increase number of k, we can interested in less pixels because the fields have less size so we can see the image which has more details.

Superpixel level: Superpixel is finding field that has same color. Superpixel level is the number of the field has same color. In step one that is mean of RGB colors, if we are using high superpixel level, it can be search field that has less size and it could be draw that has same color area for each superpixel.So super pixel level is giving the color information in image and high superpixel level has more detail than low superpixel level in color perception.

Superpixel level features is faster than pixel-level features. It is more efficienty than pixel-level features.