Clustering

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Clustering

- Grouping a set of data objects into different groups based on similarity
- An example of unsupervised learning
- Data objects can be vectors representing different attributes for an object, for example, customer, location, product, etc.

Examples

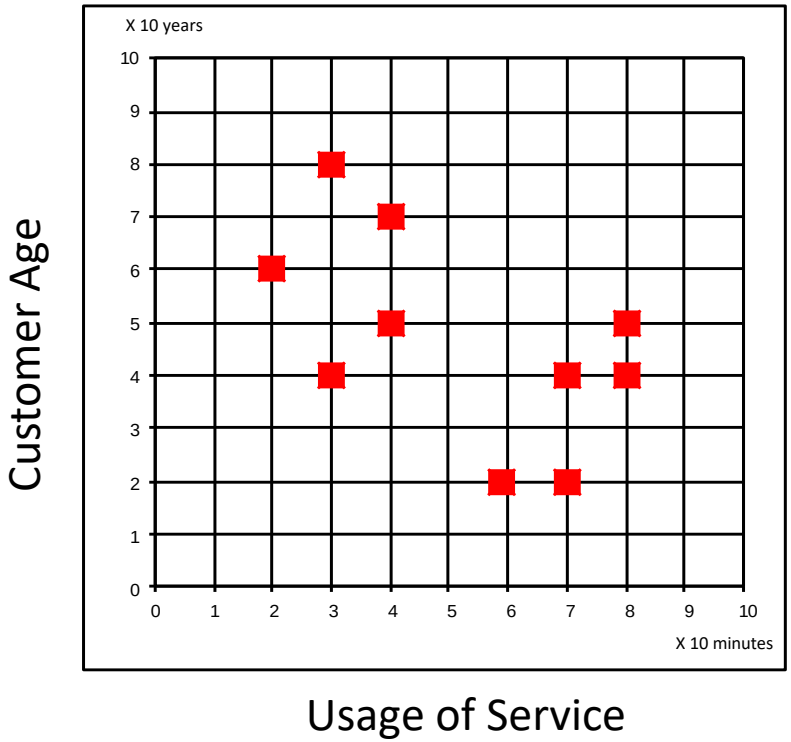
- Used in a variety of areas
  - Marketing
  - Urban planning
  - Customer segmentation
  - Product segmentation
  - Seismology

Similarity Measure

- If two objects i and j are represented by vectors x^i and x^j
  - How do you measure similarity between the two objects
    - Euclidean distance
    - Manhattan distance
    - Mahalanobis distance
  - Similarity can be chosen based on the application

Similarity Measure

- Consider 10 customers with two attributes
  - Attribute 1: Recent usage of services
  - Attribute 2: Customer age
- Objective: Cluster the data into two classes and design two marketing campaigns for the two customer segments



