Spectral clustering
Programming assignment - 4

November 22, 2017

Abstract

Implement over-segmentation using Normalized Cuts..

1 Introduction

The image segmentation problem is to partition an image into multiple regions with same feature.

Spectral clustering techniques perform dimensionality reduction on eigenvalues of the similarity matrix of the data before clustering in fewer dimensions.

2 Algorithmns

1. Import the two images in grayscale format. resize the image to reduce memory consumption.
2. Construct a weighted graph $G(V; E)$ by taking each pixel as a node. The weight on the edges depends on the spatial location and intensity value. two pixels which are closer and have similar intensity are given high weight.
3. Compute the weights as follows :

$$w_{ij} = e^{\frac{-\|F_i - F_j\|^2}{\sigma_I^2}} * e^{\frac{-\|X_i - X_j\|^2}{\sigma_X^2}} \quad if||X_i - X_j|| < r \tag{1}$$

4. Solve for the eigenvectors with the smallest eigenvalues of the system

$$(D - W)_y = \lambda D_y$$

5. use the top eigenvectors as n dimensional indicator. Perform K-means clustering on the rows of the eigenvectors matrix.

3 Implementation details

1. the following parameters were used : $\sigma_I = 0.1$, $\sigma_X = 15$.
2. threshold distance, r = 5.

4 Results

figure 1.1: clustering for into 5 components

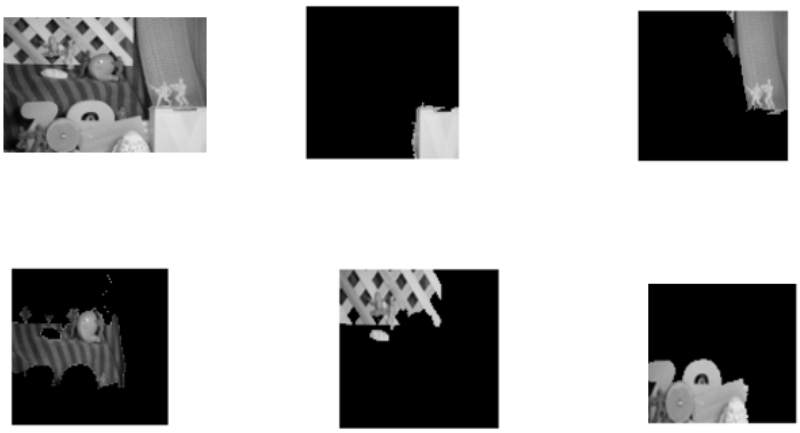

figure 1.2: clustering for into 5 components

References

[1] Jianbo Shi and Jitendra Malik, Member, IEEE, *Normalized Cuts and Image Segmentation.*

[2] www.mathworks.com

[3] Ulrike von Luxburg, A Tutorial on Spectral Clustering

[4] https://in.mathworks.com/matlabcentral/fileexchange/41526-gray-scale-image-segmentation-using-normalized-graphcuts?focused=3784795tab=function