Data Mining Cluster Analysis

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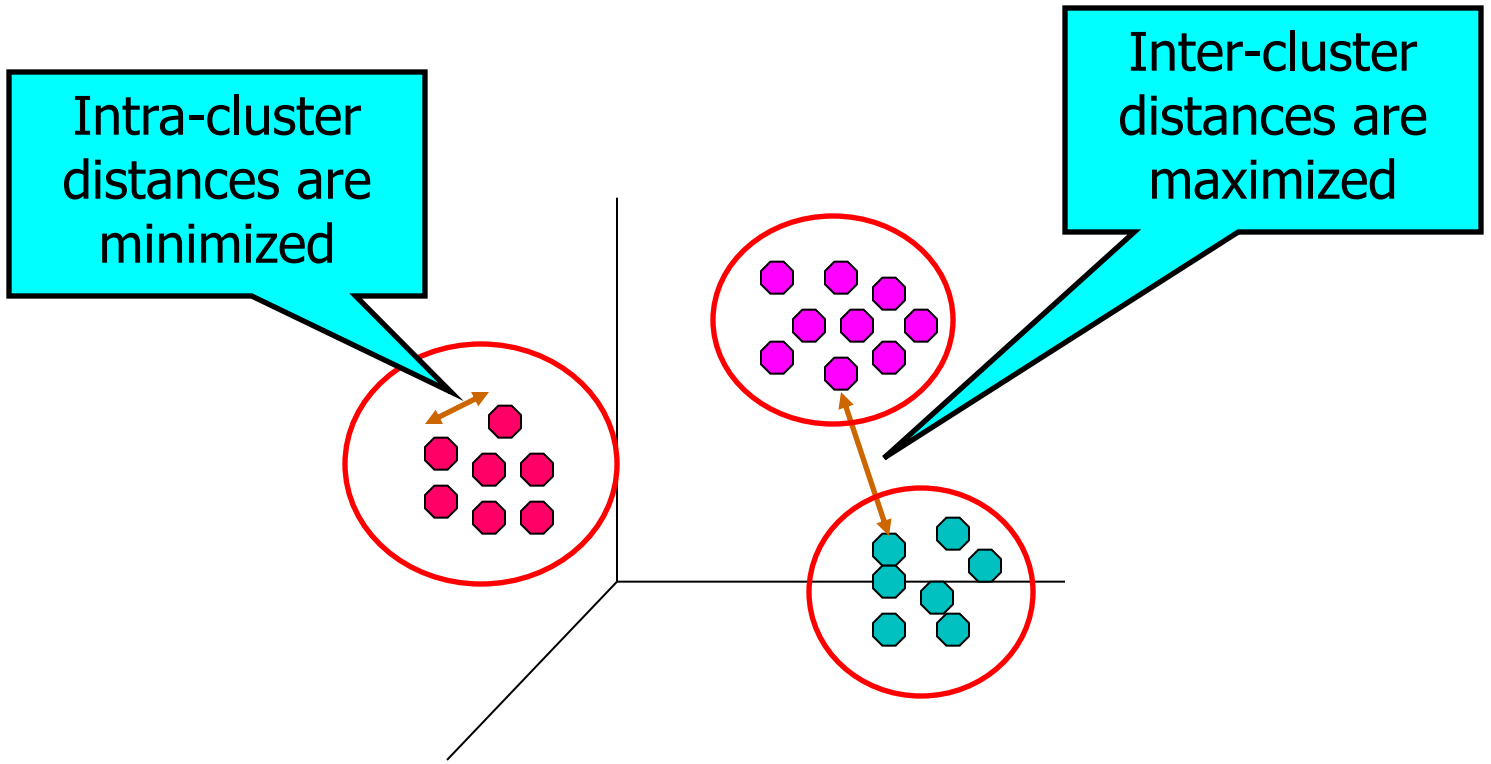
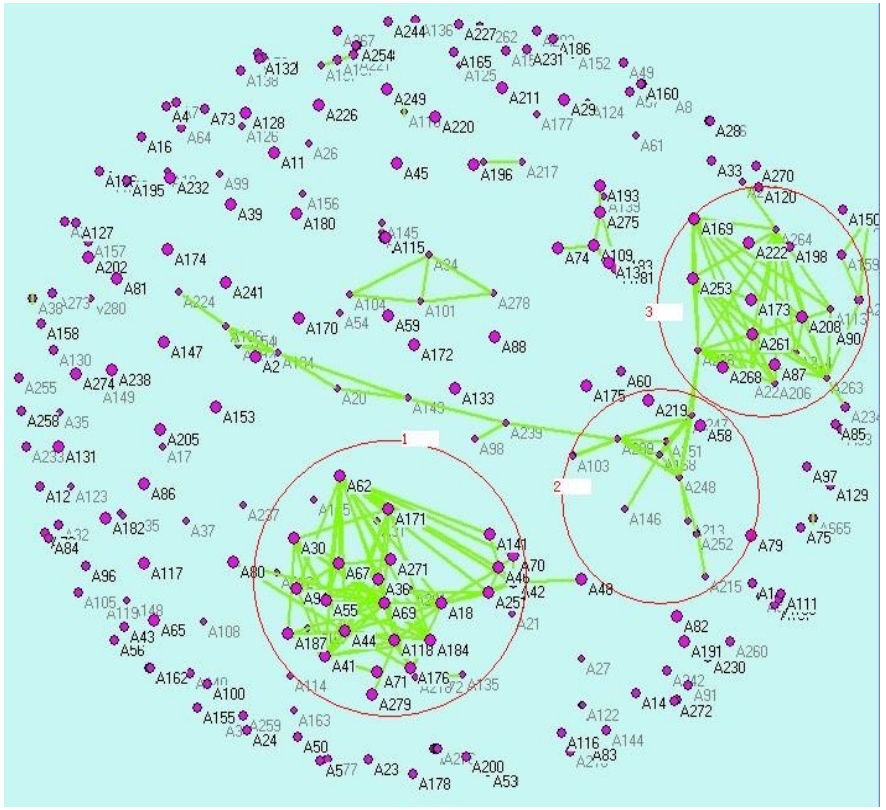
What is Cluster Analysis?