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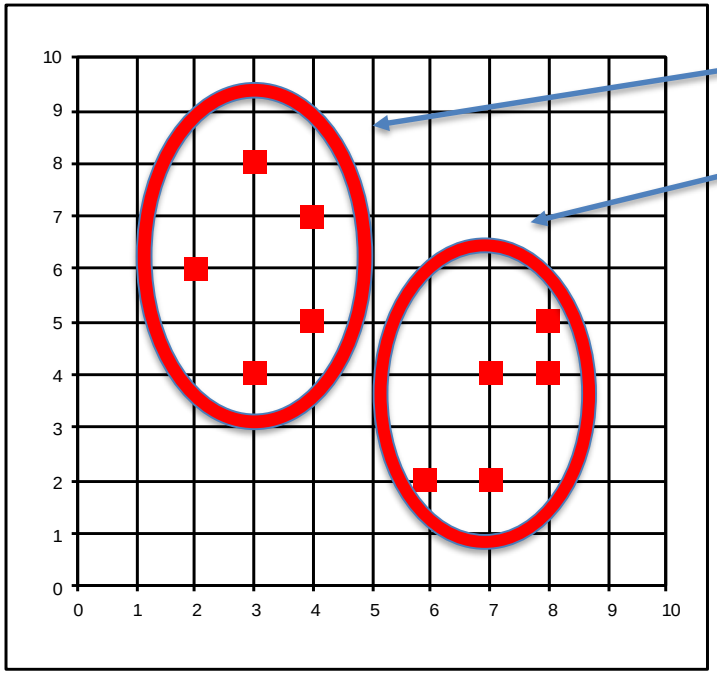
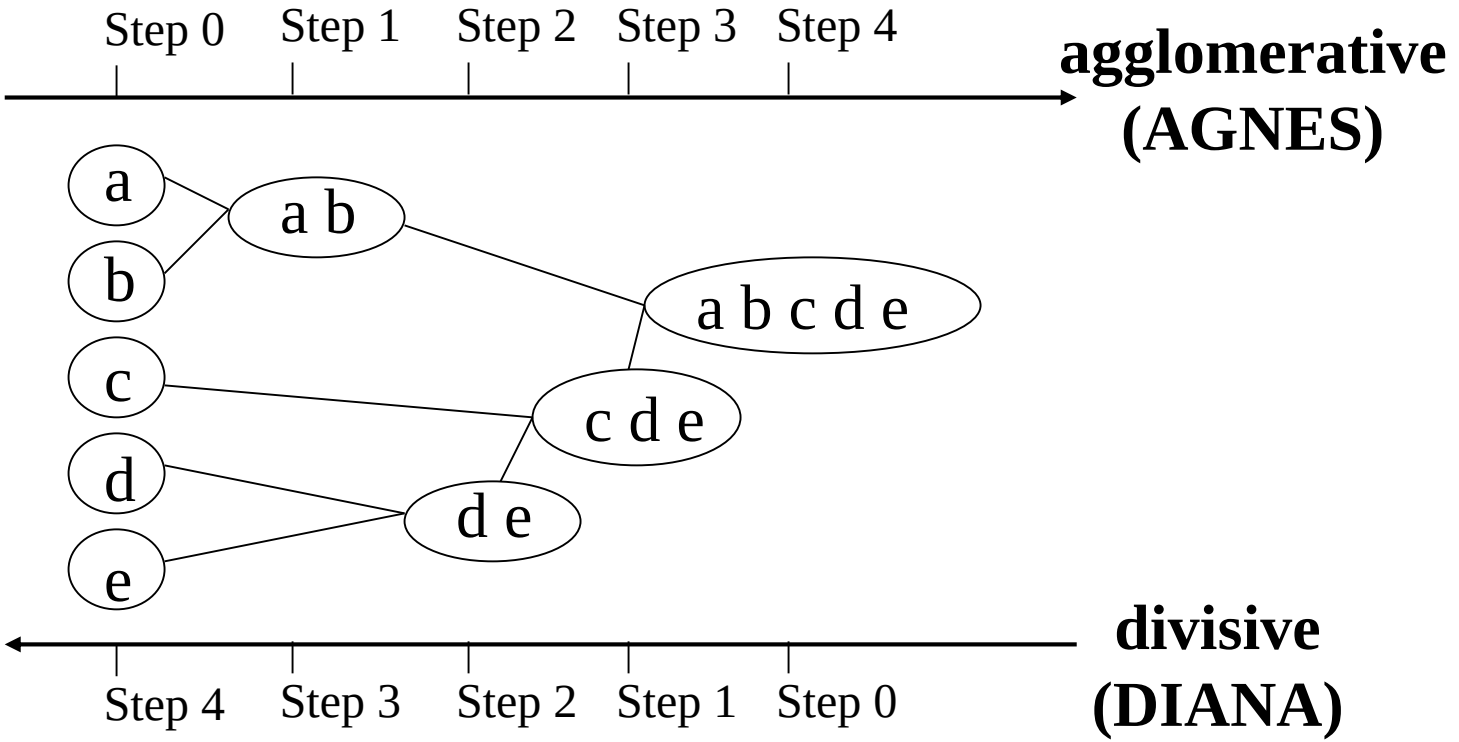


Cluster 1	Cluster2
(3,4)	(6,2)
(2,6)	(7,2)
(4,5)	(7,4)
(4,7)	(8,4)
(3,8)	(8,5)

