CREATIVE DATA MINING

Introduction to Unsupervised Machine Learning

06.11.2017

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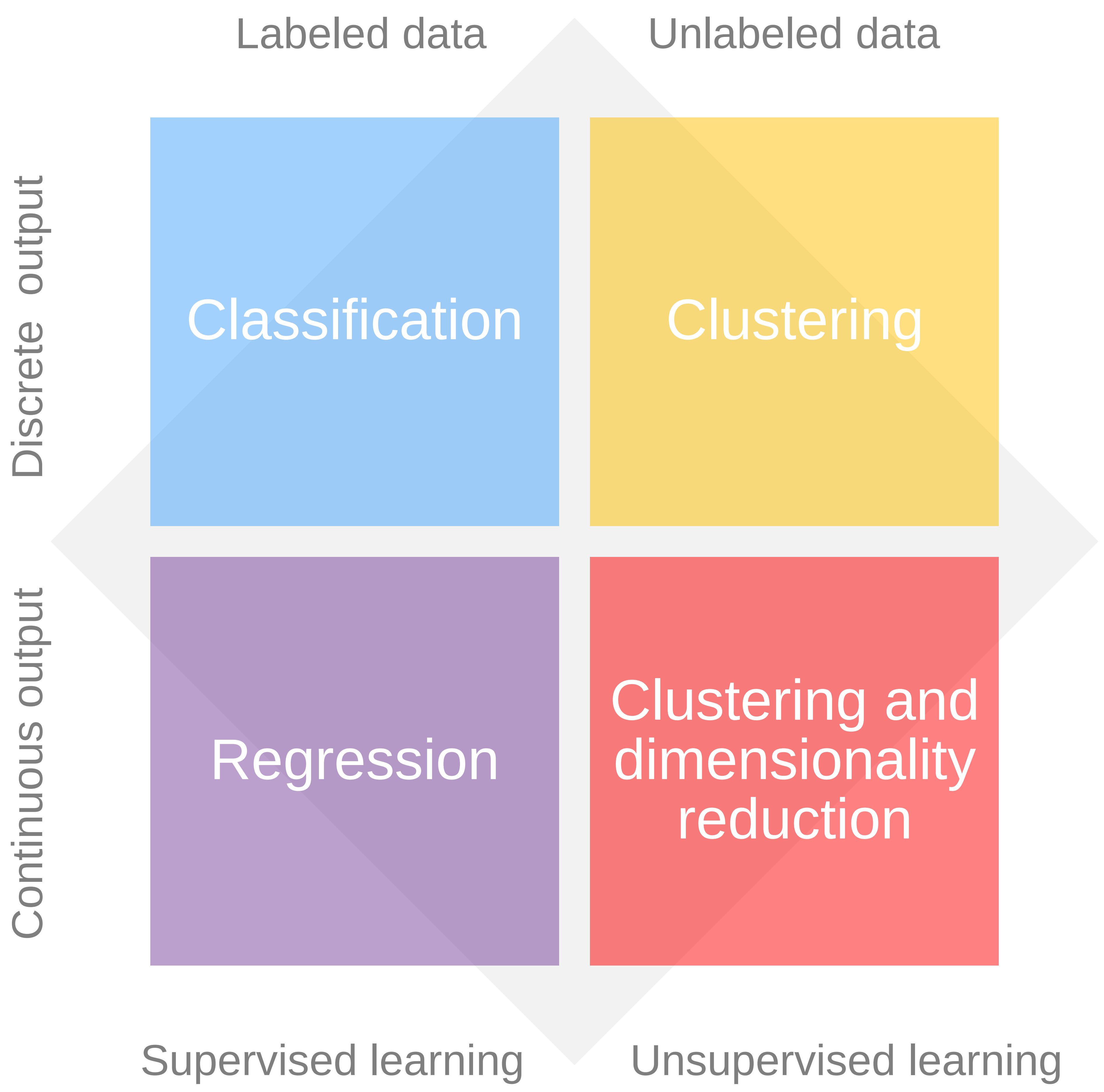
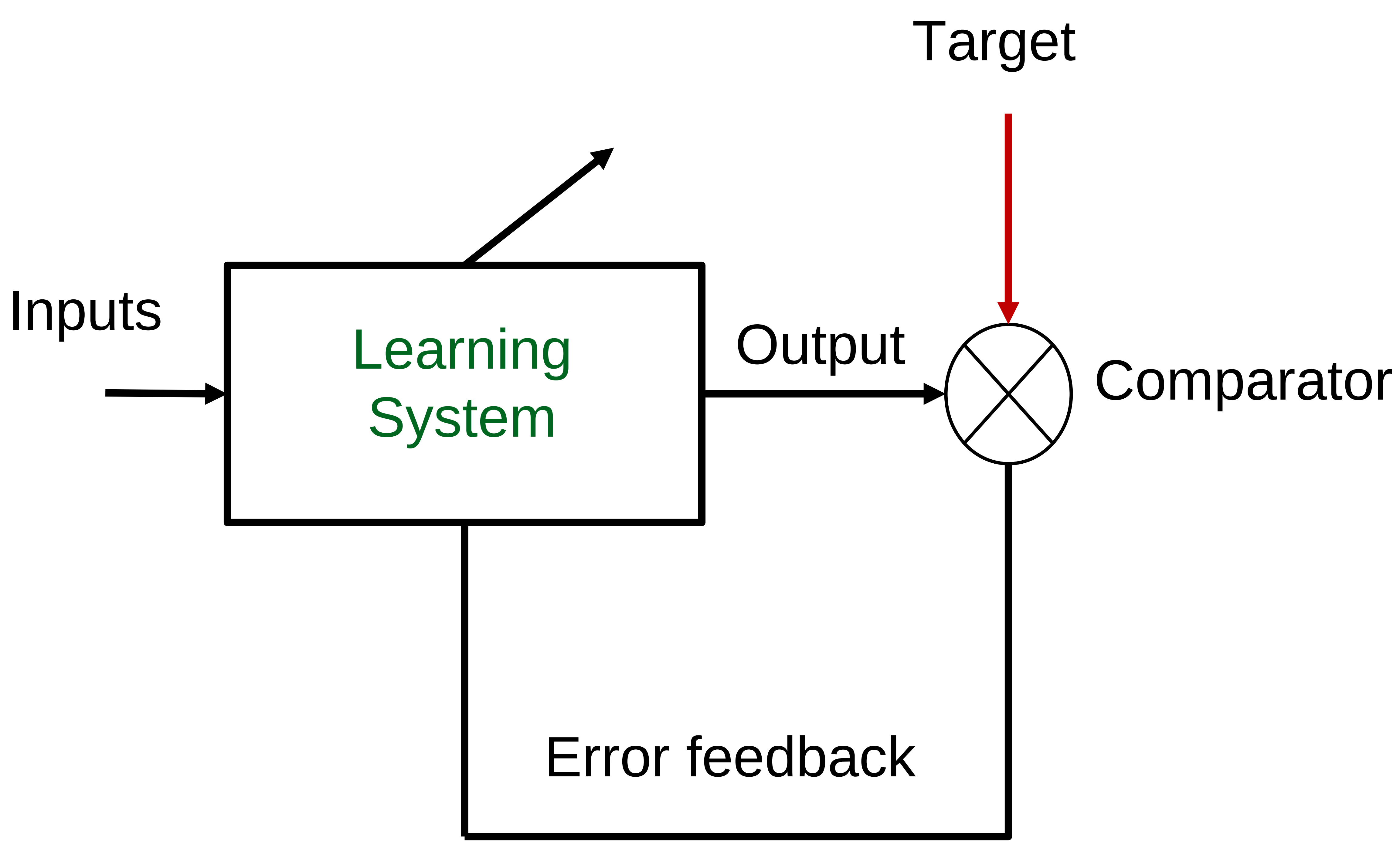


Learning Systems

Supervised



Unsupervised

Data (unlabeled)

#	Inputs			
	F1	F2	F3	F4
1	76.85	17.27	0.22	34.63
2	76.97	19.54	0.22	34.64
3	77.10	18.51	0.22	34.64
4	85.28	46.09	0.22	34.61
5	85.42	35.83	0.22	34.61
6	88.02	2.59	0.22	34.63
7	77.25	6.34	0.22	34.65
8	77.49	6.98	0.22	34.63
9	85.81	12.18	0.22	34.61

We do not know what is target/output.