- Finding groups of objects such that the objects in a group will be similar (or related) to one another and different from (or unrelated to) the objects in other groups

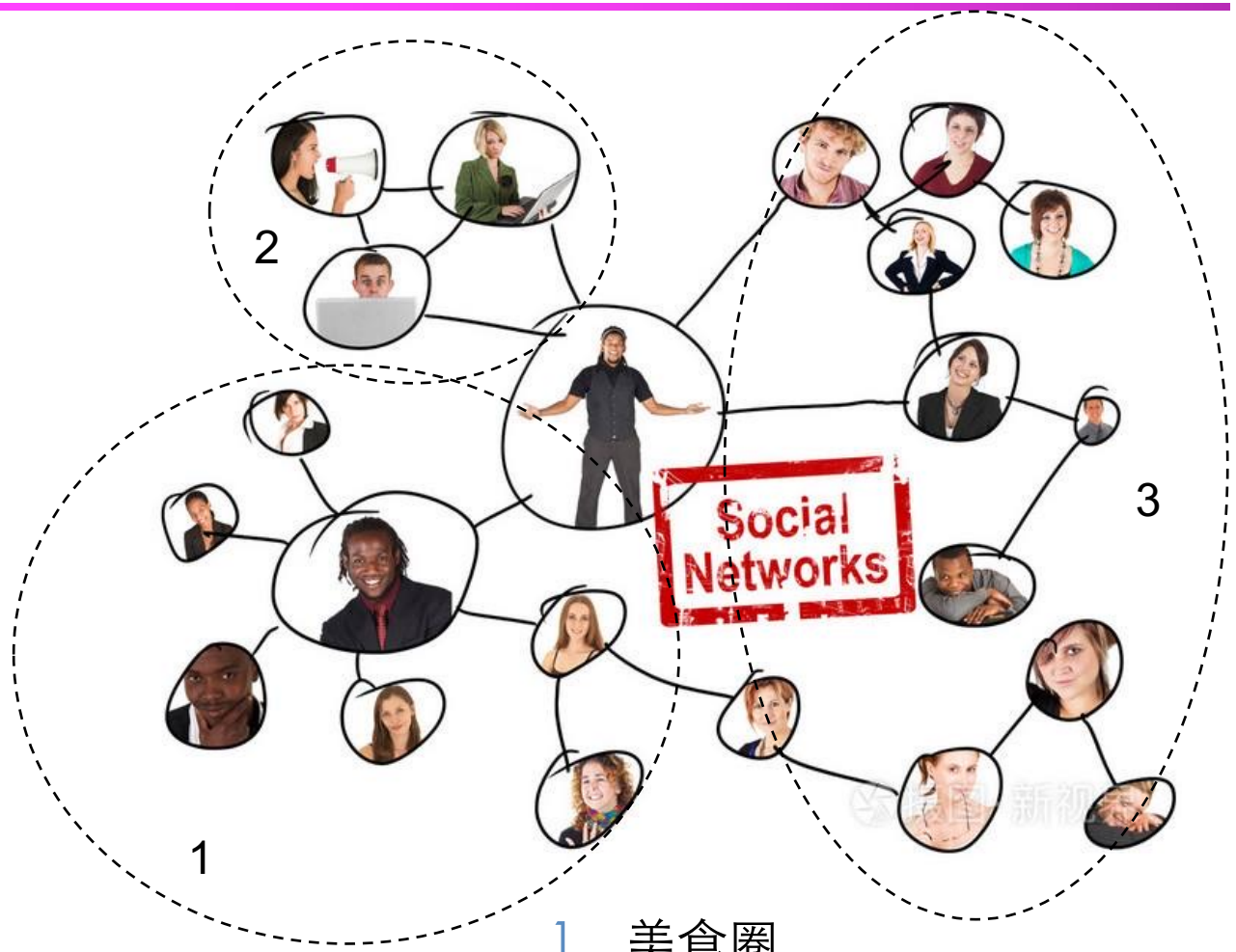


Applications of Cluster Analysis



輿情群体分析

1. 三鹿事件报道
2. 问责食品安全
3. 网民调侃三鹿



社交网络分析

1. 美食圈
2. 电影圈
3. 运动圈

Notion of a Cluster can be Ambiguous

How many clusters?

Six Clusters

Two Clusters

Four Clusters

Clustering

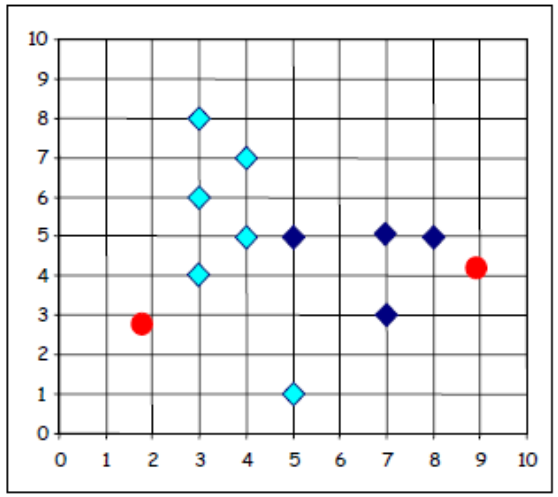
- Each cluster is associated with a centroid (center point)
- Each point is assigned to the cluster with the closest centroid
- Number of clusters, K, must be specified
- The basic algorithm is very simple