Clustering approaches

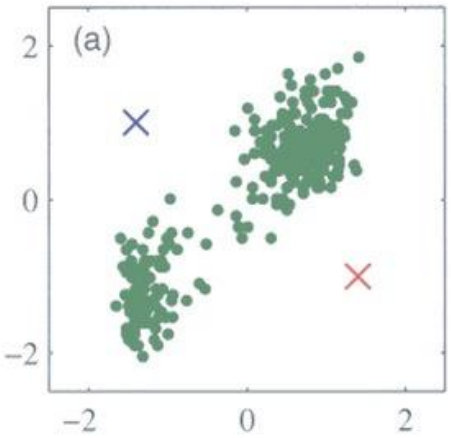
- Hierarchical clustering
  - Agglomerative
  - Divisive



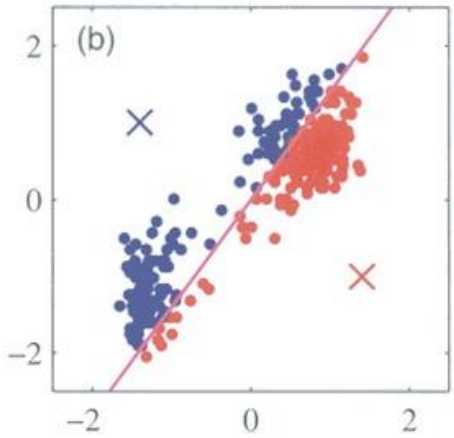
Clustering approaches

- K-means Clustering
  - Select initial centroids randomly
  - Assign objects to centroids based on similarity measure
  - Compute new centroid as mean of each class
  - Repeat the above two steps until there is no change

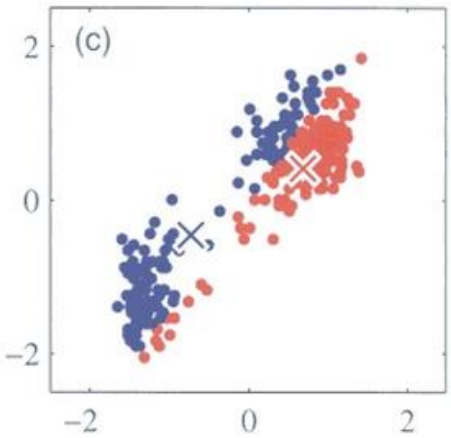
K-Means Clustering



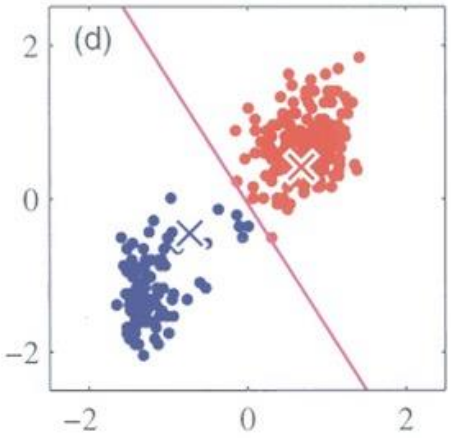
Start with centroids randomly placed



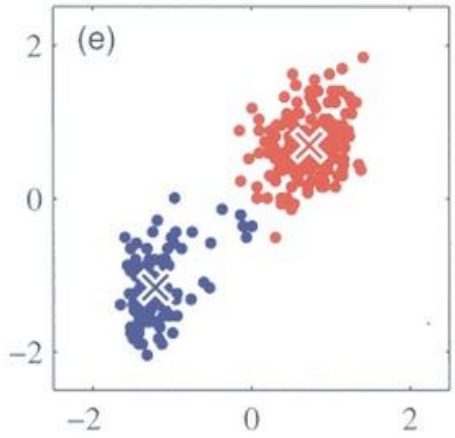
Assign points to the centroids



Update centroids



Assign points to the new centroids



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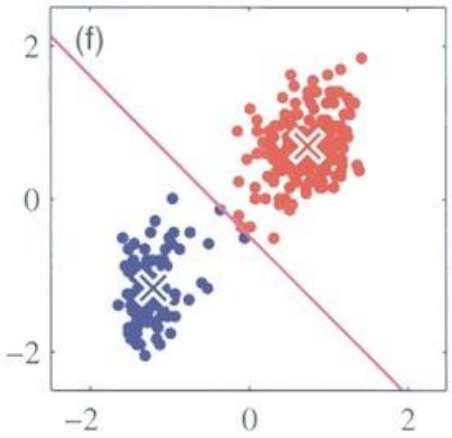