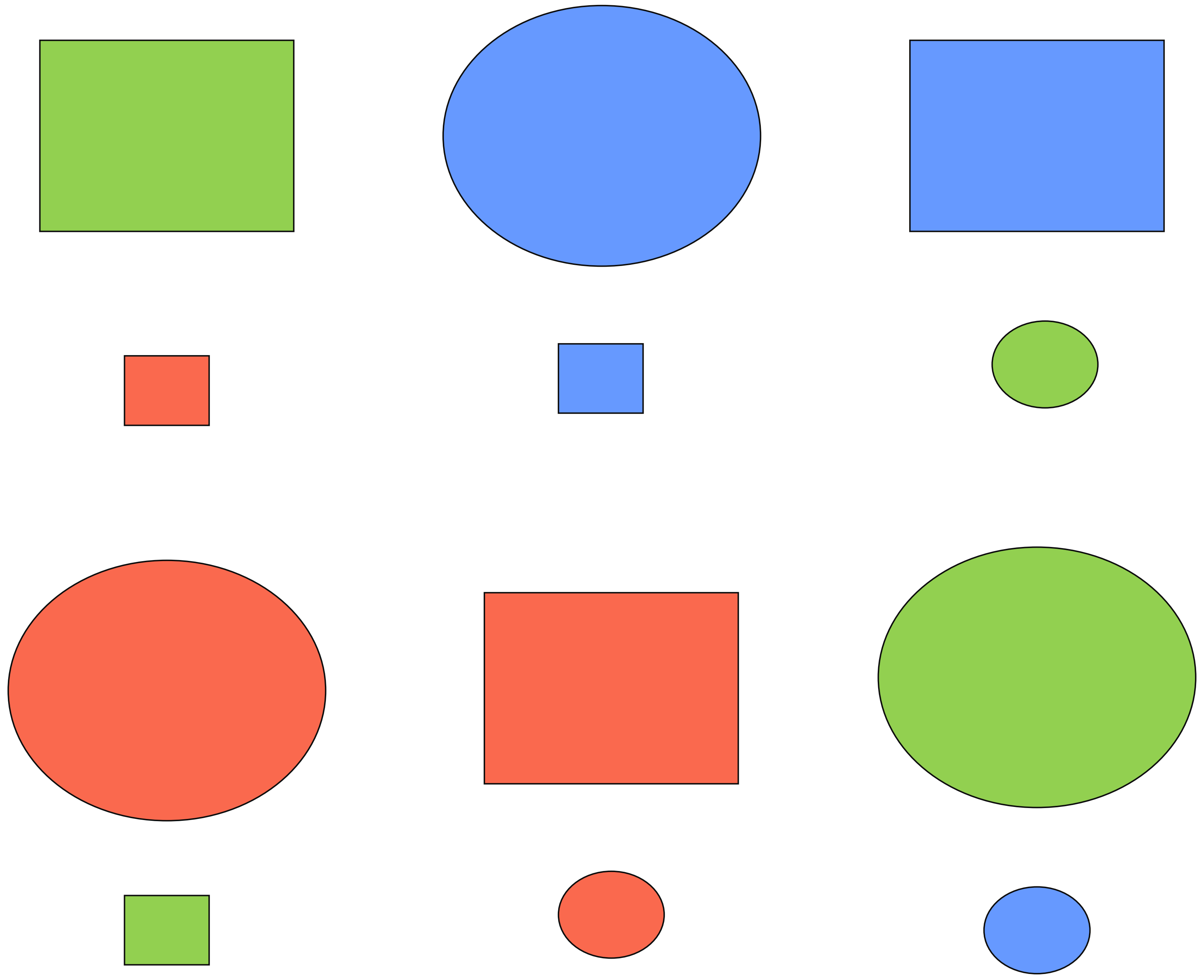
We just want to understand some pattern or some sort of grouping of data points.

Data (unlabeled)

Example: natural concept

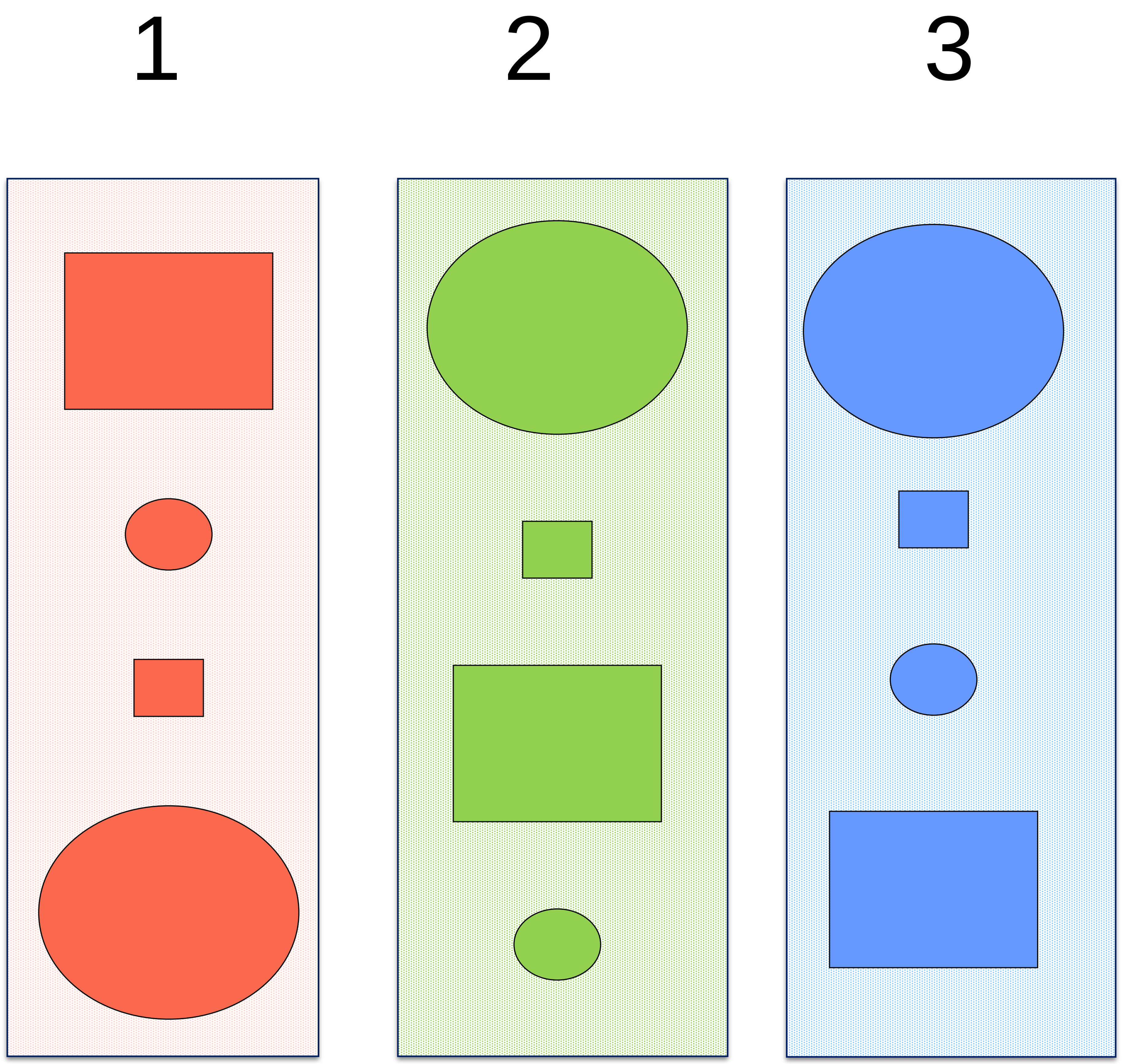
Can we form groups of these objects?

What features these objects has?



