CLUSTERING

CLUSTERINg

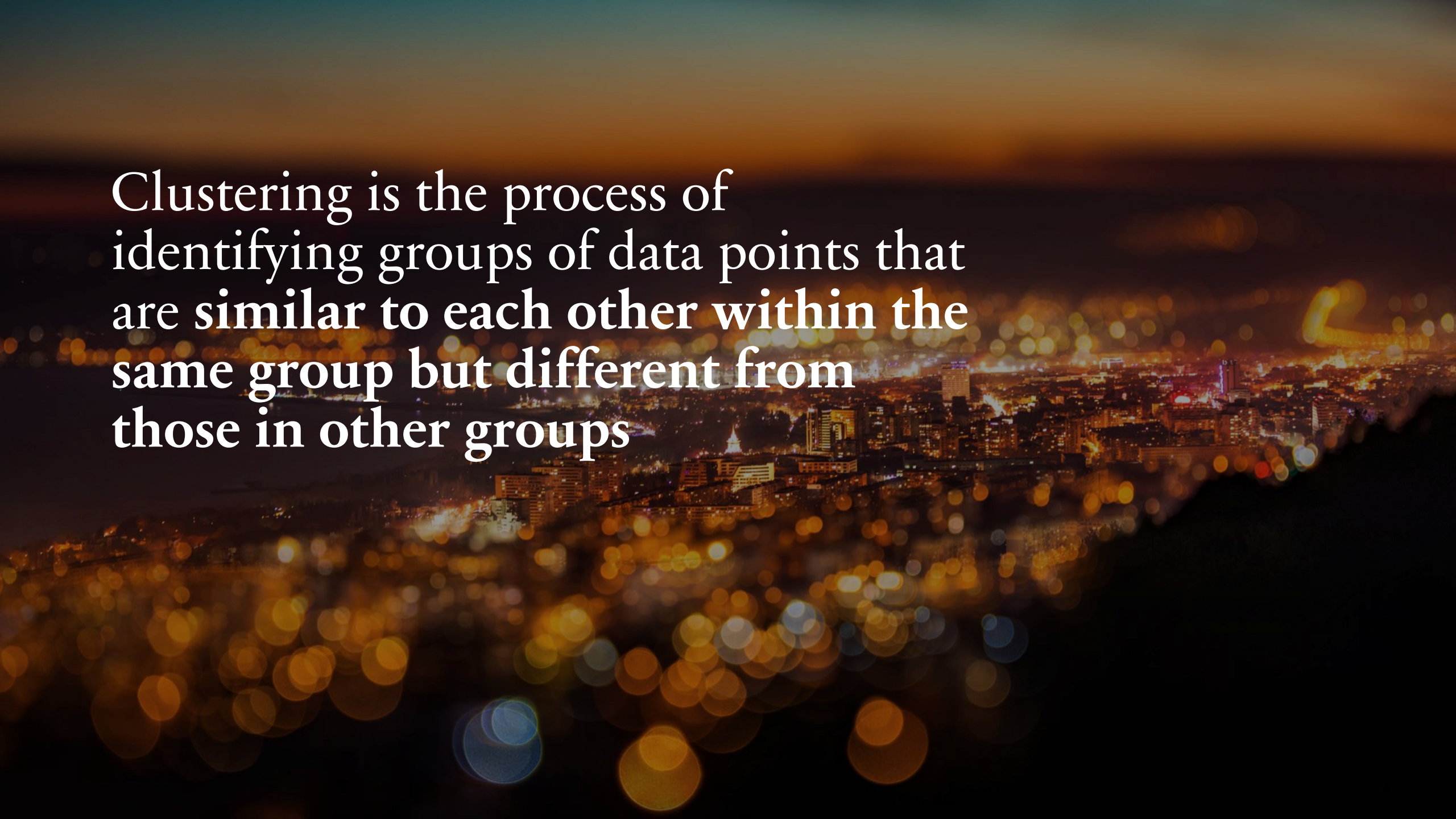
What is clustering?

