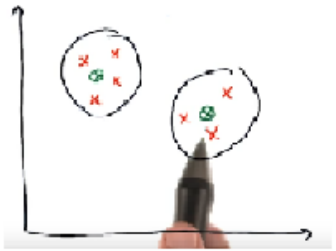
# K-Means Clustering



In this example, we can see two clusters of red crosses. And cluster centres can also be visualized (green cross).

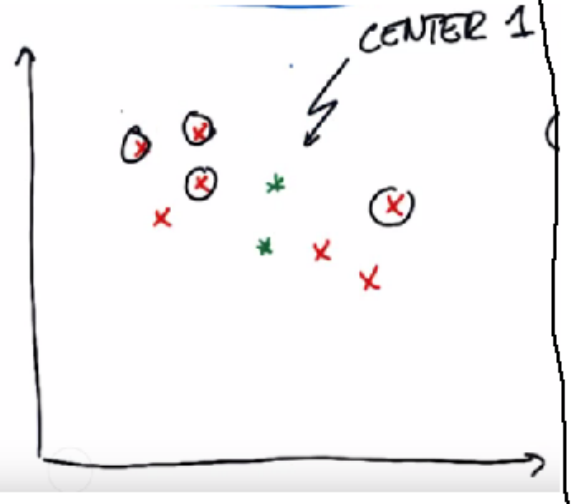
Lets apply K-Means algorithm to find those cluster centers:

In K-Means, we randomly assign cluster centers. Obviously, those two cluster centers are not correct.

So, k-Means works in 2 steps:

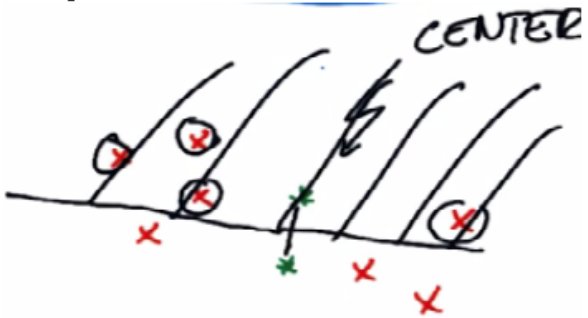
- ASSIGN
- OPTIMIZE

Lets start 1. Assign.

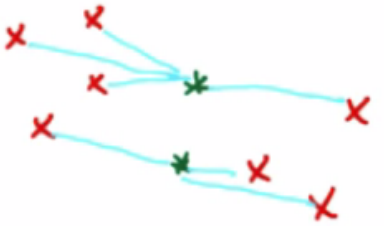



We can see that those 4 circled X are closer to center 1 than center.

We can visualize this by drawing orthogonal line

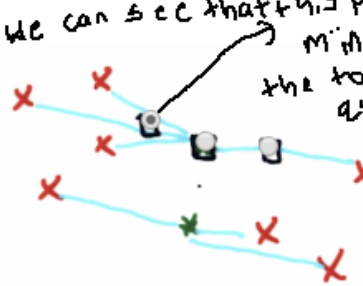


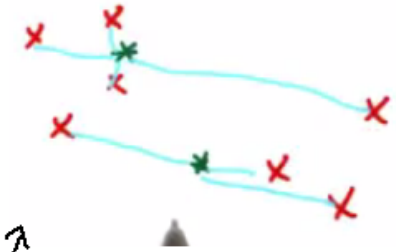

Now we shall assign those points to the clusters.



Next step is Optimization

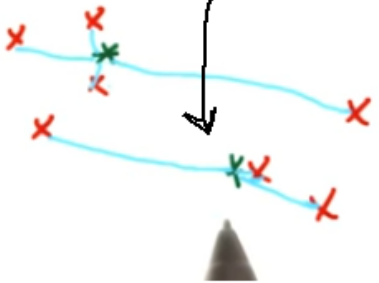
Optimization is done by minimizing the total quadratic dist of a cluster center to the points. So we need move our cluster centers



After moving cluster 1

Similarly, for cluster 2



We shall repeat the process.

① Assign, for cluster 1

for cluster 2 as well

So, we have iteratively assigned and optimized to get the correct cluster centers as expected. This is called K-Means clustering algorithm