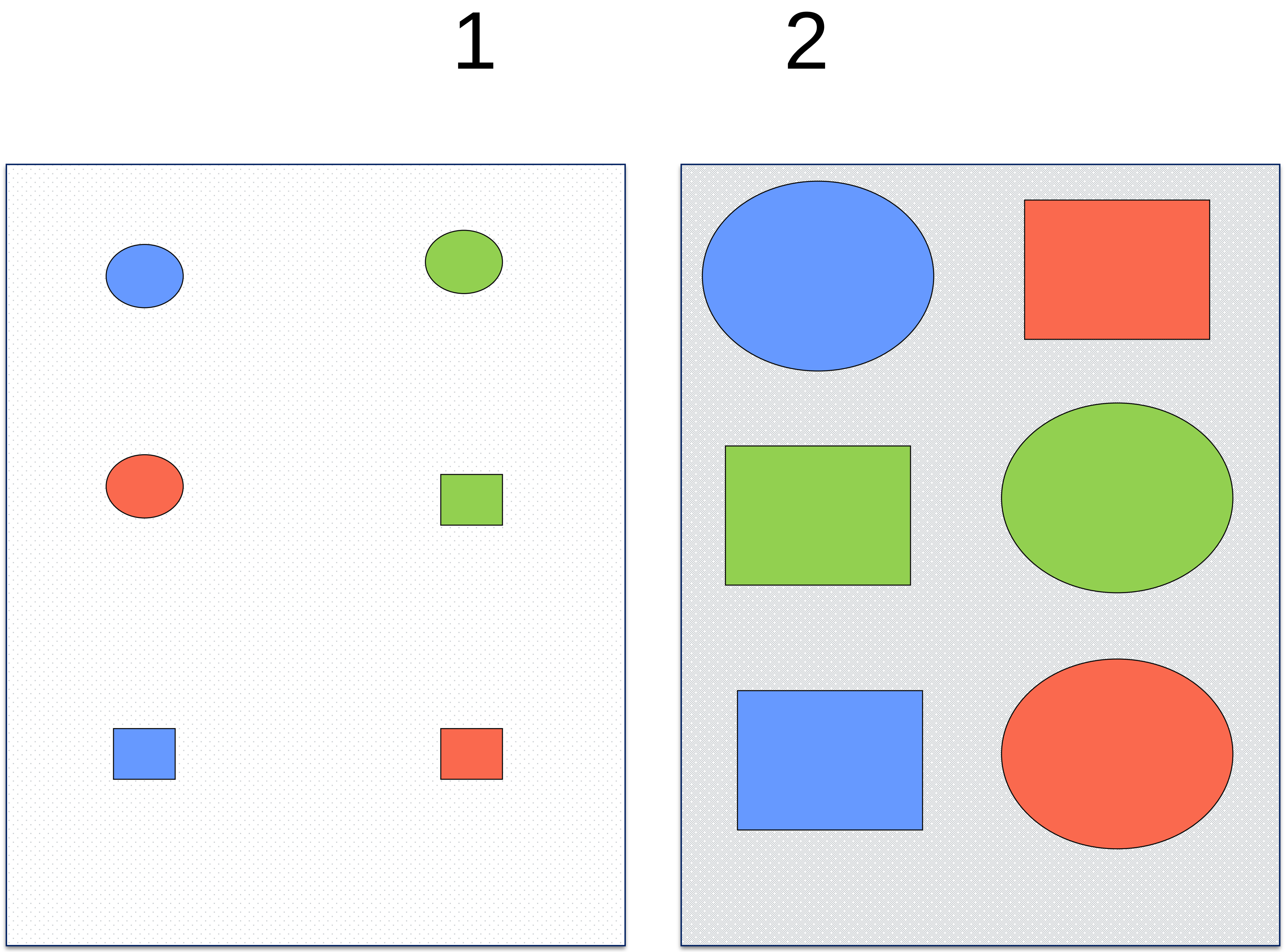
Clustering

Criteria: Color



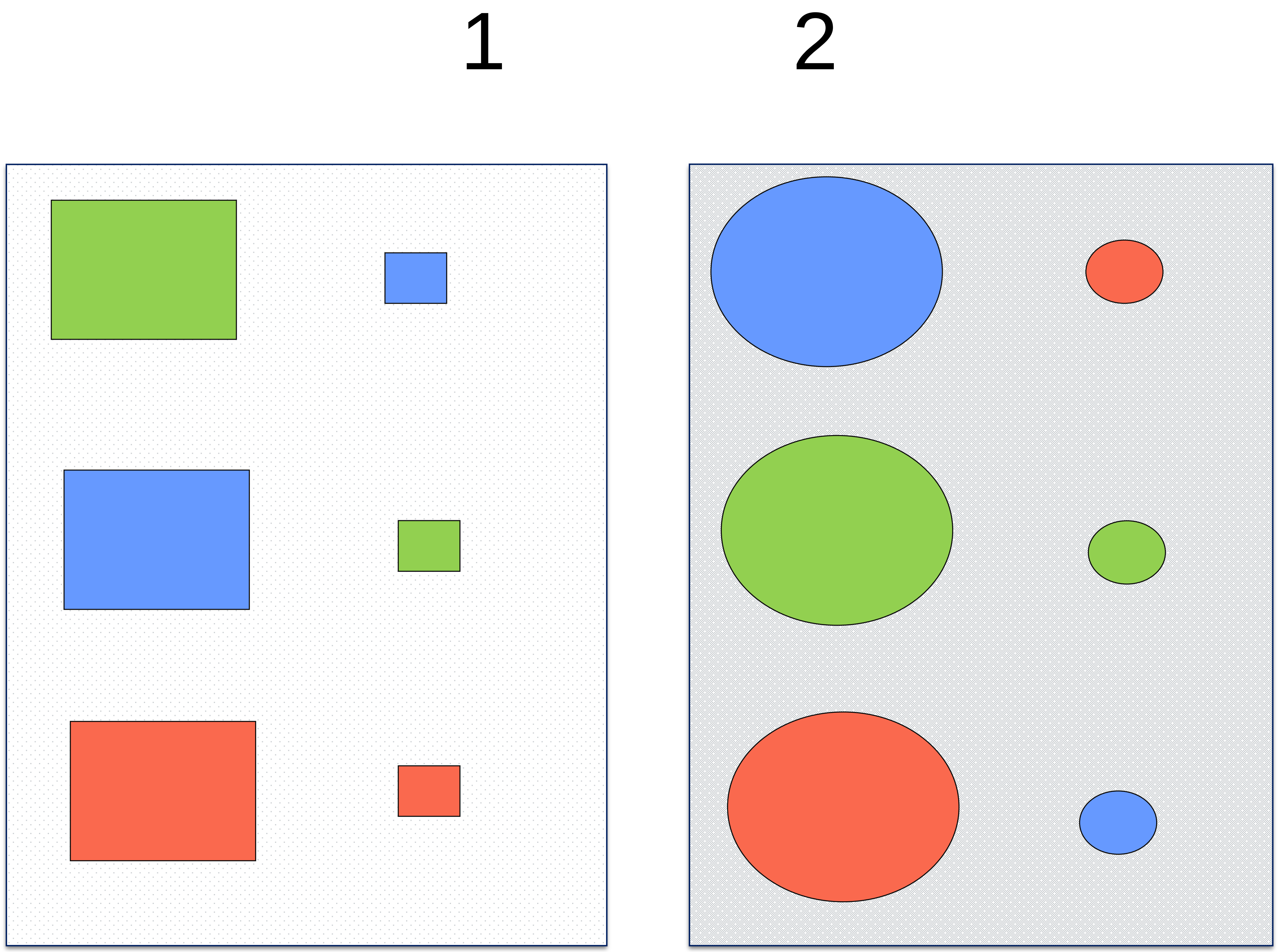
Clustering

Criteria: Size



Clustering

Criteria: Shape



Data (unlabeled)

Can we form groups of these samples?

What are the criteria for grouping?

#	Inputs			
	HR	BVP	EDA	TempBF
1	76.85	17.27	0.22	34.63
2	76.97	19.54	0.22	34.64
3	77.10	18.51	0.22	34.64
4	85.28	46.09	0.22	34.61
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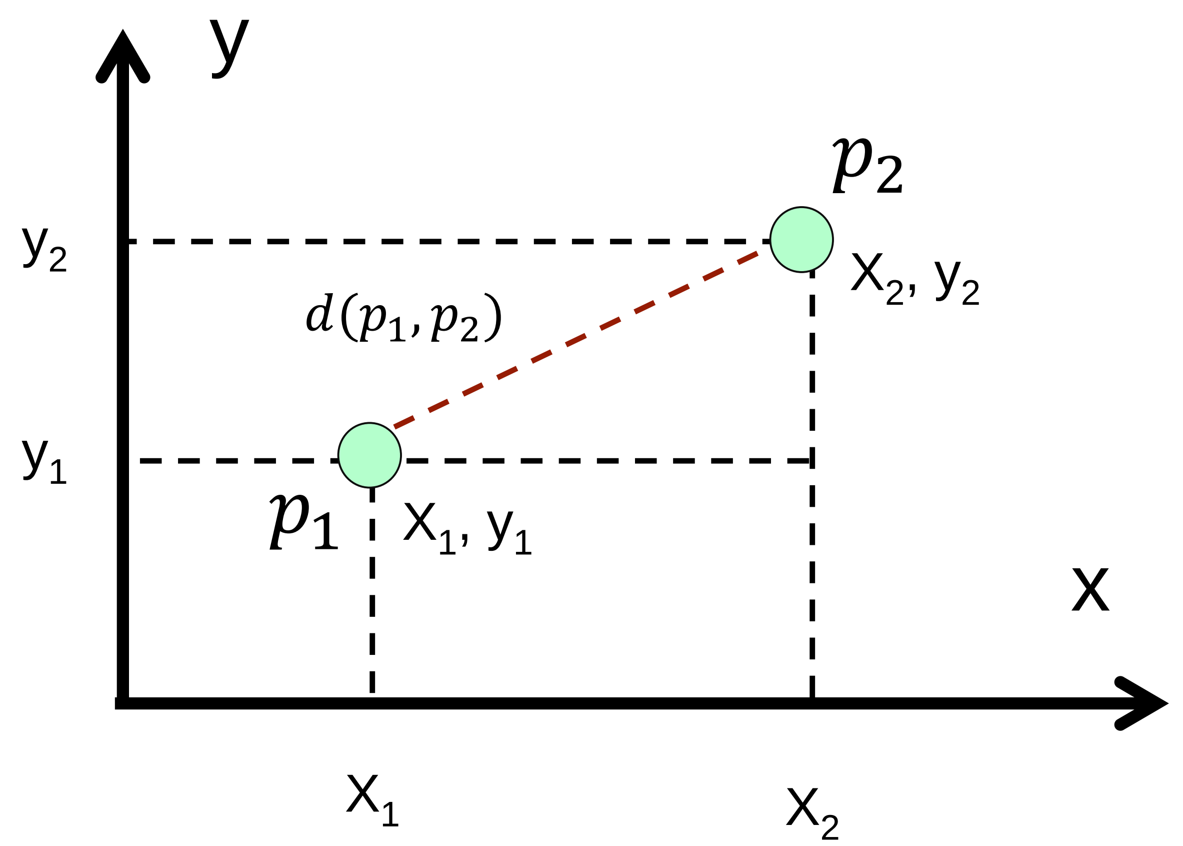
Clustering