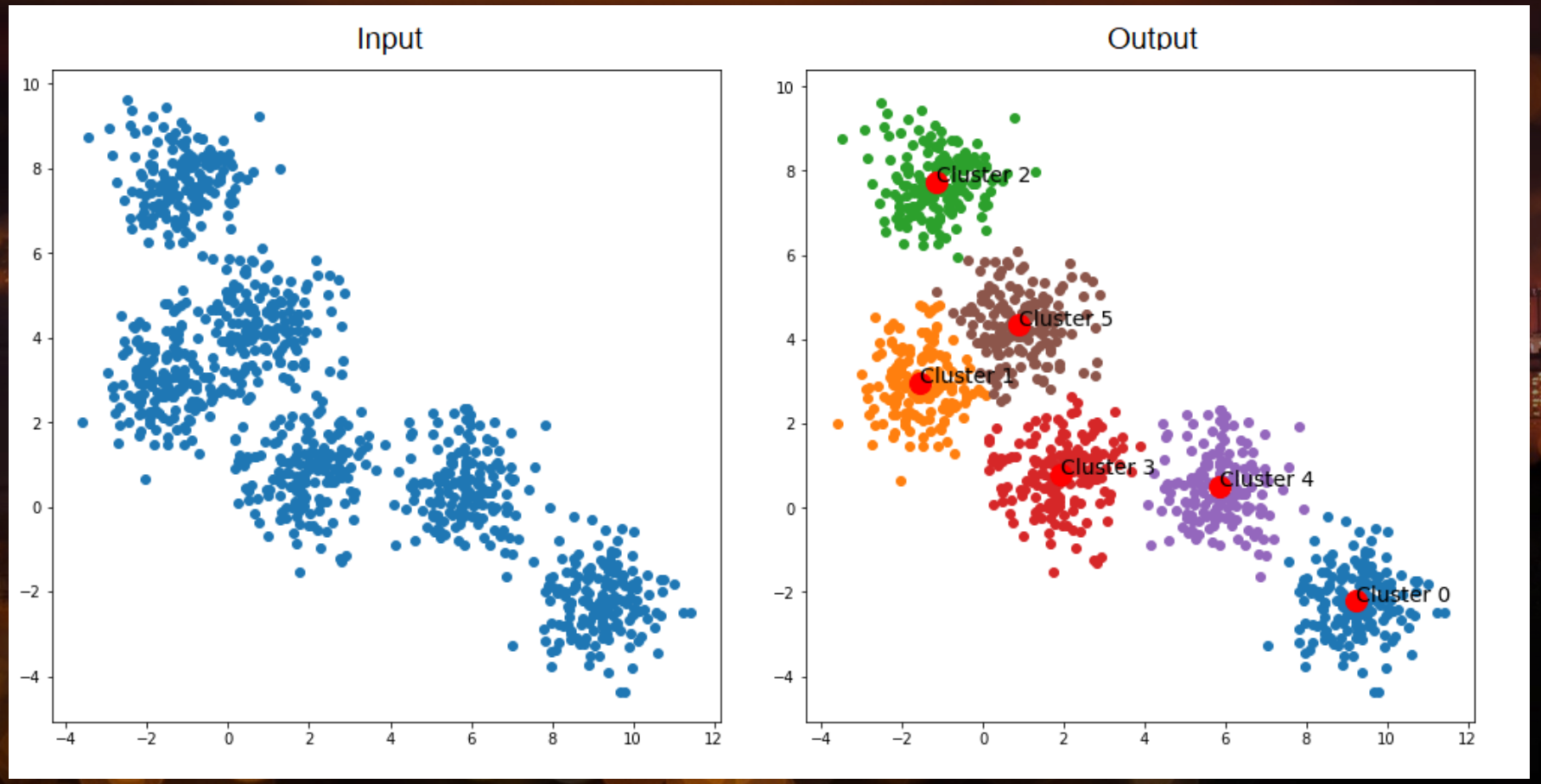
Benefit of clustering

Types of clustering

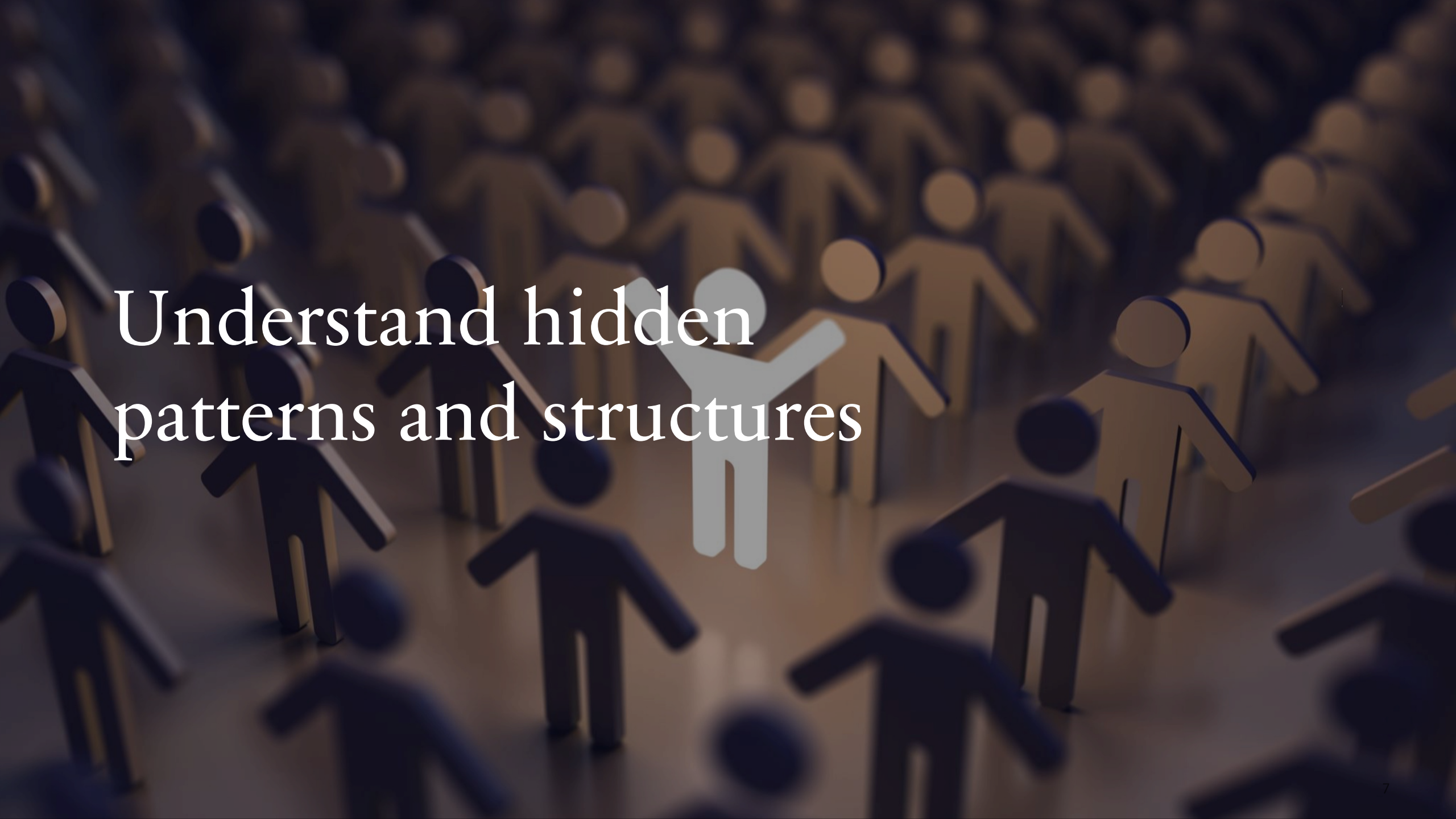
Further reading


WHAT IS CLUSTERING?


Clustering is the process of identifying groups of data points that are **similar to each other within the same group but different from those in other groups**


Input
Output
Cluster 2
Cluster 5
Cluster 1
Cluster 3
Cluster 4
Cluster 0

BENEFIT OF CLUSTERING


Understand hidden
patterns and structures

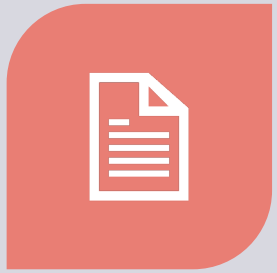
Understand hidden patterns and structures

- Feature engineering
- Improve performance
- Prevent overfitting

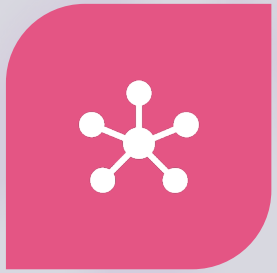
FOR MORE EXPLAIN

TYPE OF CLUSTERING

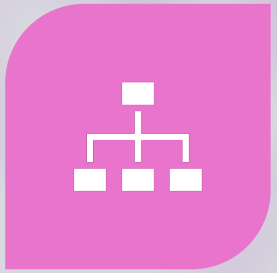
CENTROID-BASED CLUSTERING



DENSITY-BASED CLUSTERING



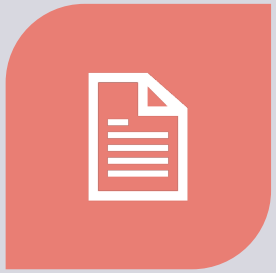
DISTRIBUTION-BASED CLUSTERING



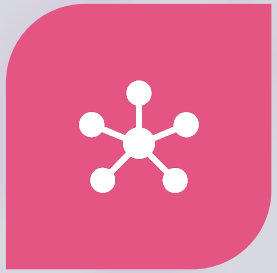
HIERARCHICAL CLUSTERING

CLUSTERING ALGORITHMS

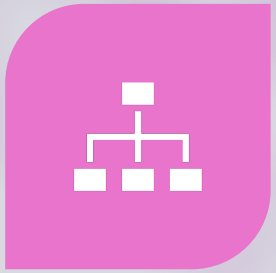
K-MEANS CLUSTERING



DBSCAN



GAUSSIAN MIXTURE MODEL



AGGLOMERATIVE HIERARCHY CLUSTERING

K-MEANS CLUSTERING

K-MEANS CLUSTERING

What is K-mean clustering?

Calculation step

Calculation example

Code

What is K-mean clustering?

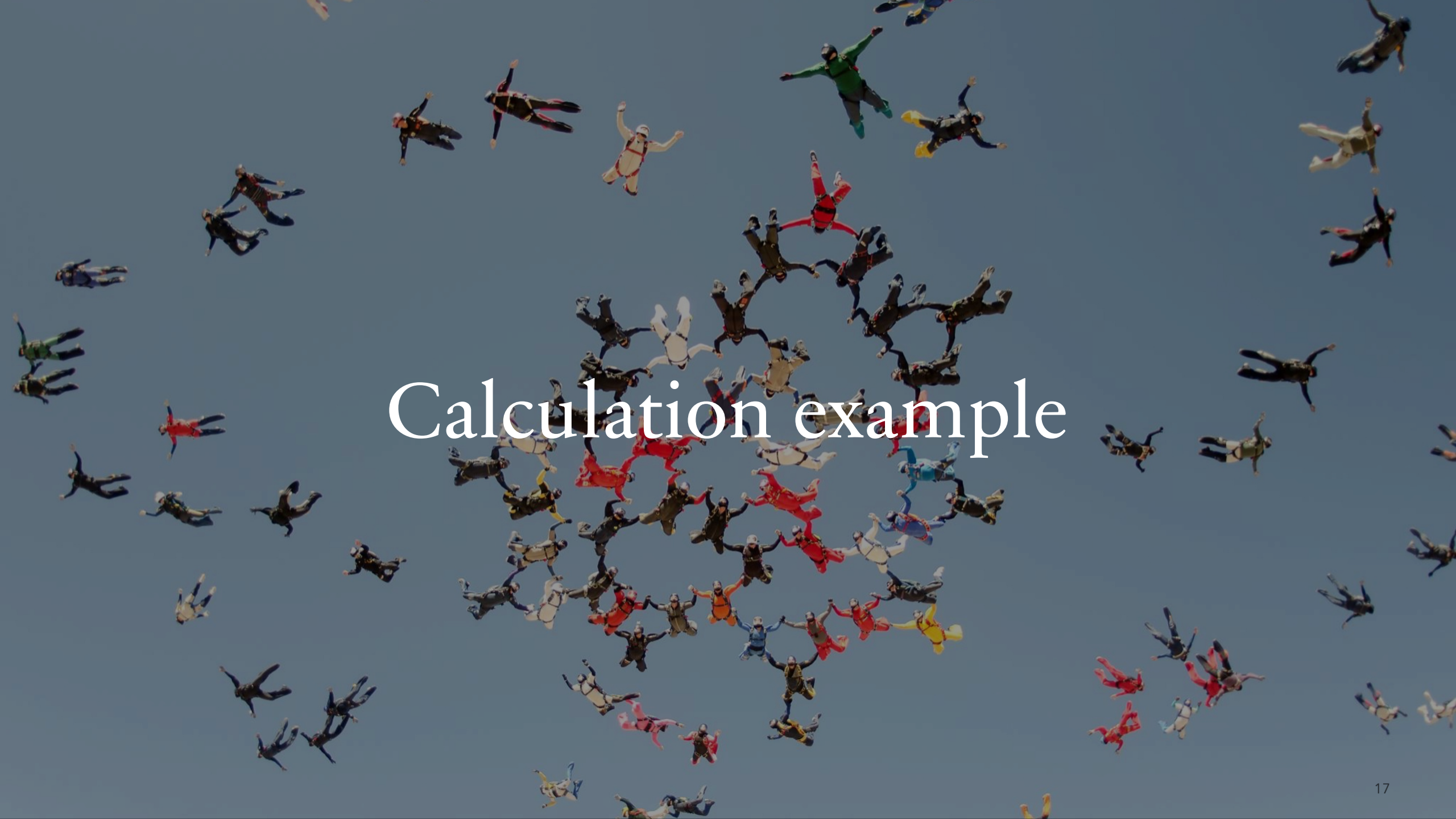
K-mean clustering is centroid-based clustering method that aims to partition n observations into K clusters in which each observation belongs to the cluster with the nearest mean (cluster centers or cluster centroid)

