BIL 415 - Image Processing Practicum

1 Means Shift Clustering for Image Segmentation

Due Date: 23:59pm on Monday, January 6th, 2016

a) Input Image   b) Depth Map   c) Segmentation Result

Figure 1: Mean Shift Image Segmentation

Background

Clustering is a process that groups data with respect to data similarity so that similar data take part same cluster. In image domain clustering is used for various types of problem e.g. *image quantization*, *image segmentation*. A good clustering algorithm must group data to homogeneous subsets as possibble. Mean shift clustering is one of the most efficient clustering algorithm that groups data to dissimilar clusters. It is an unsupervised learning algorithm for clustering problem and the main idea is to define a search window for one of each data point in feature space. These search windows find dense points by shifting to means of them in each step until no change occurs. These dense points in feature space are assigned as cluster centers. In the last step, all data points are end up near the same dense point are grouped in the same cluster.

Overview

In this assignment, you will use mean shift clustering algorithm for image segmentation by using color, spatial and depth information:

- Feature Representation of Each Image Pixel

  You will define a feature vector to represent each pixel. This feature vector may contain various type of features such as color,intensity, location, depth or 1st order statistics of these features in vicinity of pixels e.g. *means of intensities*. You will build up your own feature representation.

- Means Shift Clustering

  You can use off-the-shelf mean shift clustering codes. You will give feature points obtained from each pixel and search window size to mean shift algorithm so that mean shift algorithm will produce cluster labels for each image pixel.

Details

Your Matlab program will take an color or gray level image and search window size as input and produce segmentation result.

-You must take results on the least 5 images. You can find lots of images with depth maps in NYU Depth Dataset[2].

-You must play with search window size according to the image content to obtain good results.

-You must analyze effect of each specific feature to result you obtained. For example, how does depth information or spatial information affect the result?

-You must comment your results why they are satisfactory or not.

What to Hand In

You are required to submit all your code along with a short report. For that purpose, prepare a folder containing

- README.txt *(text file containing details about your code)*

- code/ *(directory containing all your code)*

- report.pdf/ *(a report which is prepared with LATEX)*

Archive this folder as studentid.zip and submit via https://submit.cs.hacettepe.edu.tr .
In this assignment you will write detailed report which contains a brief overview of the problem, details of your implementation and the results with your comments. You must play with related parameters. .All results you obtain must be put to your report and all observations must be specified clearly. Analyzing the results with appropriate comments you will do is important for this assignment.

If your algorithm failed to give a satisfactory result on a particular image, provide a brief explanation of the reason(s).

Policy

All work on assignments must be done individually unless stated otherwise. You are encouraged to discuss with your classmates about the given assignments, but these discussions should be carried out in an abstract way. That is, discussions related to a particular solution to a specific problem (either in actual code or in the pseudo code) will not be tolerated. In short, turning in someone elses work(from internet), in whole or in part, as your own will be considered as a violation of academic integrity. Please note that the former condition also holds for the material found on the web as everything on the web has been written by someone else.

References

[1] http://cs.nyu.edu/ silberman/datasets/nyu_depth_v2.html