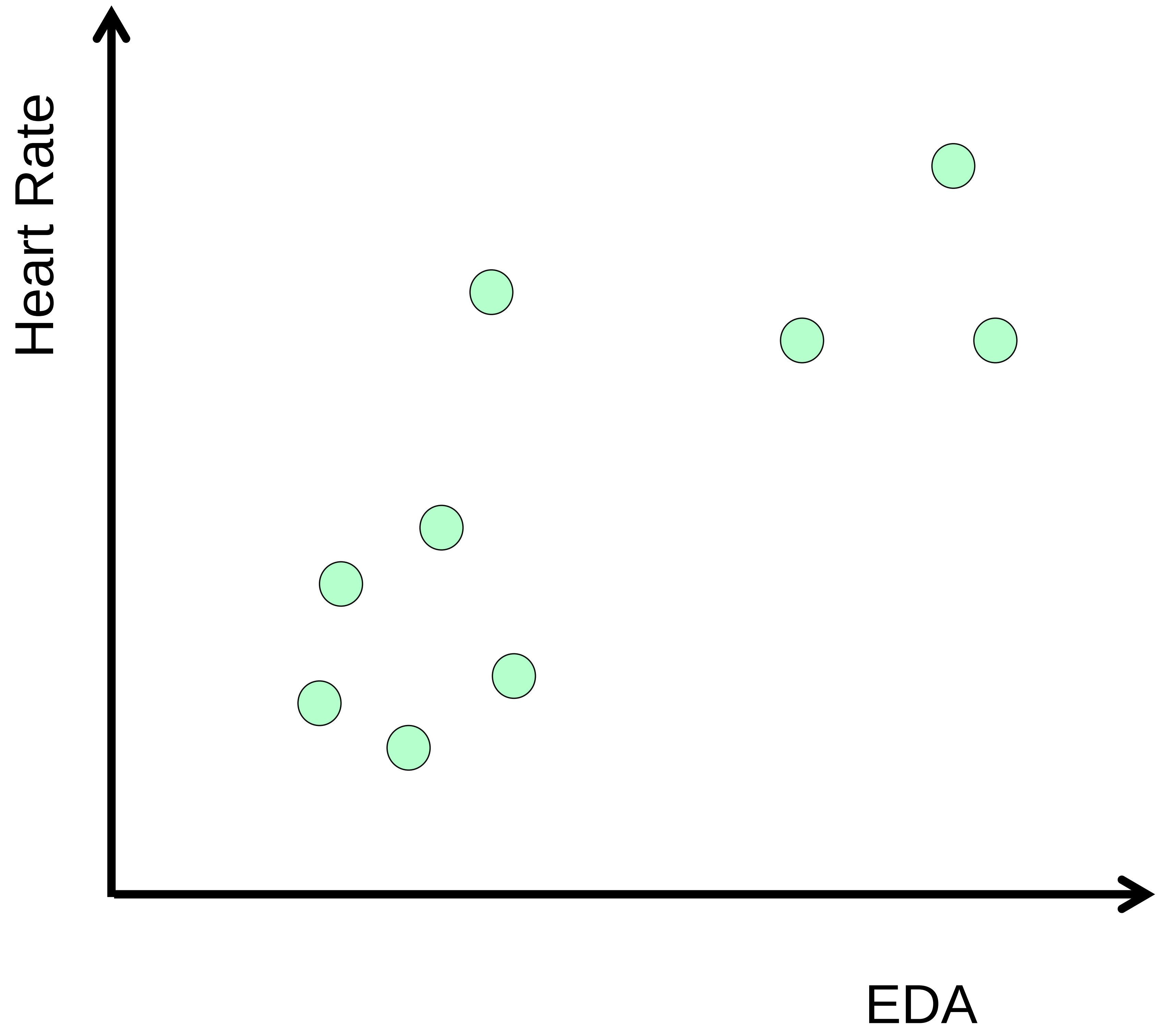
Distance based: K-Means



Euclidean distance:

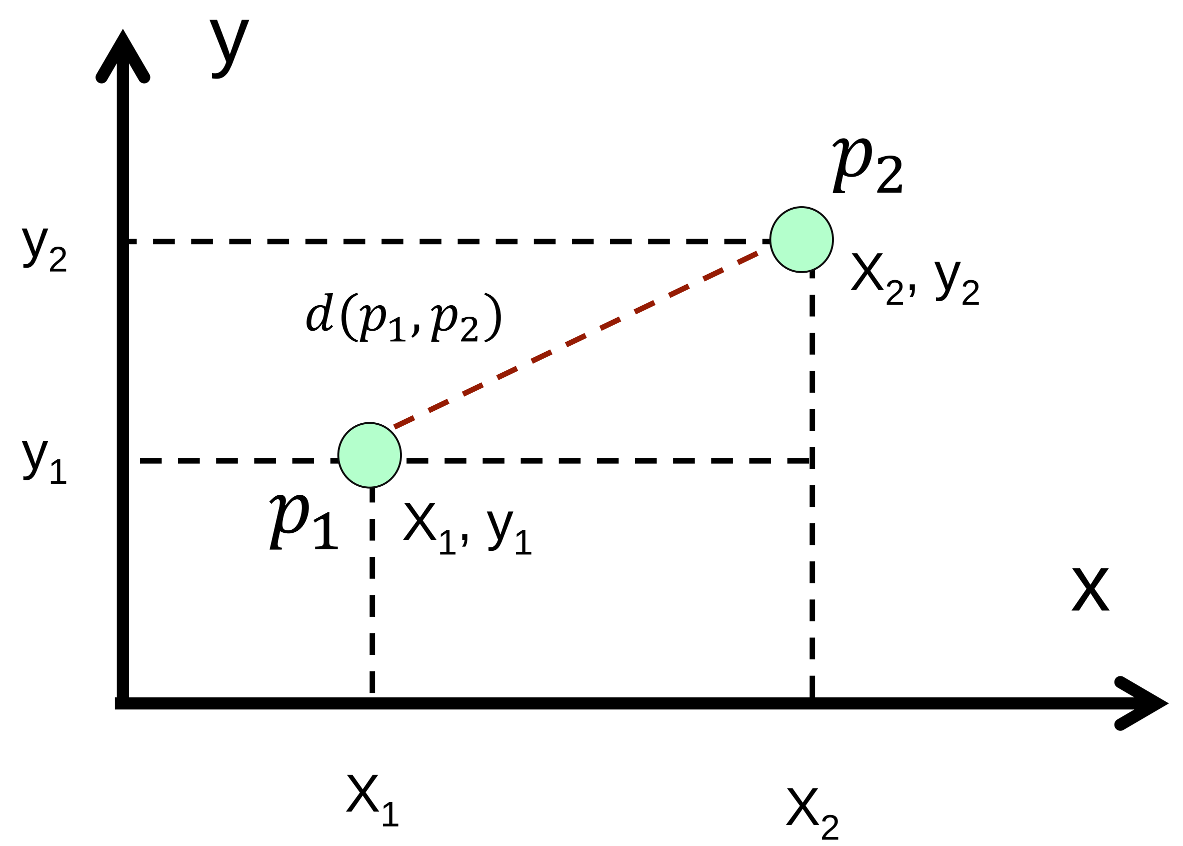
$$d(p_1, p_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

ESUM data



Clustering

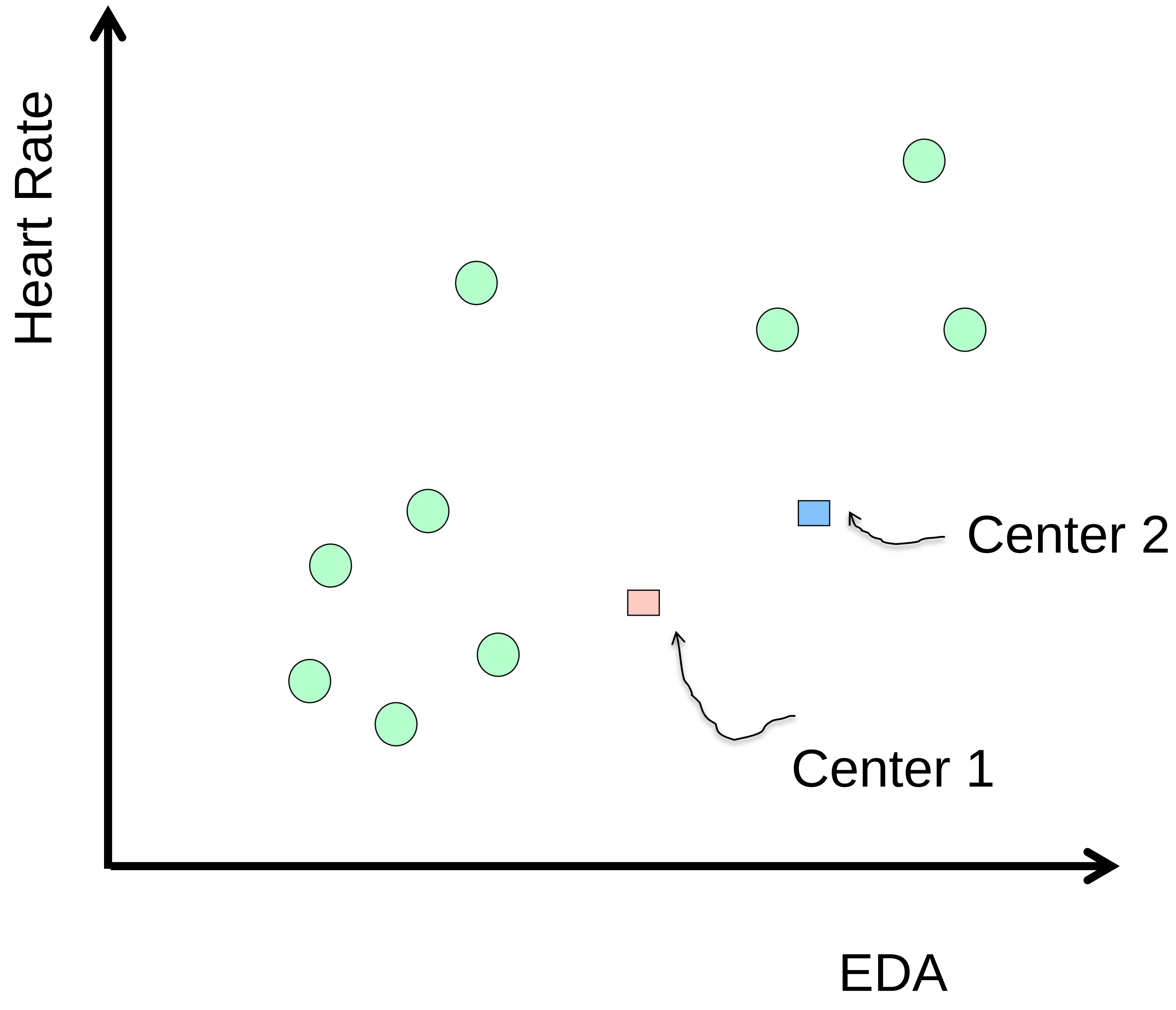
Distance based: K-Means



Euclidean distance:

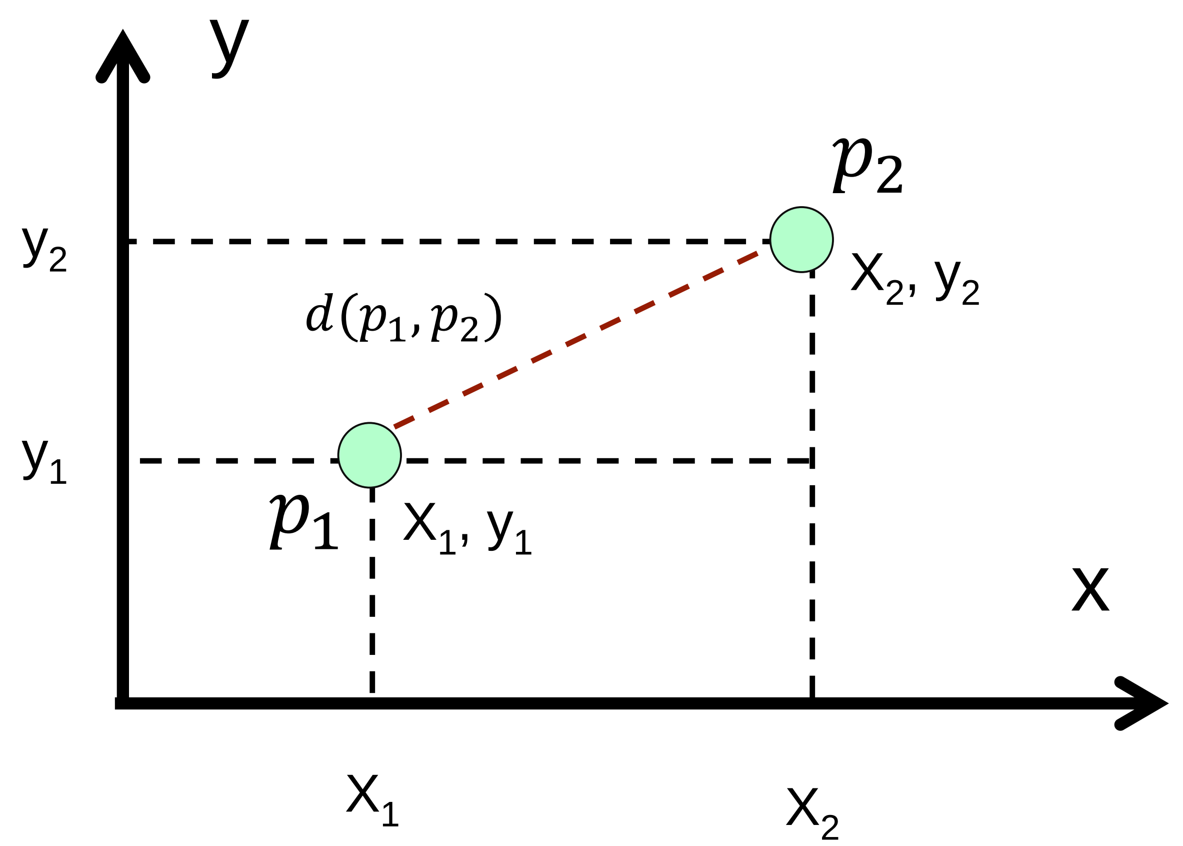
$$d(p_1, p_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Defining centers



Clustering

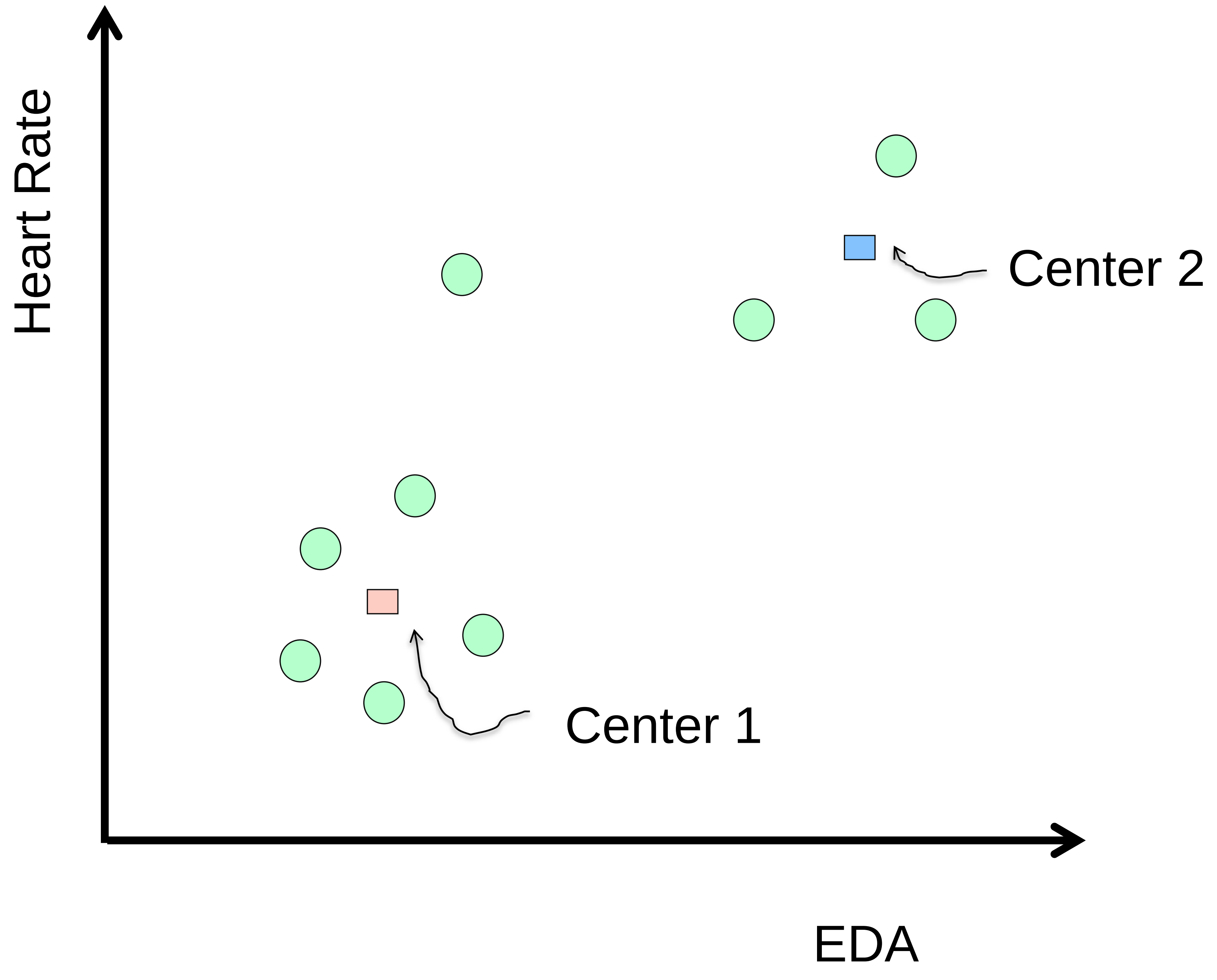
Distance based: K-Means



Euclidean distance:

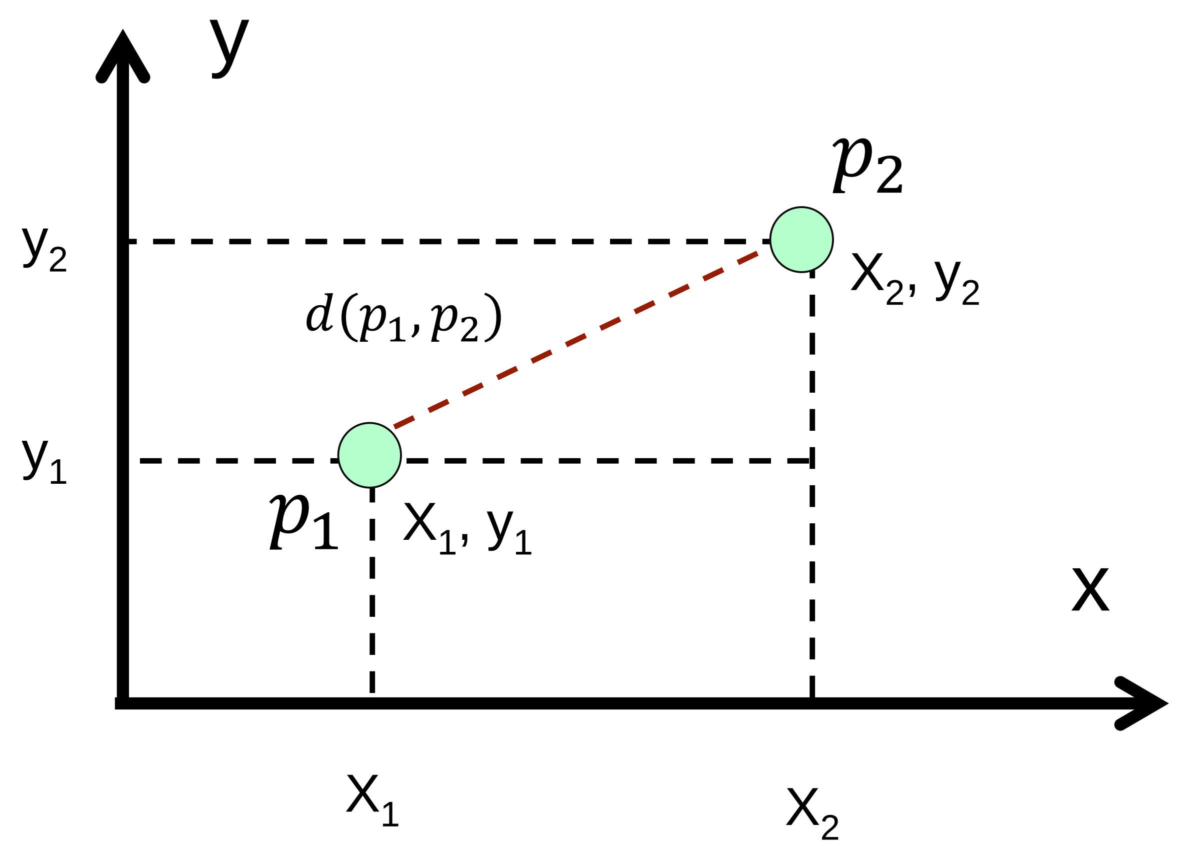
$$d(p_1, p_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Results