Calculation step

1. Choose the number of clusters K
2. Select K random datapoints from the data as centroids
3. Assign all the datapoints to the closest cluster centroid
4. Recompute the centroids of newly formed clusters
5. Repeat steps 3 and 4 until meet stopping criteria

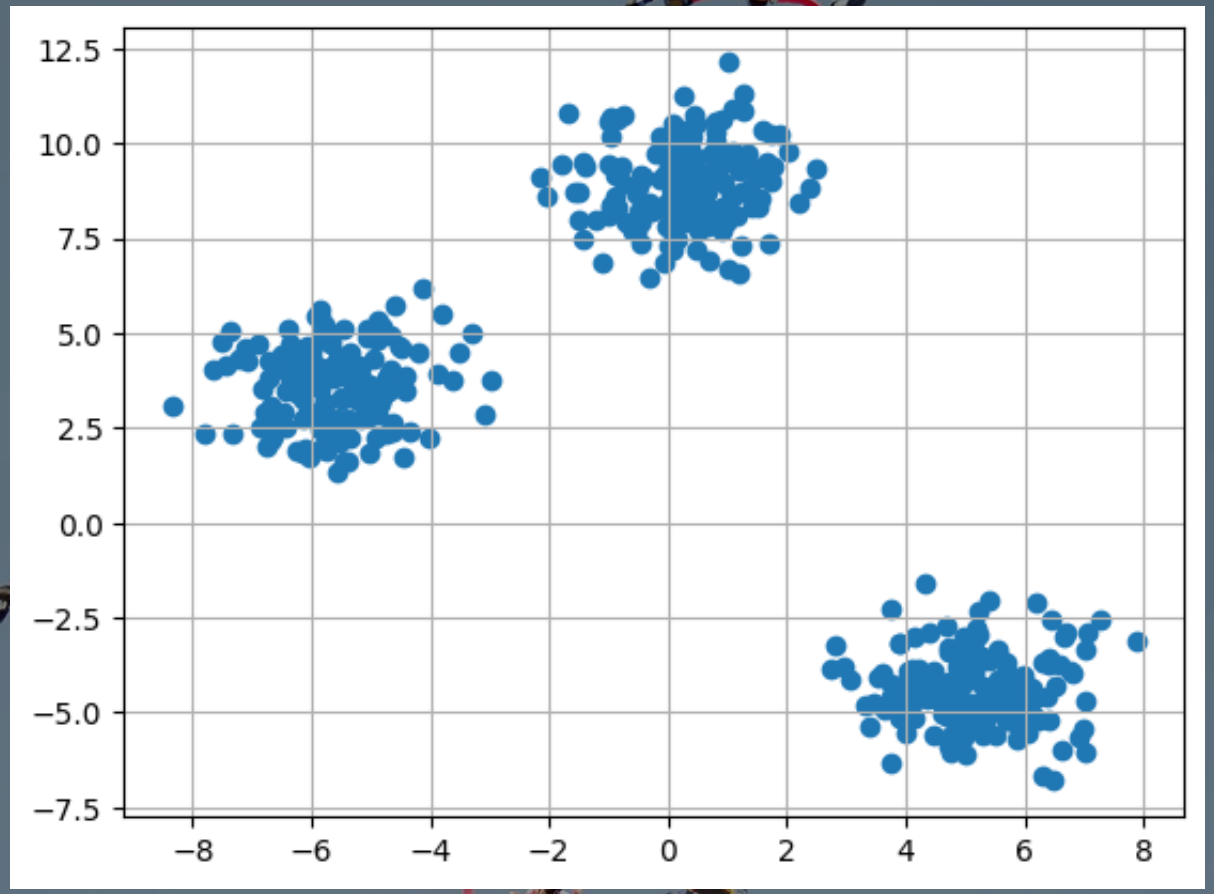
Stopping criteria

1. Centroids do not change
2. All datapoints remain in the same cluster
3. Maximum number of iterations is reached

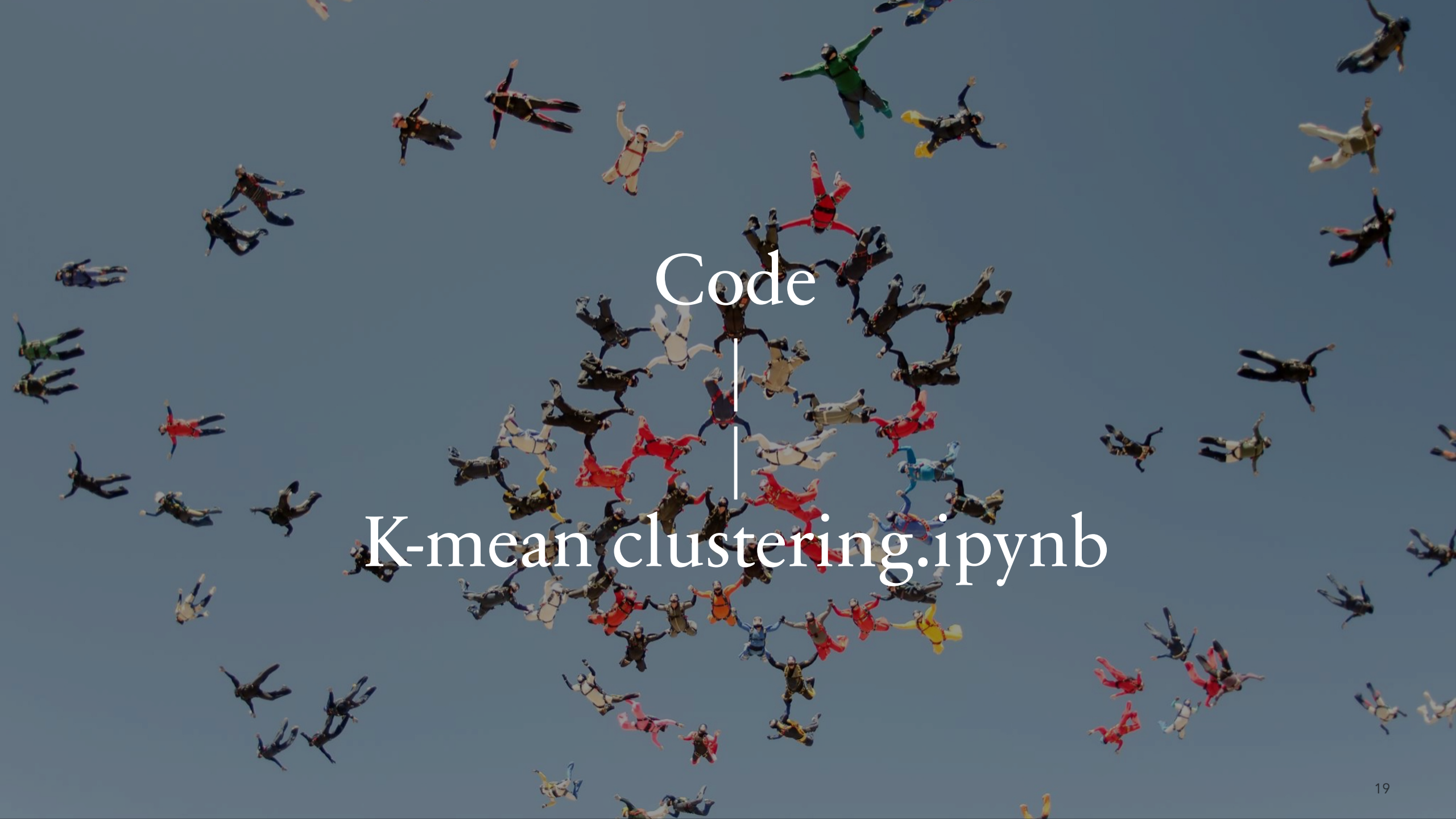


Calculation example

Calculation concept



https://www.geeksforgeeks.org/k-means-clustering-introduction/



Code

K-mean clustering.ipynb

DBSCAN

DBSCAN

What is DBSCAN?

Calculation Step

Calculation Example

Code

What is DBSCAN?

DBSCAN is a density-based clustering method: given a set of points in some space, it groups together points that are closely packed together (points with many nearby neighbors), marking as outliers points that lie alone in low-density regions (whose nearest neighbors are too far away)

Calculation step

1

If the number of neighborhood points around x are less than MinPts and it has a core point in its neighborhood, treat it as a border point.