1: Select K points as the initial centroids.
2: **repeat**
3: Form K clusters by assigning all points to the closest centroid.
4: Recompute the centroid of each cluster.
5: **until** The centroids don't change

Clustering – Details

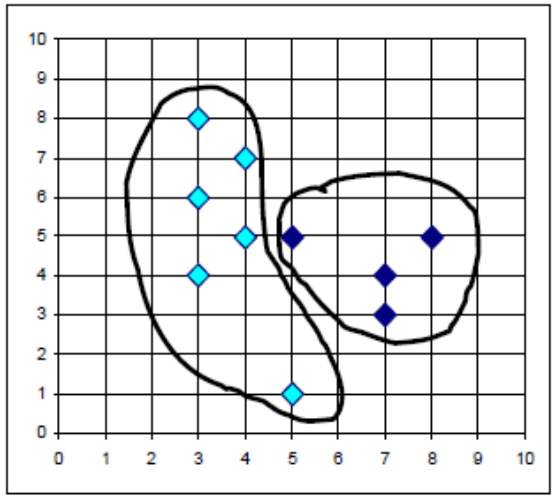
- Initial centroids are often chosen randomly.
  - Clusters produced vary from one run to another.
- The centroid is (typically) the mean of the points in the cluster.
- 'Closeness' is measured by Euclidean distance, cosine similarity, correlation, etc.
- Algorithm will converge for common similarity measures mentioned above.
- Most of the convergence happens in the first few iterations.
  - Often the stopping condition is changed to 'Until relatively few points change clusters'
- Complexity is O(n * K * I * d)
  - n = number of points, K = number of clusters,
    I = number of iterations, d = number of attributes

Clustering

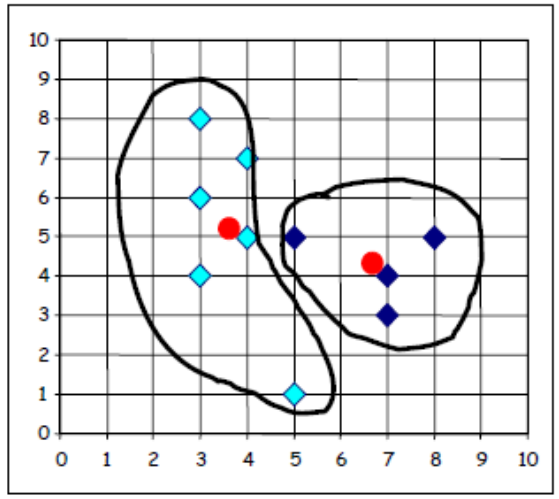


K=2

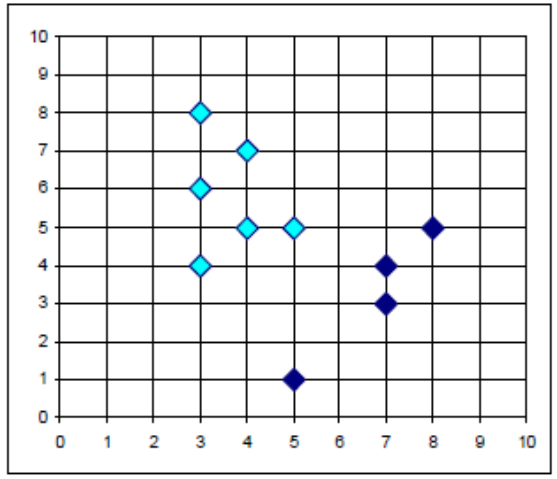
Arbitrarily choose K object as initial cluster center