Clustering

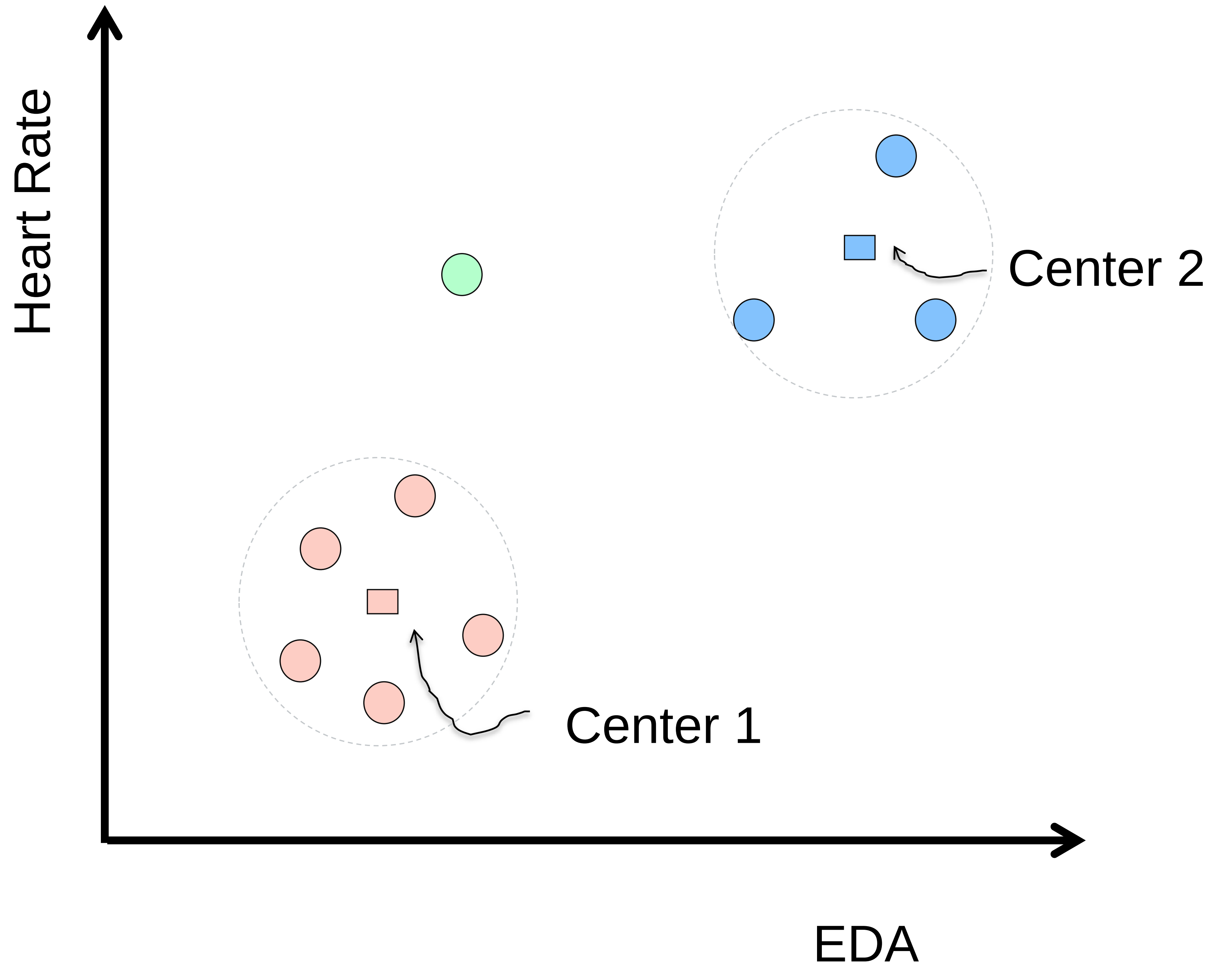
Distance based: K-Means



Euclidean distance:

$$d(p_1, p_2) = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$$

Results



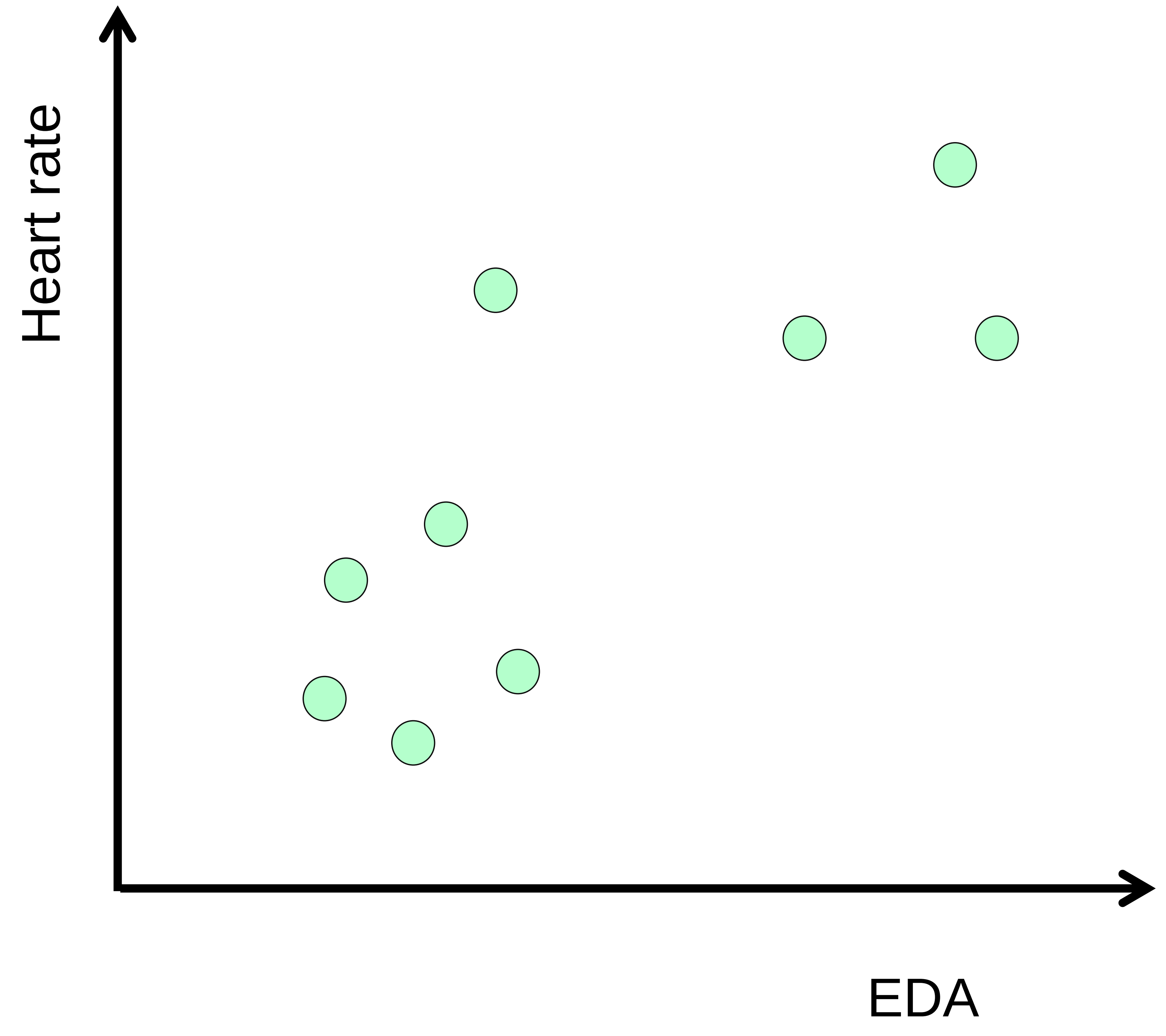
Clustering

Density based : DBSCAN

- Select two parameters:
  - ε-Neighborhood
  - m-minimum number of points
- Select a point *p* randomly
- Find all points reachable from *p* based on ε and m
- If *p* is a *core point*, mark points as a cluster.
- If *p* is a *border point*, no points are reachable from *p*.