2

If no neighborhood points around x, treat it as a outlier.

3

Include all the density connected points as a single cluster.

4

Repeat the above steps for every unvisited point in the data set and find out all core, border and outlier points.

Calculation step

5

Choose a value for eps and MinPts

6

For a particular datapoint (x) calculate its distance from every other datapoints.

7

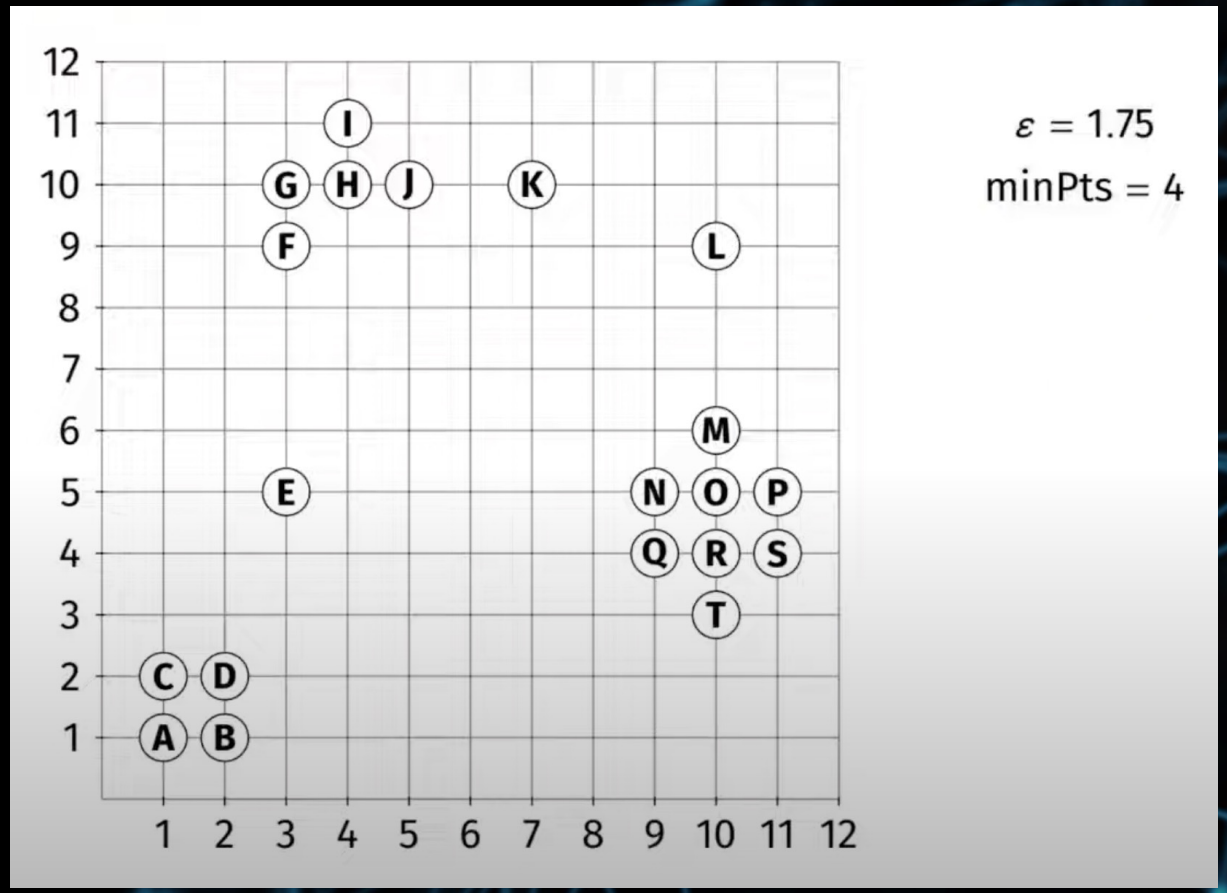
For a particular datapoint (x) calculate its distance from every other datapoints.

8

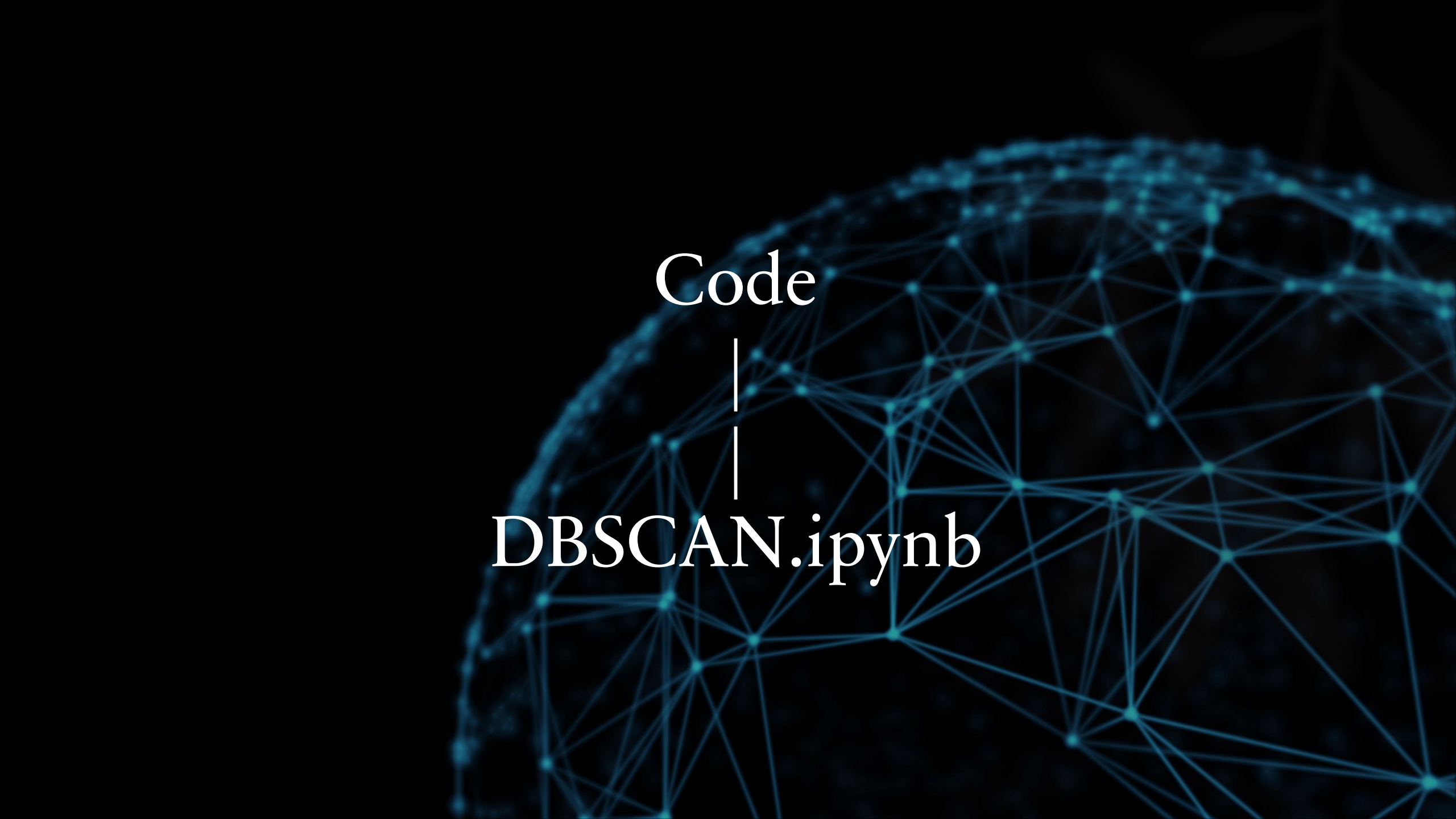
If the number of neighborhood points around x are greater or equal to MinPts then treat x as a core point (if it is not assigned to any cluster.)

