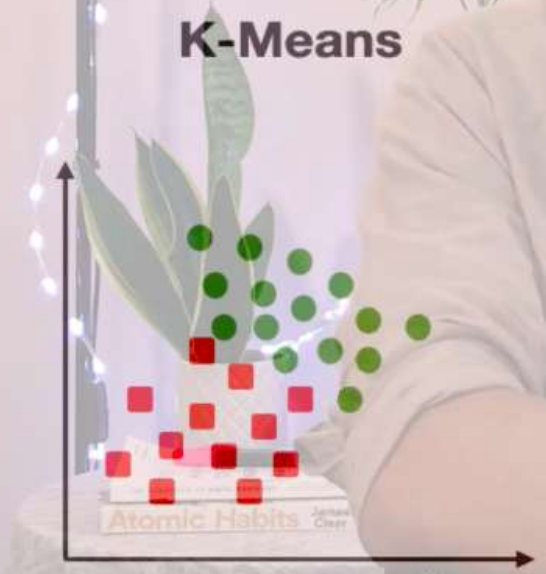
Type of Clustering

- Hard Clustering
  - Data points belong to only one cluster
  - Example - K-Means
- Soft Clustering
  - Data points can belong to more than one cluster
  - Example - Fuzzy C-Means

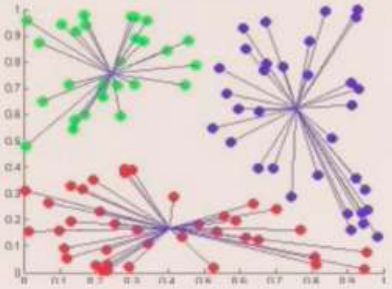


A Simple Example

- Using a simple one-dimensional data
- We have weight and need to classify them into child and adult
- 1- Is an example for hard clustering and 2- Soft Clustering
- In Fuzzy C-Means the clustering function uses a smoother line to unlike the image 1.
- The grey dots in image 2 will have probability value for both clusters

Steps

- Randomly select ‘c’ cluster centers
- Calculate the cluster membership probability (for ith data point to the jth cluster)
- Compute the fuzzy centers again using Vj
- Repeat the previous 2 steps until minimal J value is achieved



$$\mu_{ij} = 1 / \sum_{k=1}^{c} (d_{ij} / d_{ik})^{(2/m-1)}$$

$$v_j = (\sum_{i=1}^{n} (\mu_{ij})^m x_i) / (\sum_{i=1}^{n} (\mu_{ij})^m), \forall j = 1, 2, ...c$$

$$J(U,V) = \sum_{i=1}^{n} \sum_{j=1}^{c} (\mu_{ij})^m \left\| x_i - v_j \right\|^2$$