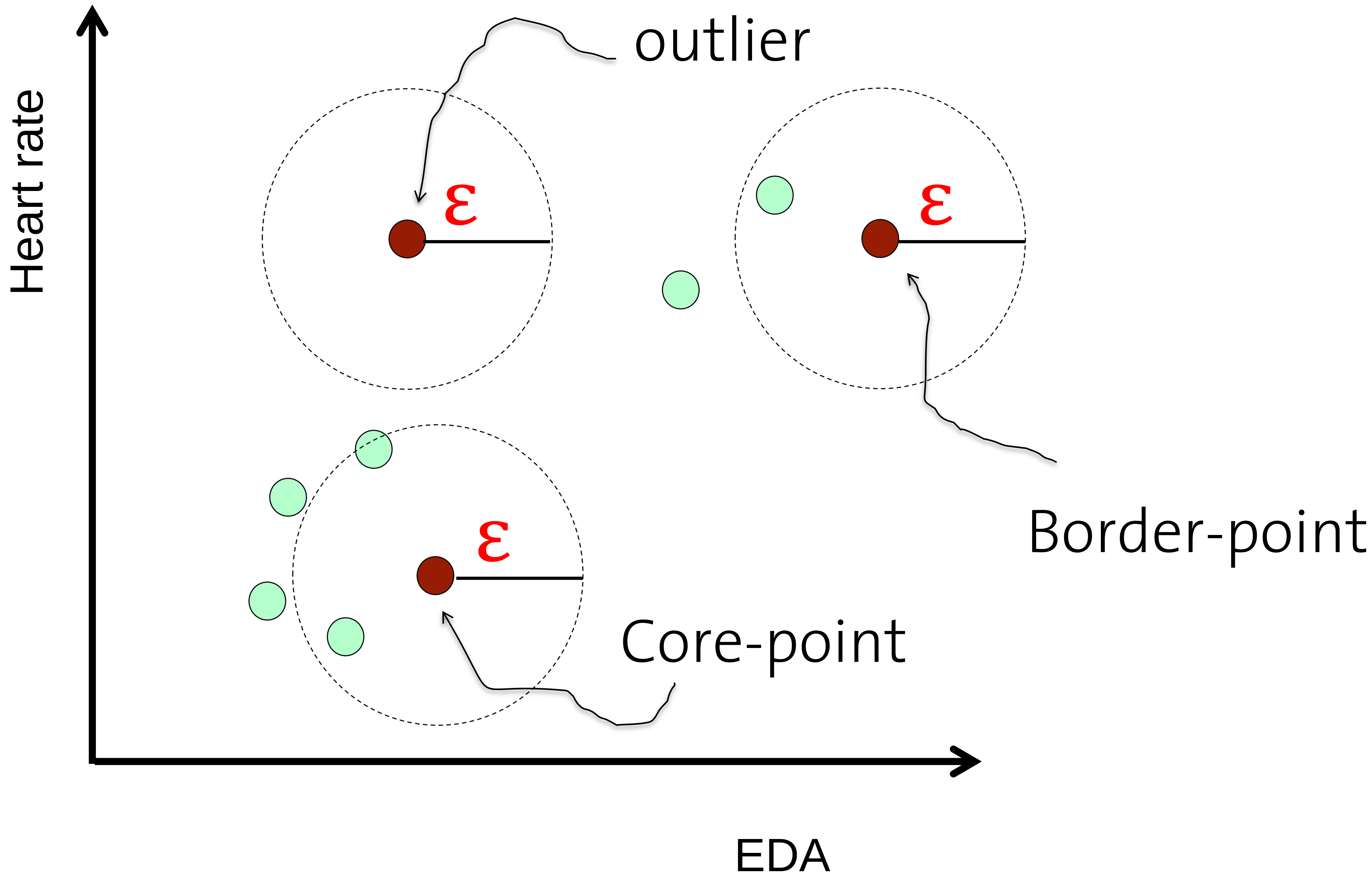
  Select a new point *p*.
- Continue until all of the points are visited.

ESUM data

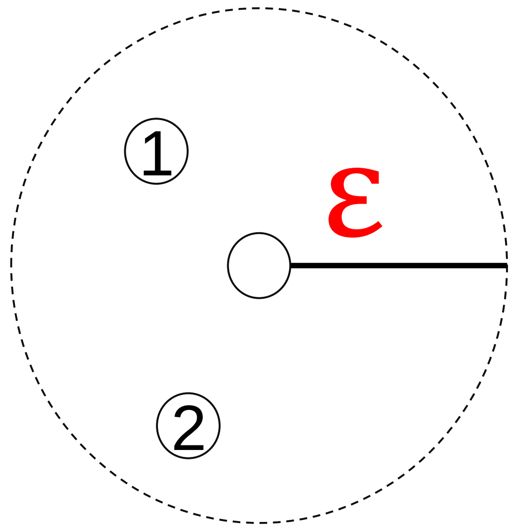


Clustering

Density based : DBSCAN



Define a center

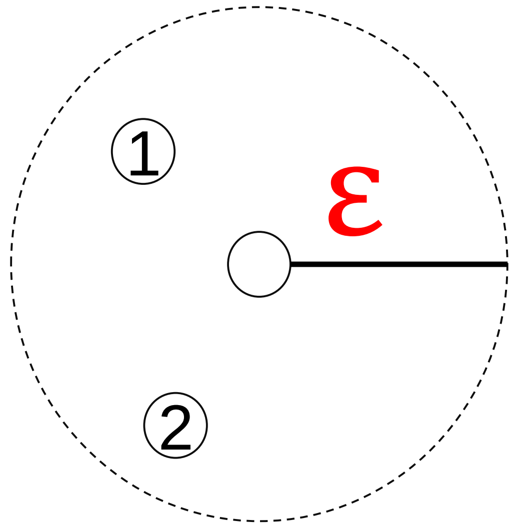


ε = 1 cm

m = 2

Clustering (DBSCAN)

For a center



ε = 1 cm

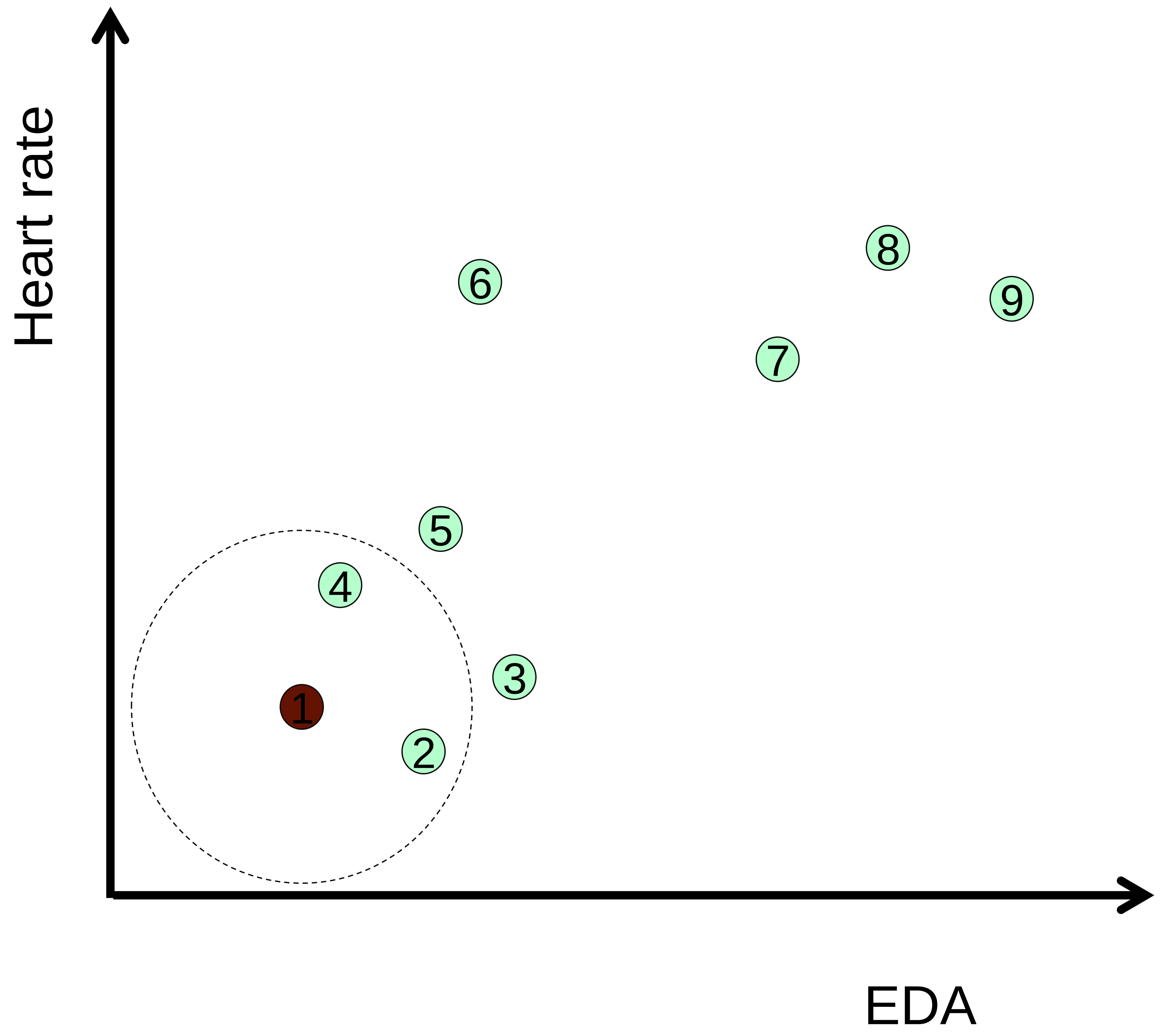
m = 2

Scanning point

1

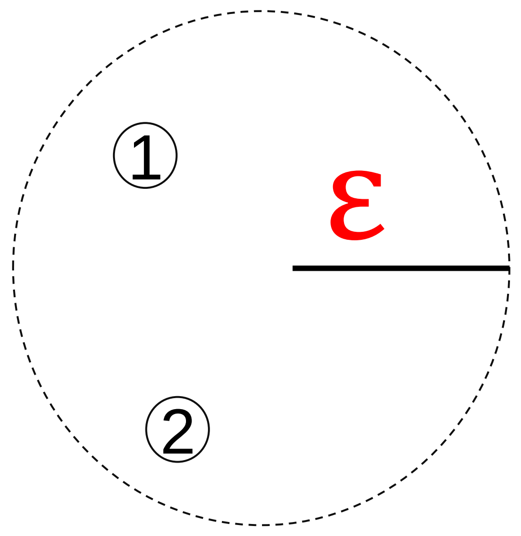
Points in cluster:

1 -> 2,4



Clustering (DBSCAN)