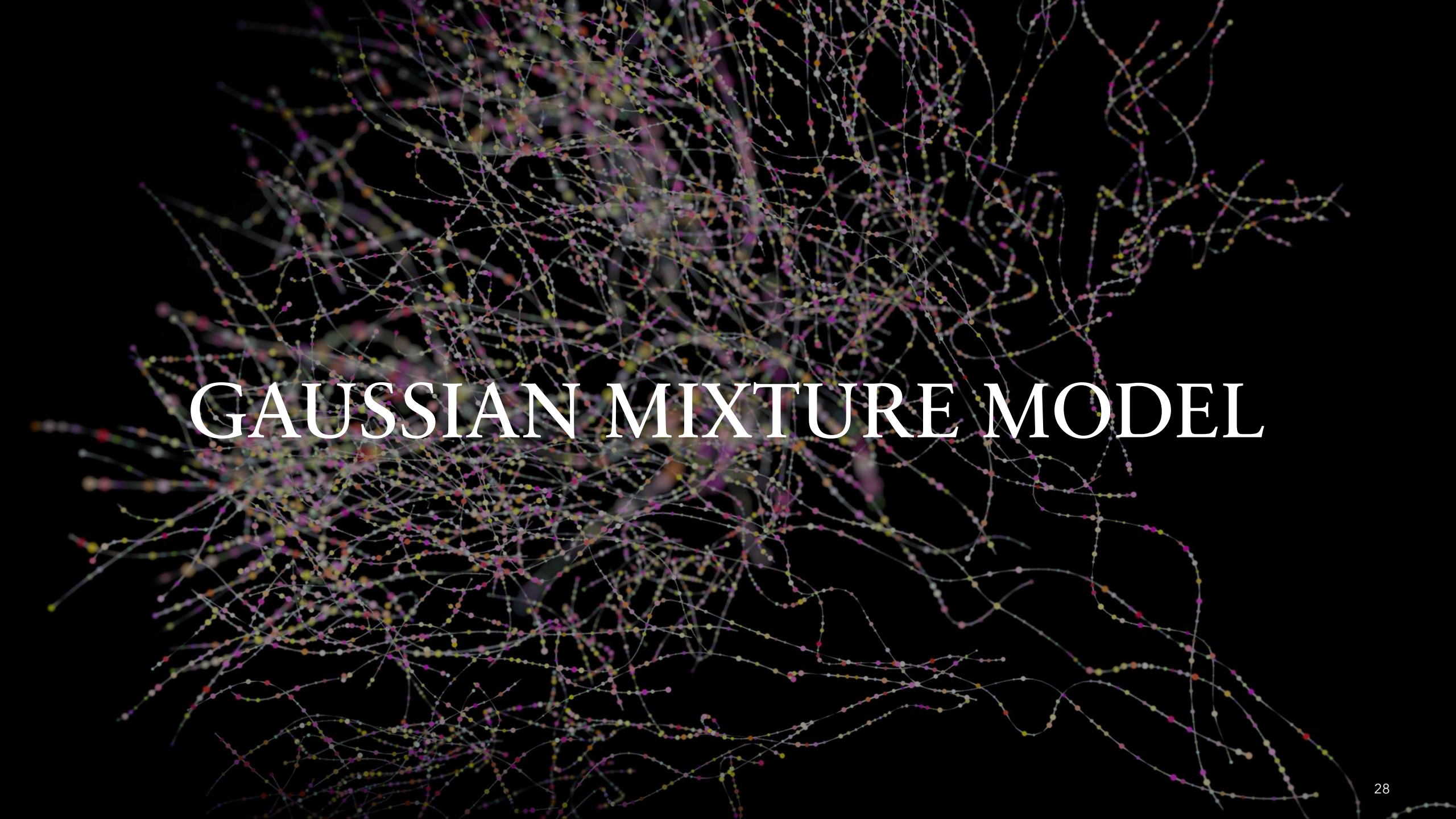
Calculation example

Calculation concept



https://www.youtube.com/watch?v=NO8-UurDrQw


Code
DBSCAN.ipynb


GAUSSIAN MIXTURE MODEL

GAUSSIAN MIXTURE MODEL

What is Gaussian mixture model?

Calculation Step

Calculation Concept

Code

What is Gaussian mixture model?

A Gaussian Mixture Model is a probabilistic model used for clustering and density estimation. It assumes that the data points are generated from a mixture of several Gaussian distributions. Each component in the mixture represents a cluster in the data, and each Gaussian distribution represents the probability distribution of data points belonging to that cluster.