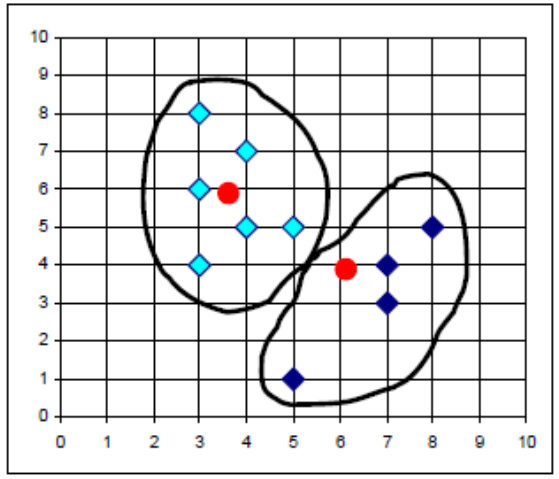
Assign each objects to most similar center



Update the cluster means



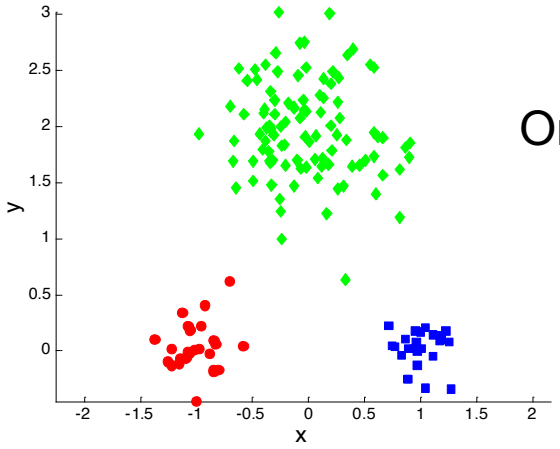
reassign



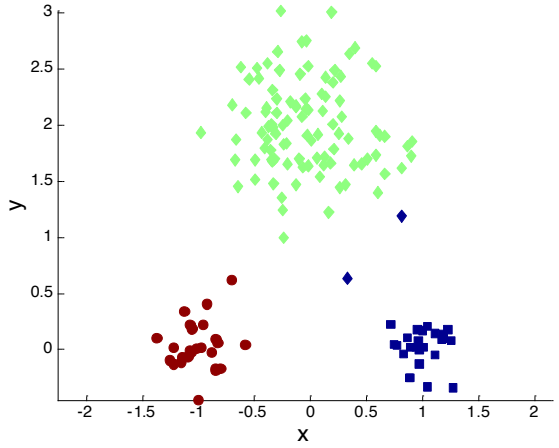
reassign

Update the cluster means

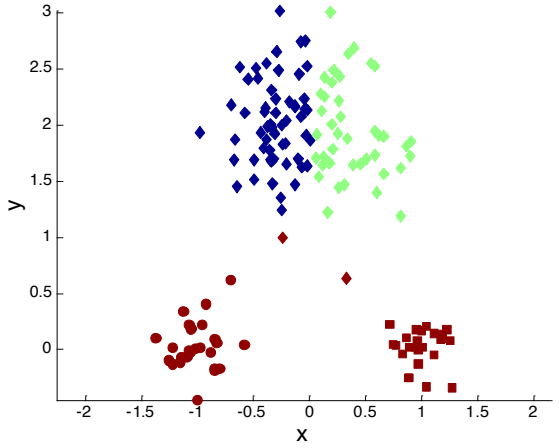
Two different Clusterings



