Lecture-04

Segmentation

Region growing

- There are a few main points that are important to consider when trying to segment an image.
  - You must have regions that are disjoint because a single point cannot be contained in two different regions.
  - The regions must span the entire image because each point has to belong to one region or another.
  - To get regions at all, you must define some property that will be true for each region that you define.

Seeded Region Growing

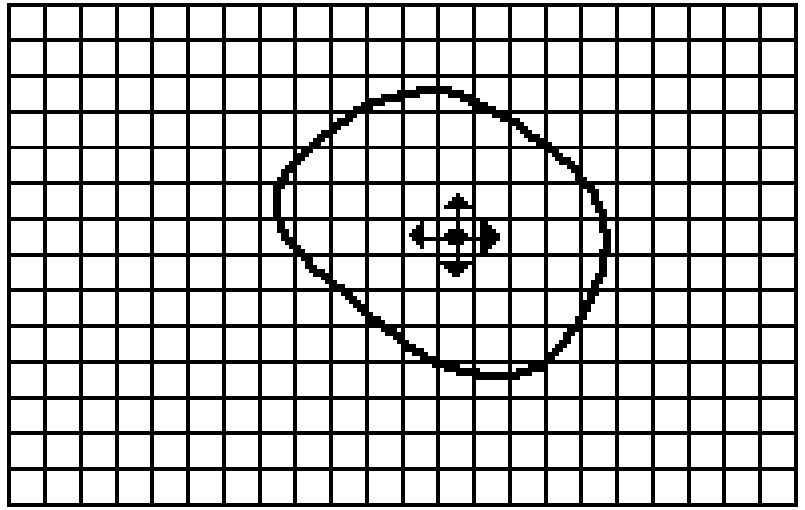
- The seeded region growing (SRG) algorithm is one of the simplest region-based segmentation methods.
- It performs a segmentation of an image with examine the neighboring pixels of a set of points, known as seed points, and determine whether the pixels could be classified to the cluster of seed point or not. The algorithm procedure is as follows.

The seeded region growing (SRG) algorithm

- **Step1**.
  - We start with a number of seed points which have been clustered into n clusters, called $C_1, C_2, \dots, C_n$, And the positions of initial seed points is set as $p_1, p_2, \dots, p_n$.
- **Step2**.
  - To compute the difference of pixel value of the initial seed point pi and its neighboring points, if the difference is smaller than the threshold (criterion) we define, the neighboring point could be classified into C_i, where $i = 1, 2, \dots, n$.

The seeded region growing (SRG) algorithm

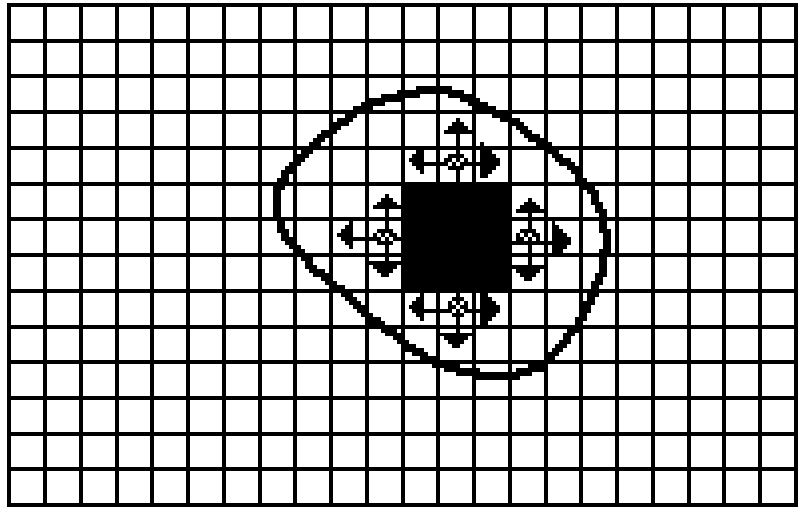
- **Step3**.
  - Recompute the boundary of C_i and set those boundary points as new seed points pi (s). In addition, the mean pixel values of C_i have to be recomputed, respectively.
- **Step4**.
  - Repeat Step2 and 3 until all pixels in image have been allocated to a suitable cluster.



Seed Pixel

Direction of Growth

(a) Start of Growing a Region



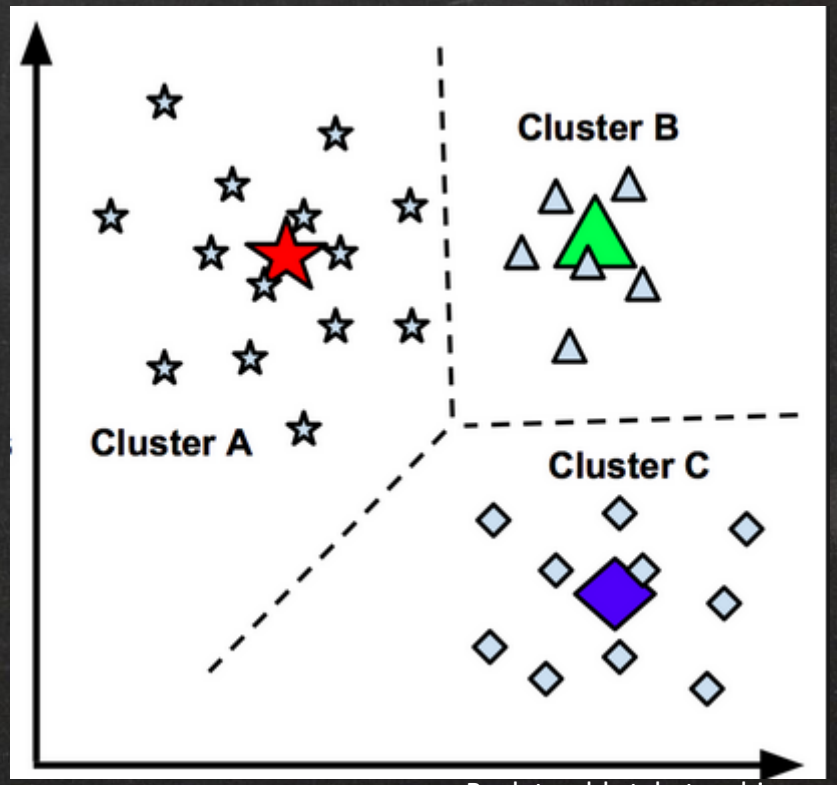
Grown Pixels

Pixels Being Considered

(b) Growing Process After a Few Iterations

Segmentation by clustering : k-means

- The most famous partitional clustering algorithm is k-means clustering.



Segmentation by clustering : k-means

- **Step1**.
  - Determine the number of clusters we want in the final classified result and set the number as N. Randomly select N patterns in the whole data bases as the N centroids of N clusters.
- **Step2**.
  - Classify each pattern to the closest cluster centroid. The closest usually represent the pixel value is similarity, but it still can consider other features.

Segmentation by clustering : k-means

- **Step2**.
  - Classify each pattern to the closest cluster centroid. The closest usually represent the pixel value is similarity, but it still can consider other features.

Segmentation by clustering : k-means

- **Step3**.
  - Recompute the cluster centroids and then there have N centroids of N clusters as we do after Step1.
- **Step4**.
  - Repeat the iteration of Step 2 to 3 until a convergence criterion is met. The typical convergence criteria are: no reassignment of any pattern from one cluster to another, or the minimal decrease in squared error.