Calculation step

1

Choose the number of clusters K

2

Initialize parameters

i) means

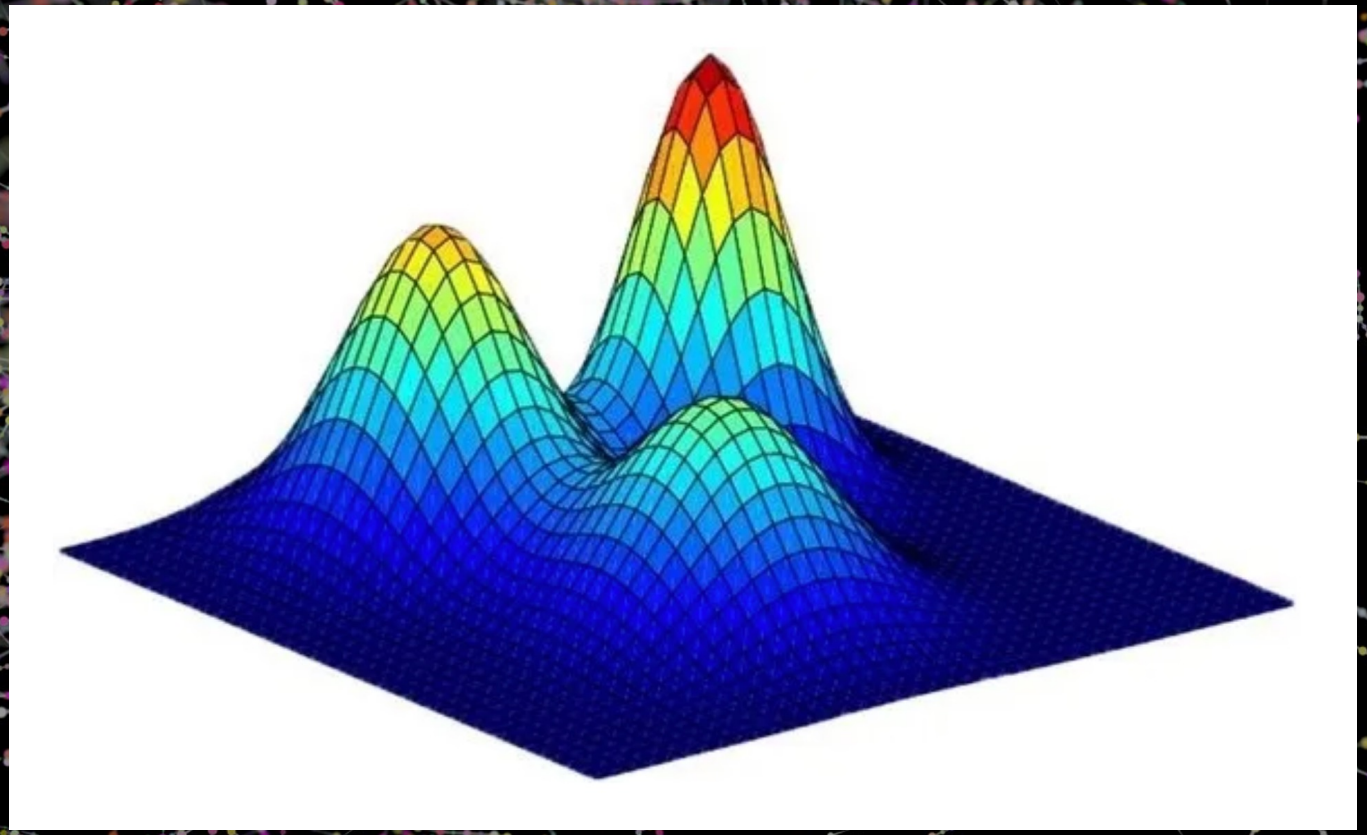
ii) covariances

iii) weights

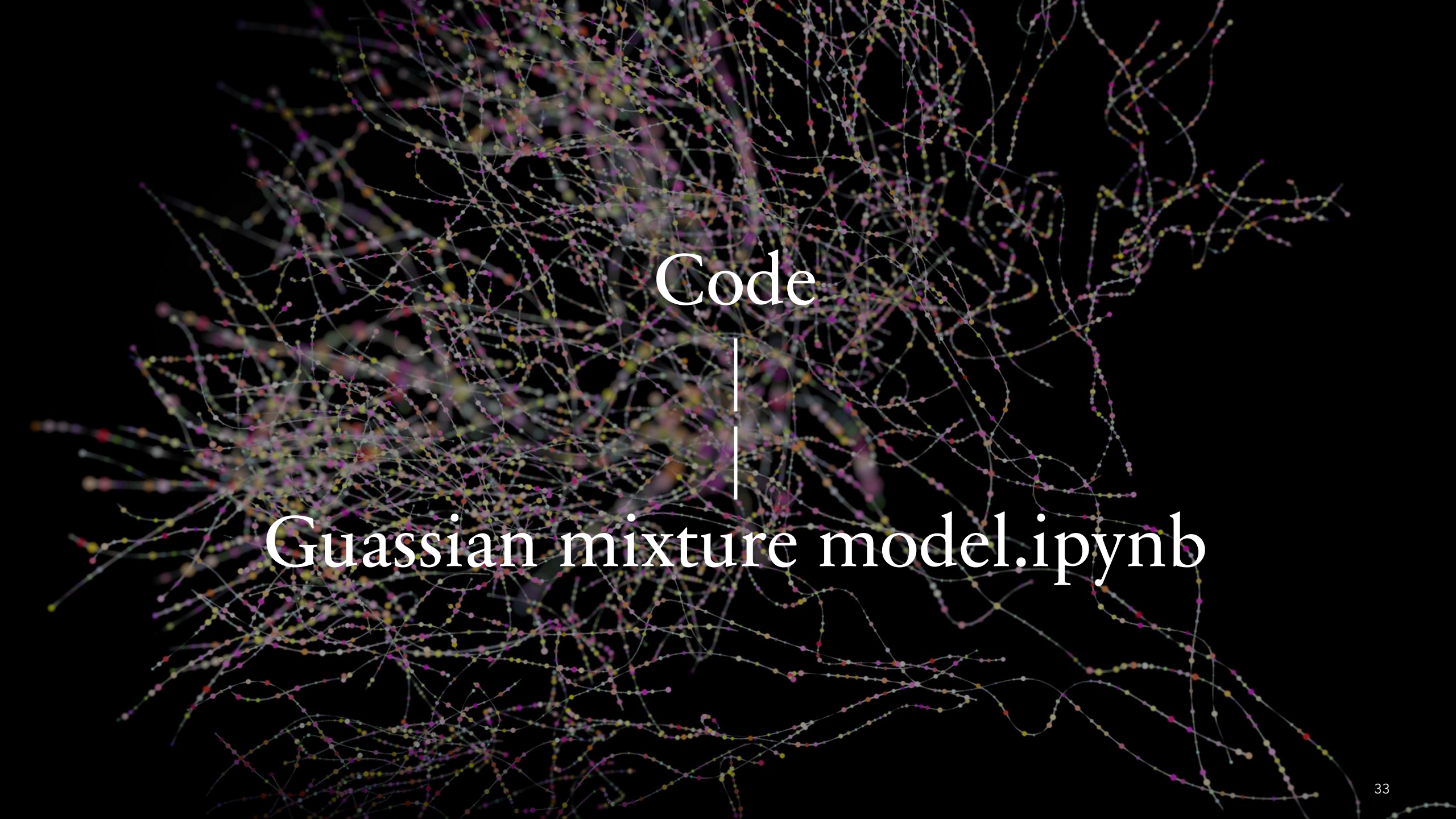
3

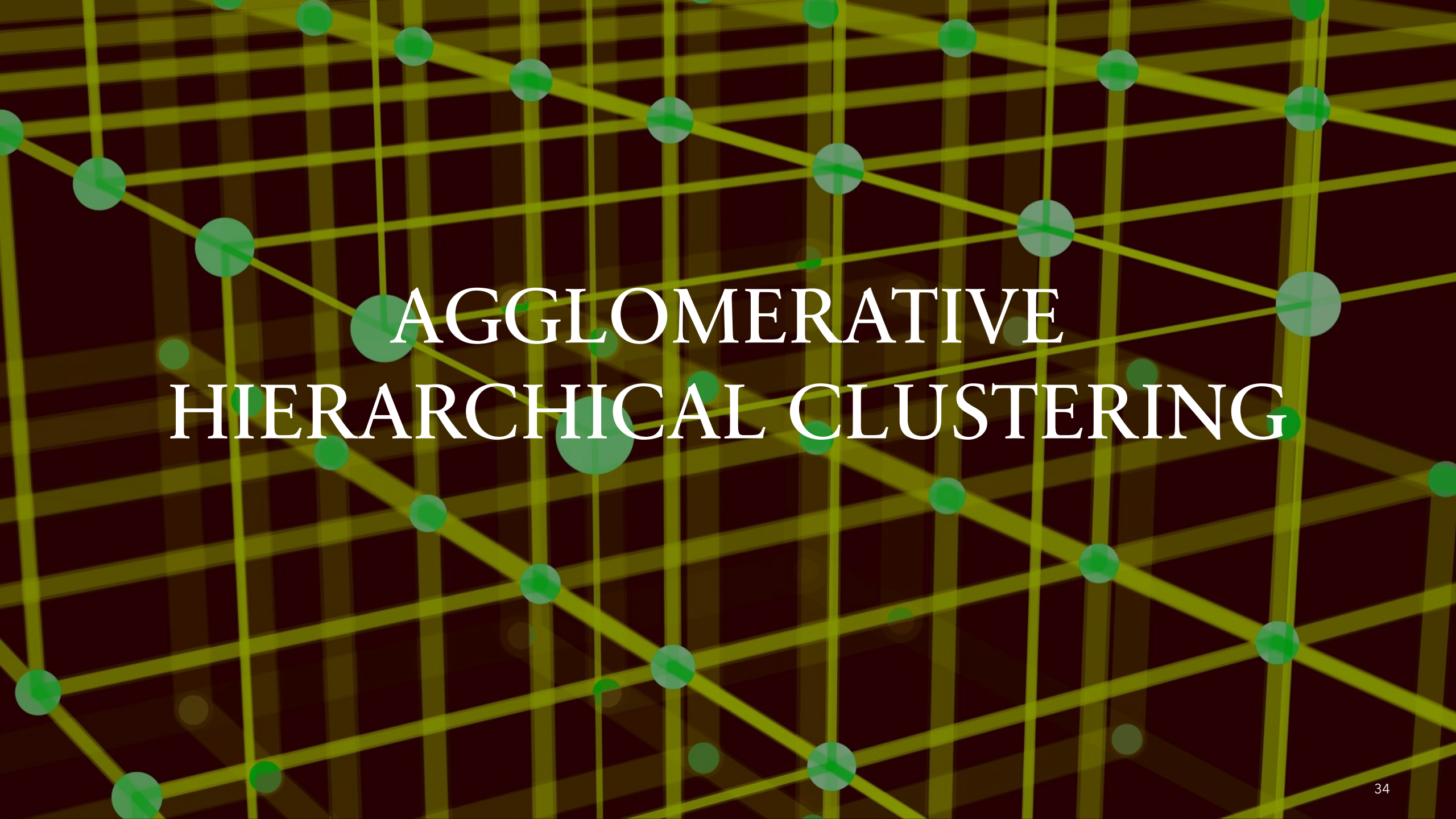
Apply EM algorithm for finding the converged parameters

Calculation concept



https://medium.com/@rahulkaliyath/day-11-gaussian-mixture-model-clustering-90e31cdadb12


