Image Segmentation

Abstract: The technology of image segmentation is widely used in medical image processing, face recognition pedestrian detection, etc. The current image segmentation techniques include region-based segmentation, edge detection segmentation, segmentation based on clustering, segmentation based on weakly-supervised learning in CNN, etc.

Image segmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as image object), In this Project I am analysing **K-means Clustering algorithm**.

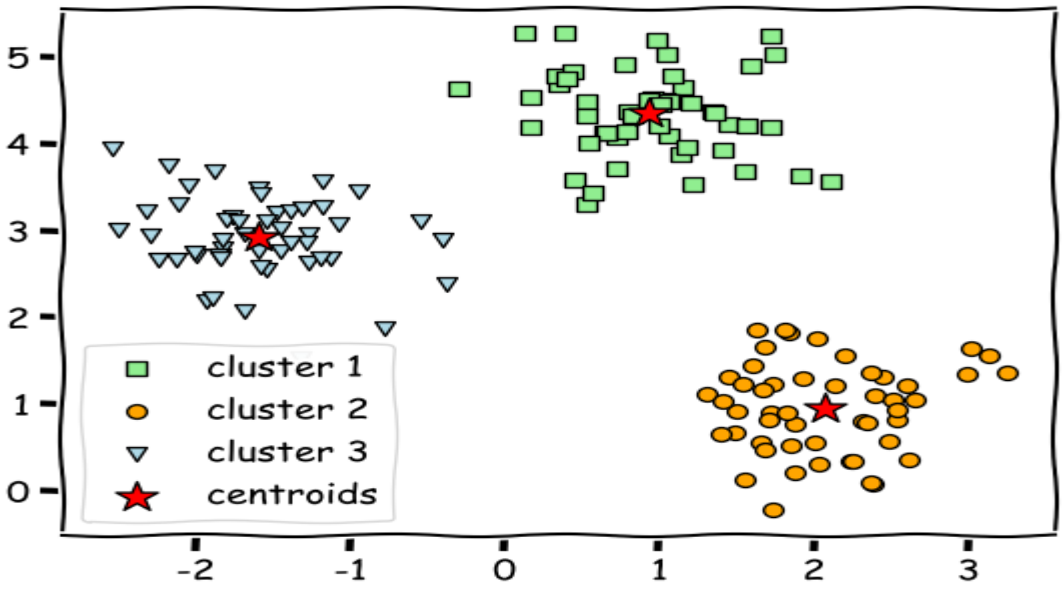
Method: Here in this project i am analysing Gaussian Mixture Model (GMM) and k-means clustering algorithm.

Gaussian Mixture states that

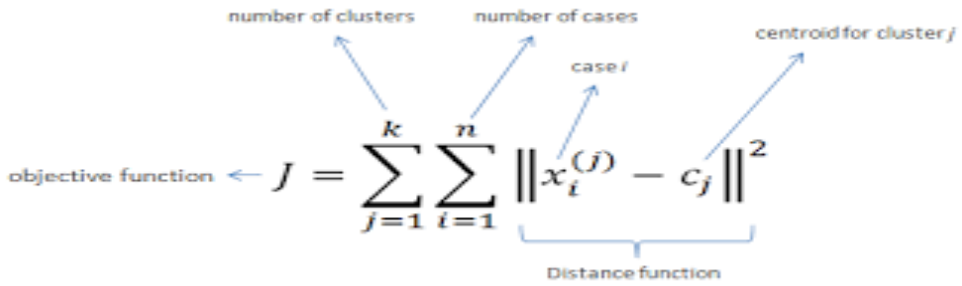
- A mean that defines the centre.
- A covariance that defines the width.
- A probability.

K-means states that initialize the centroids

- Compute the distance between each point and the centroids
- Associate each point with the closest centroid
- Update the centroids with the new groups



Overview in terms of Mathematics:



Clustering is the task of dividing the population (data points) into a number of groups, such that data points in the same groups are more similar to other data points in that same group than those in other groups. These groups are known as clusters.

One of the most commonly used clustering algorithms is k-means. Here, the k represents the number of clusters (not to be confused with k-nearest neighbour).

Let's understand how k-means works:

First, randomly select k initial clusters Randomly assign each data point to any one of the k clusters Calculate the centres of these clusters Calculate the distance of all the points from the centre of each cluster Depending on this distance, the points are reassigned to the nearest cluster Calculate the centre of the newly formed clusters Finally, repeat steps (4), (5) and (6) until either the centre of the clusters does not change or we reach the set number of iterations The key advantage of using k-means algorithm is that it is simple and easy to understand. We are assigning the points to the clusters which are closest to them.

Advantages of k-means clustering

1. K-means clustering is relatively simple to implement, and can be implemented without using frameworks—just simple programming language, specifying one's own proximity measures**.**
2. The algorithm is known to easily adapt to new examples.
3. It guarantees convergence by trying to minimize the total SSE as an objective function over a number of iterations.
4. The algorithm is fast and efficient in terms of computational cost, which is typically O(K*n*d).

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