Original Points

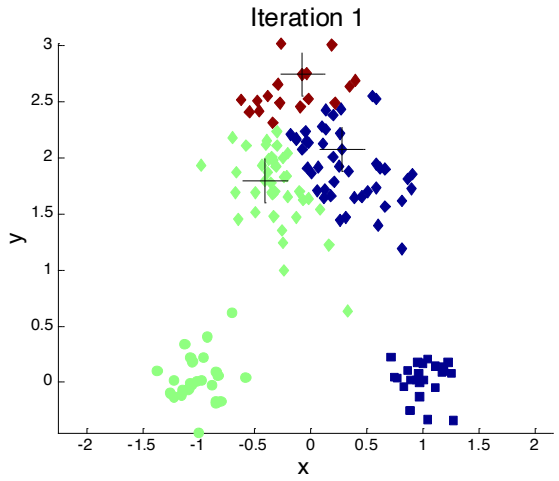


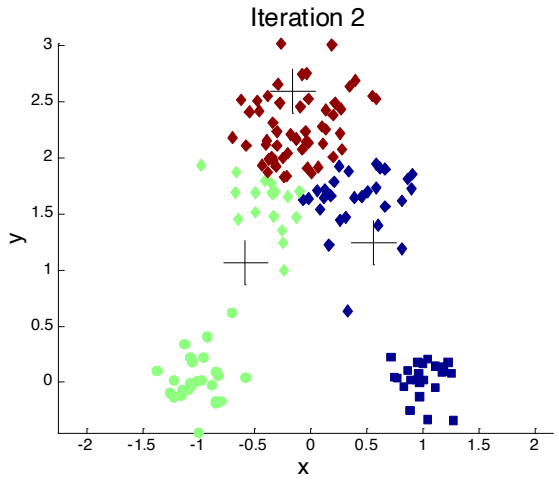
Optimal Clustering

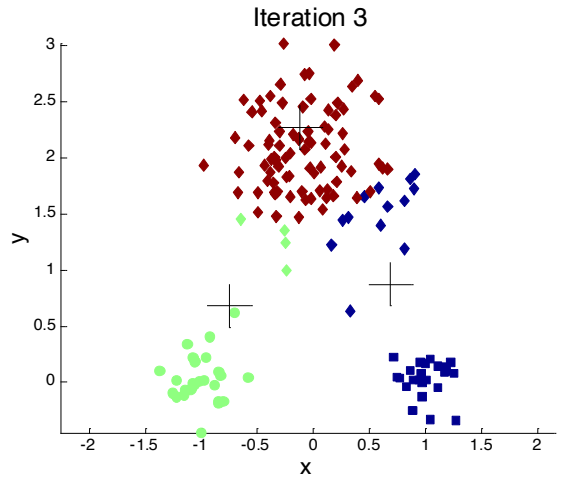


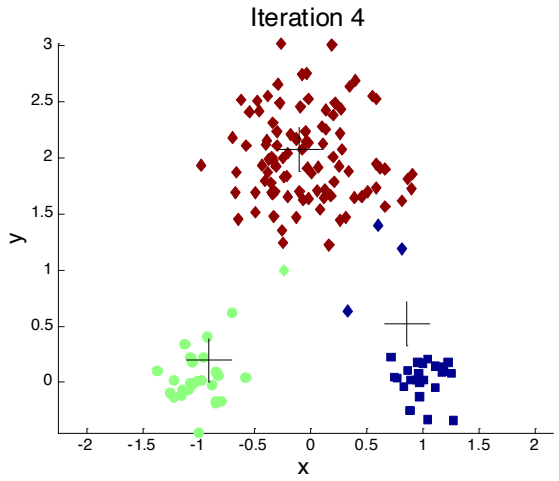
Sub-optimal Clustering

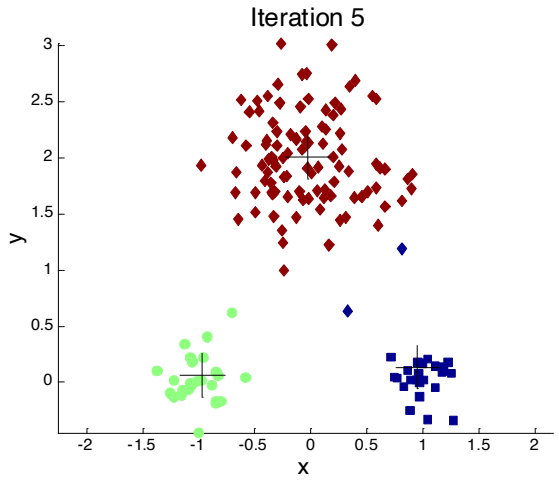
Importance of Choosing Initial Centroids