Code
Guassian mixture model.ipynb


AGGLOMERATIVE
HIERARCHICAL CLUSTERING

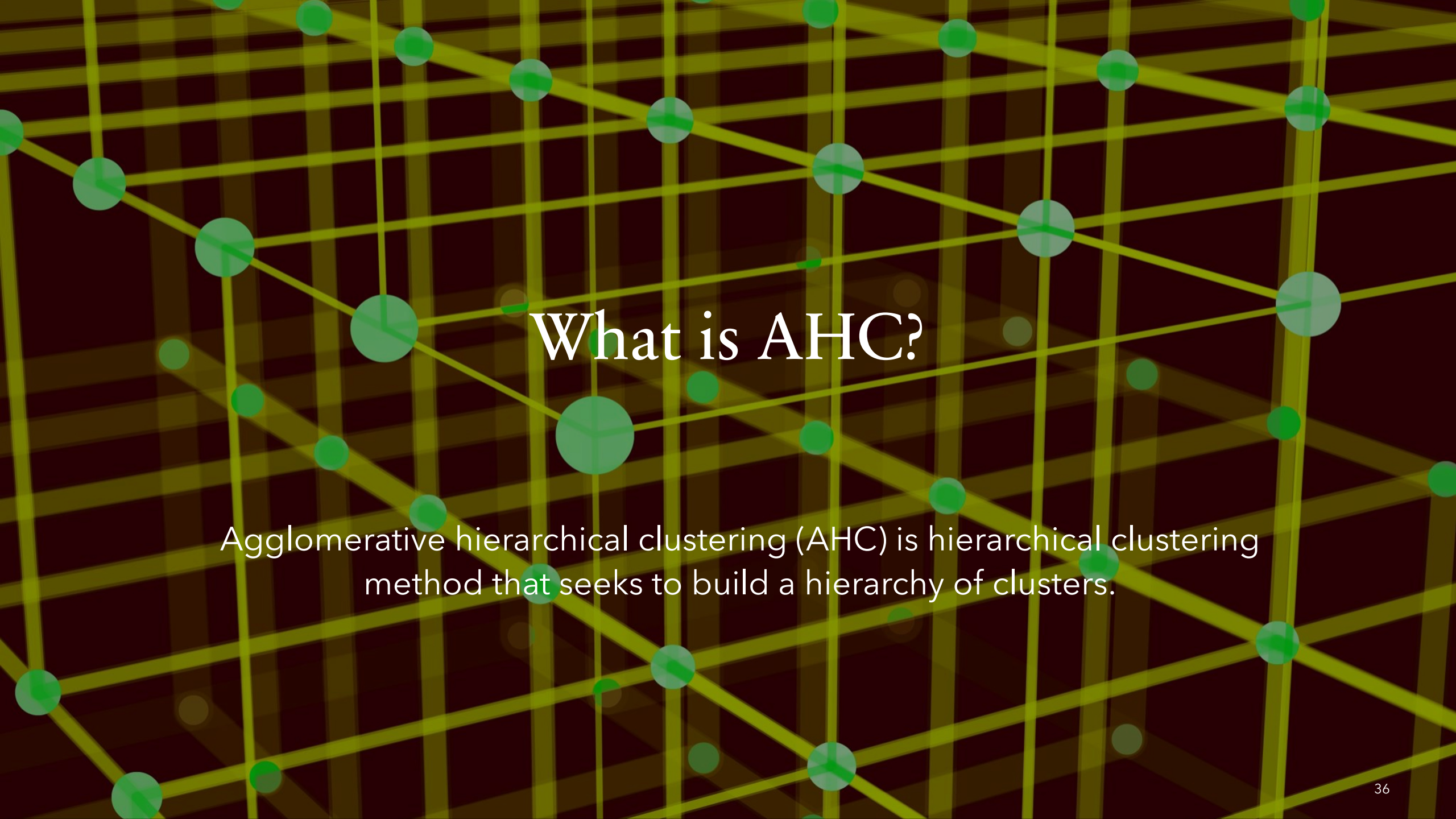
AGGLOMERATIVE HIERARCHICAL CLUSTERING

What is Agglomerative hierarchical clustering?

Calculation Step

Calculation Example

Code



What is AHC?

Agglomerative hierarchical clustering (AHC) is hierarchical clustering method that seeks to build a hierarchy of clusters.

Calculation step

1

Create each datapoint as a single cluster.

2

Take two closest datapoints or clusters and merge them to form one cluster.

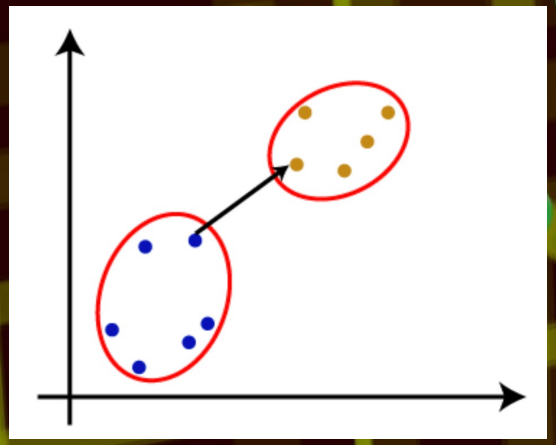
3

Repeat Step 2 until only one cluster left.

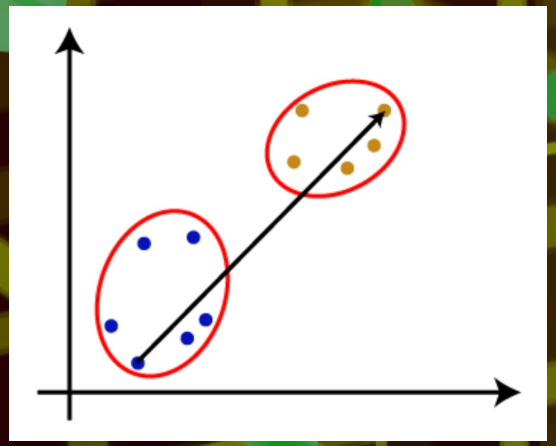
4

Once all the clusters are combined into one big cluster, develop the dendrogram to divide the clusters

