

# K-means clustering: Takeaways

by Dataquest Labs, Inc. - All rights reserved © 2021

## Syntax

- Computing the Euclidean distance in Python:

```
def calculate_distance(vec1, vec2):  
    root_distance = 0  
    for x in range(0, len(vec1)):  
        difference = centroid[x] - player_values[x]  
        squared_difference = difference**2  
        root_distance += squared_difference  
    euclid_distance = math.sqrt(root_distance)  
    return euclid_distance
```

- Assigning observations to clusters:

```
def assign_to_cluster(row):  
    lowest_distance = -1  
    closest_cluster = -1  
    for cluster_id, centroid in centroids_dict.items():  
        df_row = [row['ppg'], row['atr']]  
        euclidean_distance = calculate_distance(centroid, df_row)  
        if lowest_distance == -1:  
            lowest_distance = euclidean_distance  
            closest_cluster = cluster_id  
        elif euclidean_distance < lowest_distance:  
            lowest_distance = euclidean_distance  
            closest_cluster = cluster_id  
    return closest_cluster
```

- Initializing the KMeans class from scikit-learn:

```
from sklearn.cluster import KMeans  
kmeans_model = KMeans(n_clusters=2, random_state=1)
```

## Concepts

- Centroid-based clustering works well when the clusters resemble circles with centers.
- K-means clustering is a popular centroid-based clustering algorithm. The K refers to the number of clusters into which we want to segment our data. K-means clustering is an iterative algorithm that switches between recalculating the centroid of each cluster and the items that belong to each cluster.
- Euclidean distance is the most common measure of distance between vectors used in data science. Here is the formula for distance in two dimensions:

---

$$\sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \dots + (q_n - p_n)^2}$$

where q and p are the two vectors we are comparing.

- Example: If **q** is (5,2) and **p** is (3,1), the distance comes out to:

---

$$\sqrt{(5 - 3)^2 + (2 - 1)^2}$$

---

$\sqrt{5}$

2.23607.

- If clusters look like they don't move much after every iteration, this means two things:
  - K-means clustering doesn't cause significant changes in the makeup of clusters between iterations, meaning that it will always converge and become stable.
  - Where we pick the initial centroids and how we assign elements to clusters initially matters a lot because K-means clustering is conservative between iterations.
- To counteract the problems listed above, the `sklearn` implementation of K-means clustering does some intelligent things like re-running the entire clustering process many times with random initial centroids so the final results are a little less biased.

## Resources

- [Sklearn implementation of K-Means clustering](#)
- [Implementing K-Means clustering from scratch](#)