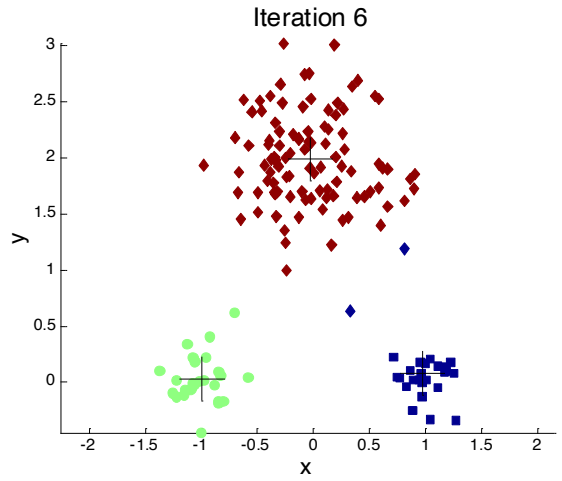




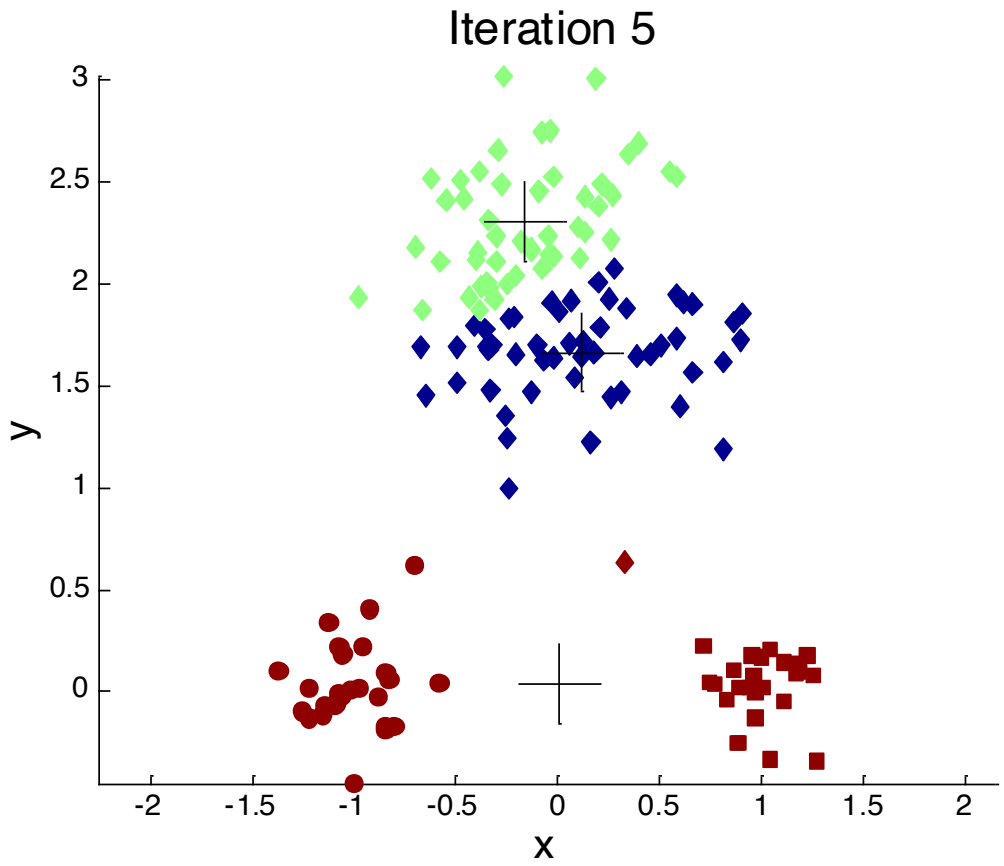








Importance of Choosing Initial Centroids



Importance of Choosing Initial Centroids