**Lecture 6: Image Segmentation**

1871098 Son Sumin

* Thresholding

Image segmentation is the method that divides an image into non-overlapping regions(object) with similar information. It is a kind of labeling problem.

Single threshold shows the hidden aspects of an image. You can also use double threshold using two thresholds. Then how to predict appropriate threshold? By watching out the histogram, we can find the threshold between two dominant distributions. Otsu’s method’s key idea is that exhaustively searching for the threshold that minimizes the within-class variance and maximizes the between-class variance when there are two representative distributions. The within-class variance uses probability sum. And then you can seek the optimal threshold k by minimizing the within-class variance in recursive way.

Adaptive thresholding based on moving averages. It works well when objects are small with respect to an image size. T is not constant, but function compared to Otsu’s method.

* K-mean clustering

It goal is choosing three “centers” as the representative intensities, and labeling every pixel according to which of these centers it is nearest to. But K should be predefined. It is a “chicken and egg” problem in Label or cluster center. Basic idea is that randomly initialize the k cluster centers and iterate between the two steps we just saw.

Feature Space on Image Segmentation

Depending on what we choose as the feature space, we can group pixels in different ways. For example, grouping pixels based on intensity, color, intensity+position and texture.

In summary, k-means is simple, fast to compute but it has problem with setting k, and it is sensitive to initial centers and outliers.

* Mean shift segmentation

It is a clustering-based segmentation. And it seeks modes or local maxima of density in the feature space. By finding mode using iterative mode search, we can find k when we used in k-means. Mode is local maximum of the density of given distribution. It is easy to see, but hard to compute. Mean shift segmentation does not assume shape in clusters. Also it has only one parameter choice. But it has the problem of selecting of window size. And it does not scale well with dimension of feature space.