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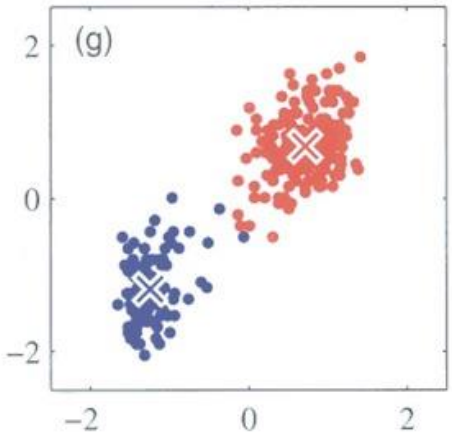
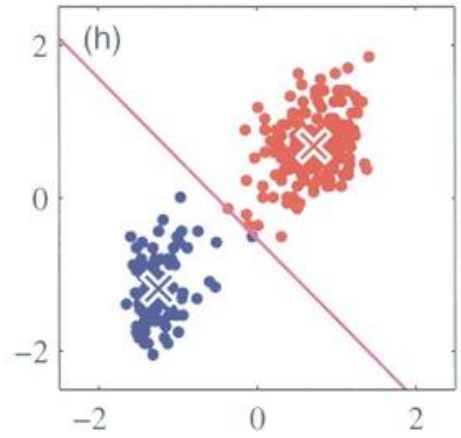
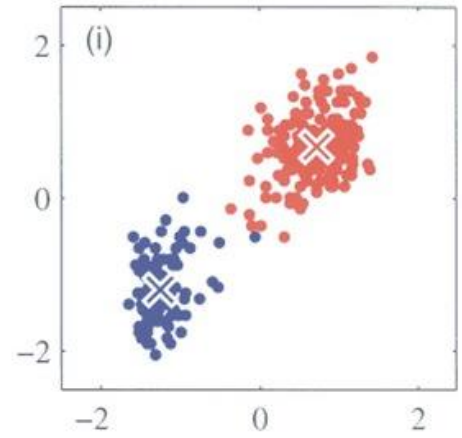
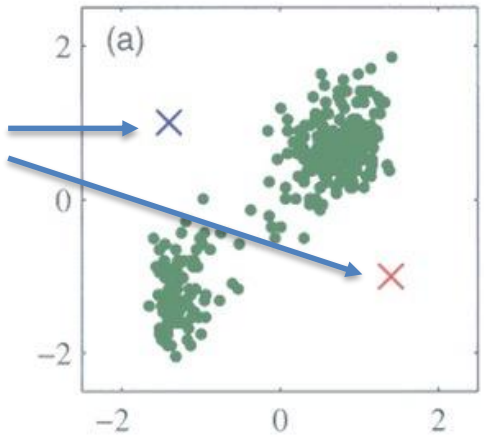






K-Means Clustering



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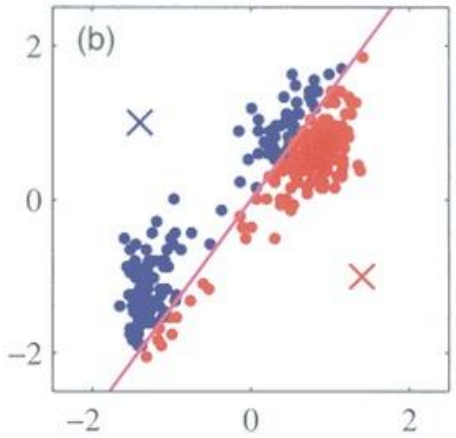

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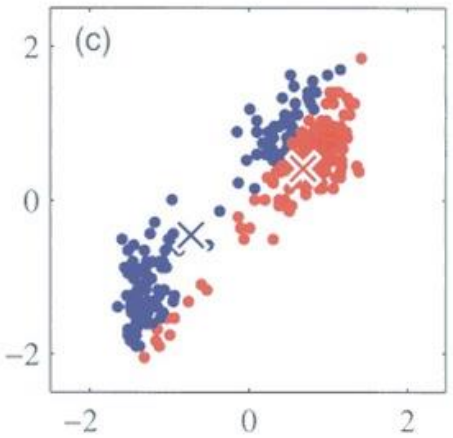
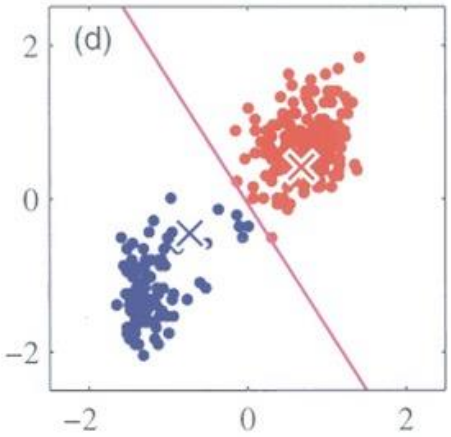