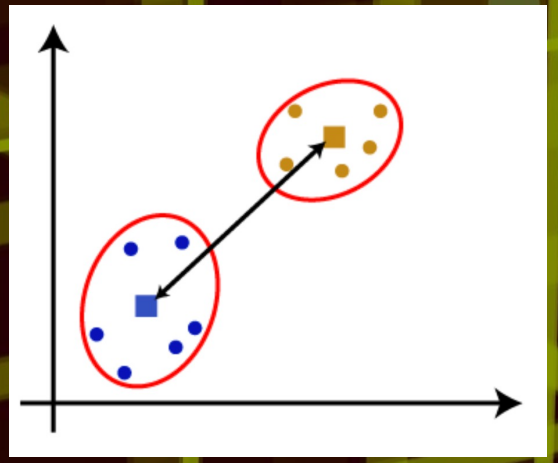
Linkage methods



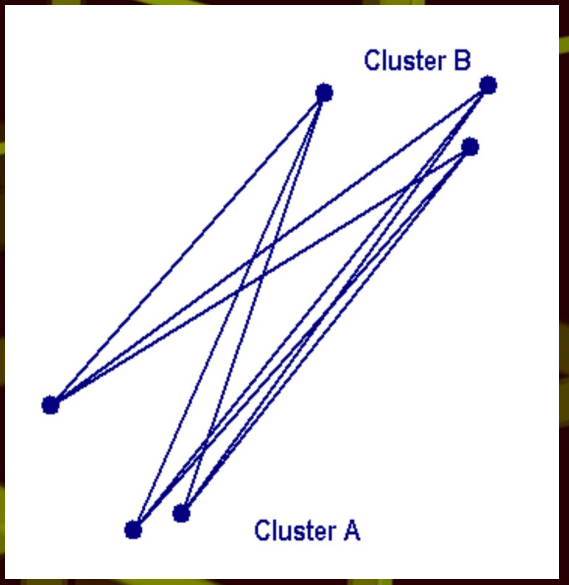
Single likage



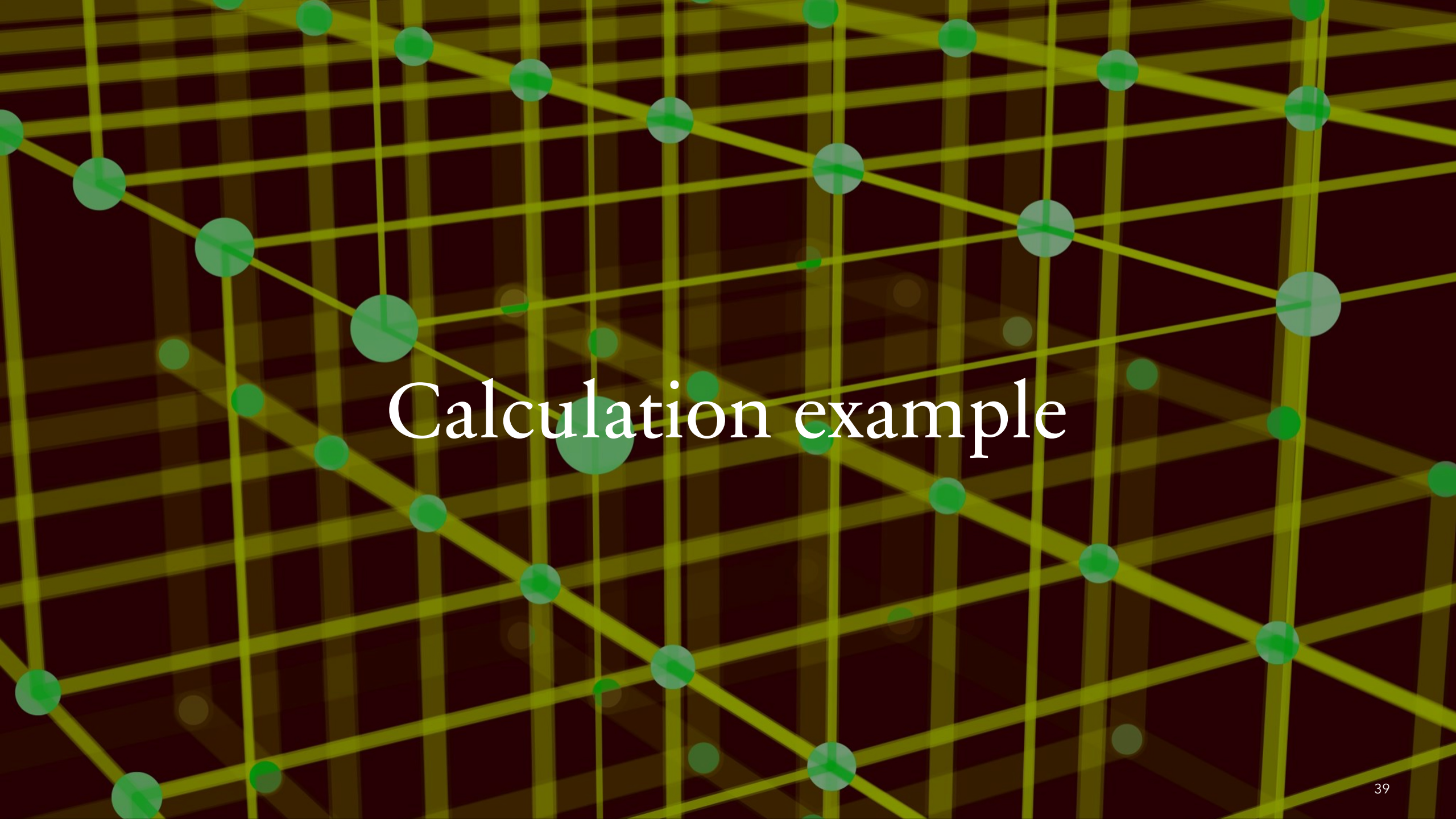
Complete likage



Centroid likage

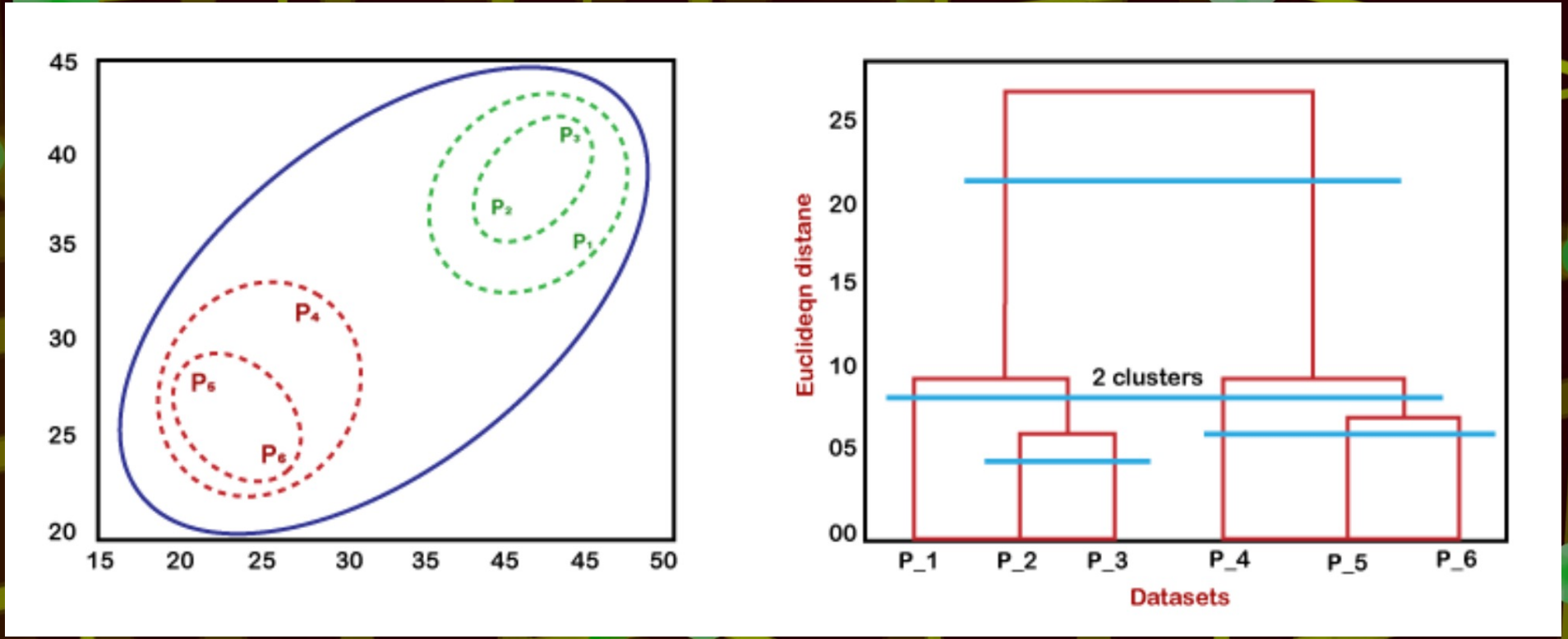


Average likage

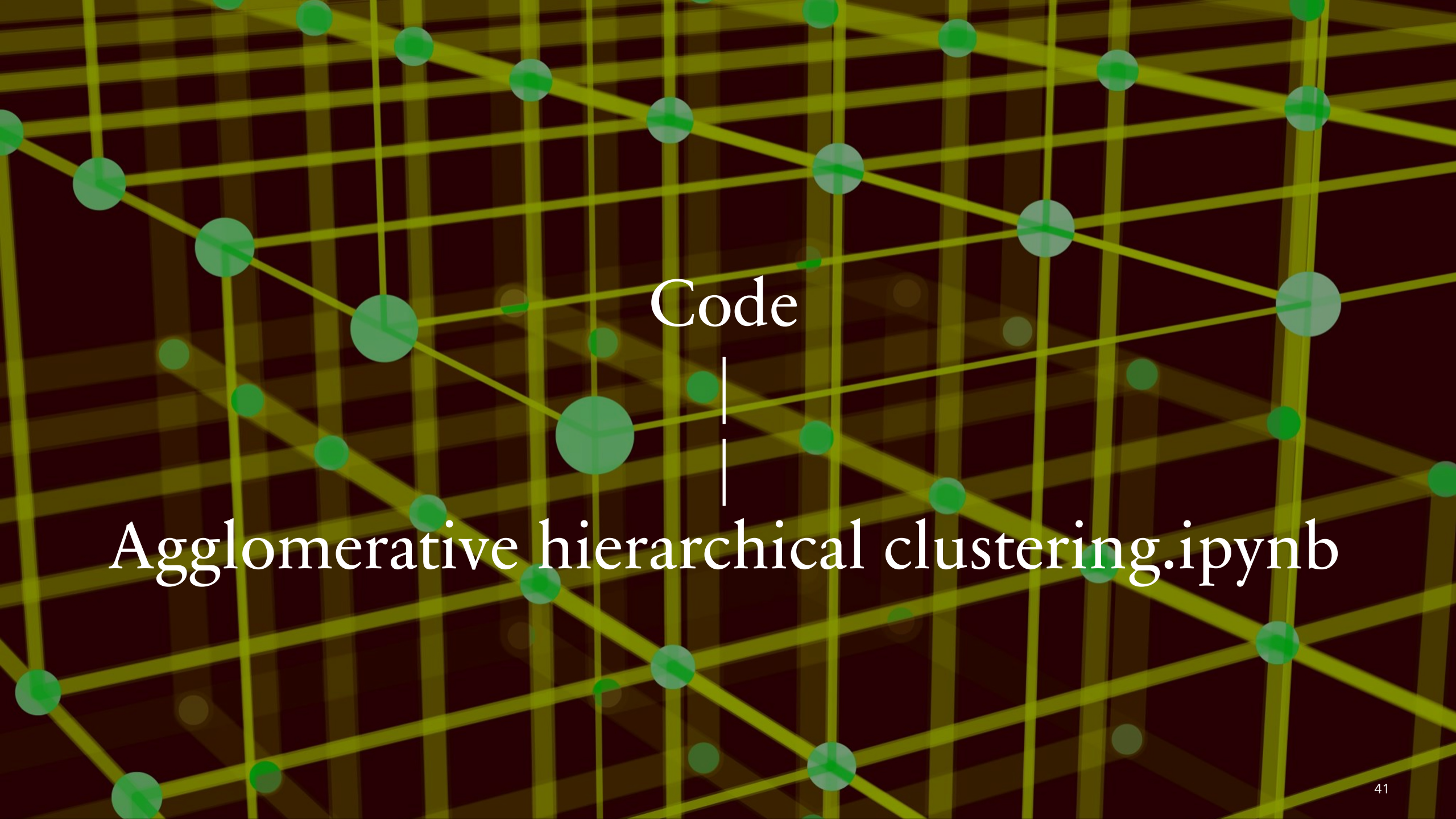


Calculation example

Calculation concept



https://www.javatpoint.com/hierarchical-clustering-in-machine-learning


Code
Agglomerative hierarchical clustering.ipynb

Comparison

	K-mean clustering	DBSCAN	Gaussian Mixture Model	Agglomerative hierarchical clustering
Clustering type	Centroid-based	Density-based	Distribution-based	Hierarchical
What users define	- Number of clusters - Initial cluster centroid (optional)	- Epsilon - MinPts	- Number of clusters - Initial parameters (optinoal)	- Distance threshold or number of clusters - Linkage method
Ability to handle outliers	Sensitive to outliers	Robust to outliers	Assign low probability to outliers	Incorporate outliers into singleton clusters or ignore them
Soft clustering?	No	No	Yes	No
Suitable data shape	Sphere (convex)	Arbitary shapes (convex & non convex)	Arbitary shapes (convex & non convex) *** not that good	Arbitary shapes (convex & non convex)

FURTHER READING

- Ensemble clustering
- Adaptive clustering
- Dynamic time wraping
- Spectral clustering
- BIRCH
- Affinity propagation clustering
- Mean-Shift clustering
- OPTICS
- Evaluation metric for clustering

QUESTION & ANSWER

Reference (1)

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THANK YOU