Update centroids



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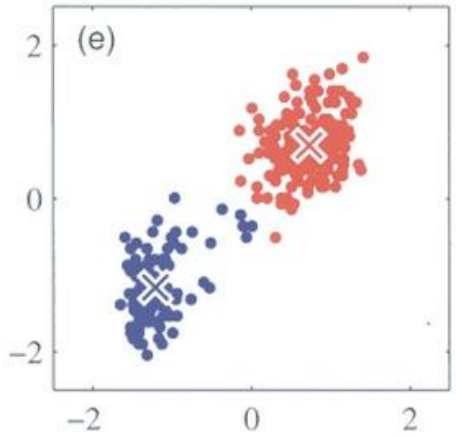

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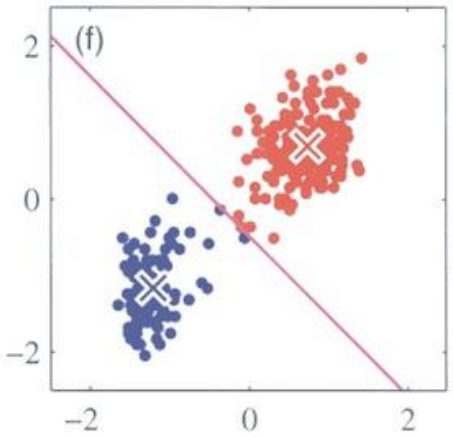

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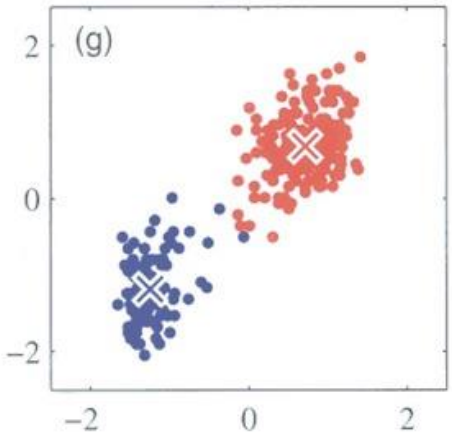

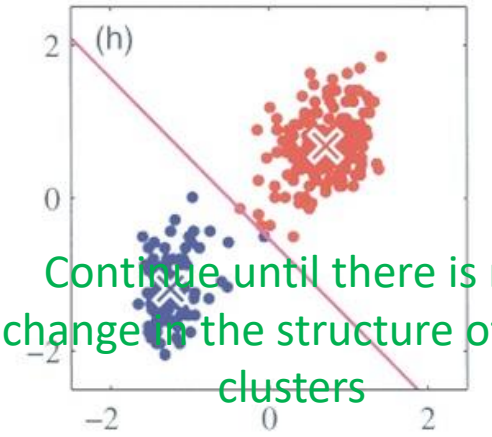

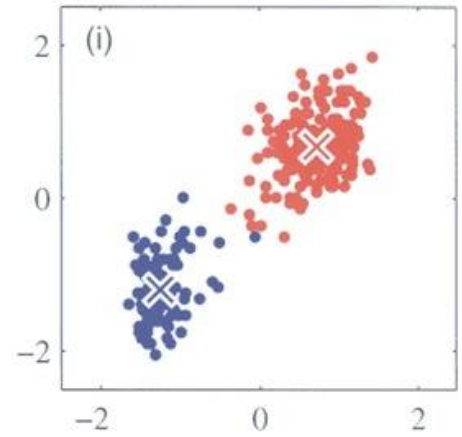

Continue until there is no change in the structure of the clusters