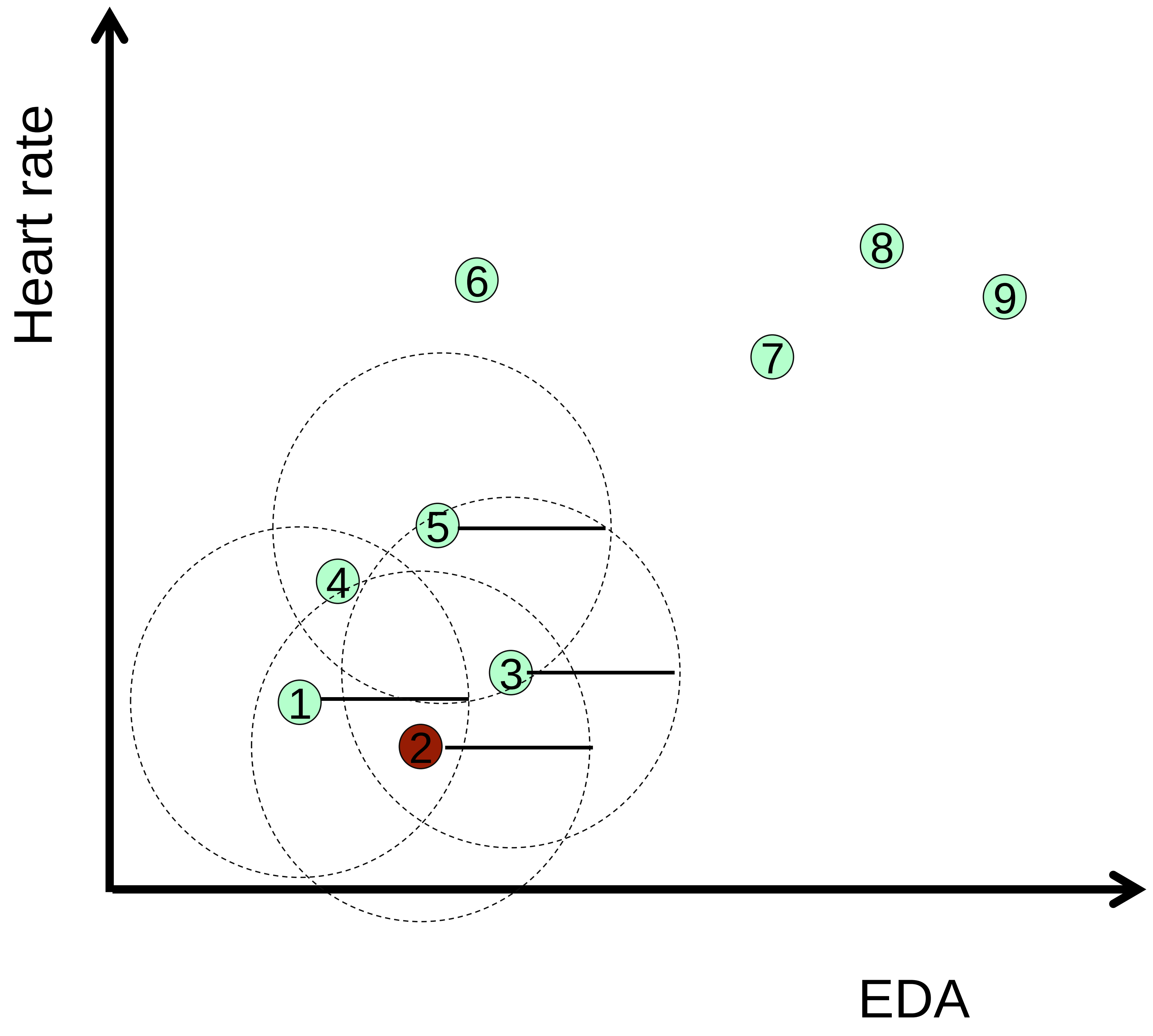
For a center



ε = 1 cm

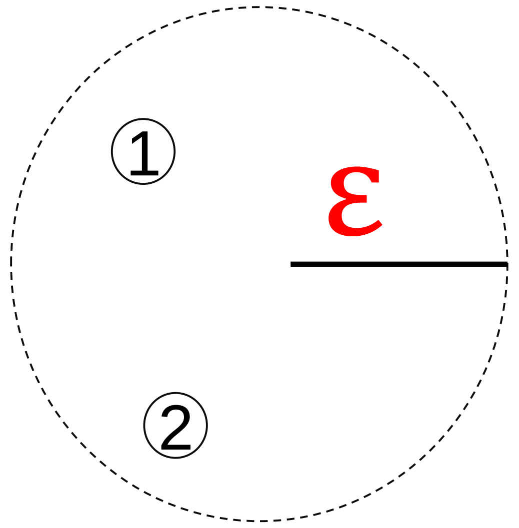
m = 2

Scanning point	Points in cluster:
# 2,	2 -> 1, 3,4
#3,	3 -> 2, 5
#5	5 -> 4,3



Clustering (DBSCAN)

For a center



ε = 1 cm

m = 2

Scanning point

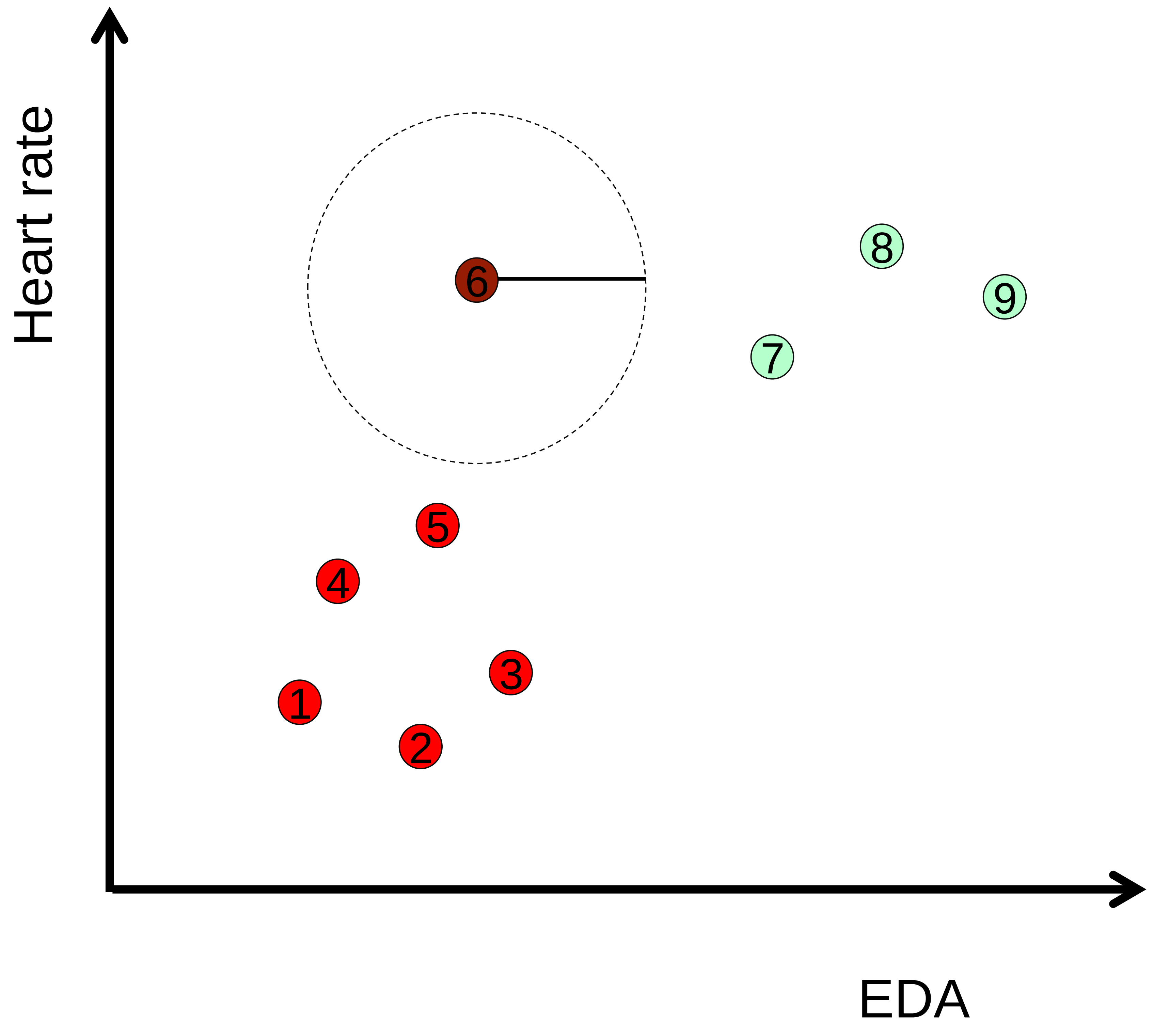
6,

Points in cluster:

6 ->

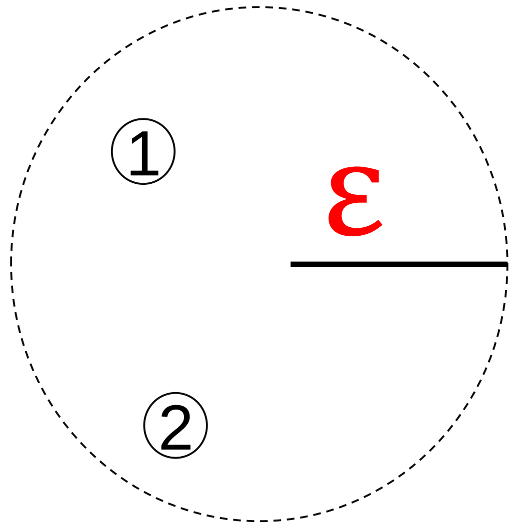
Cluster found:

red



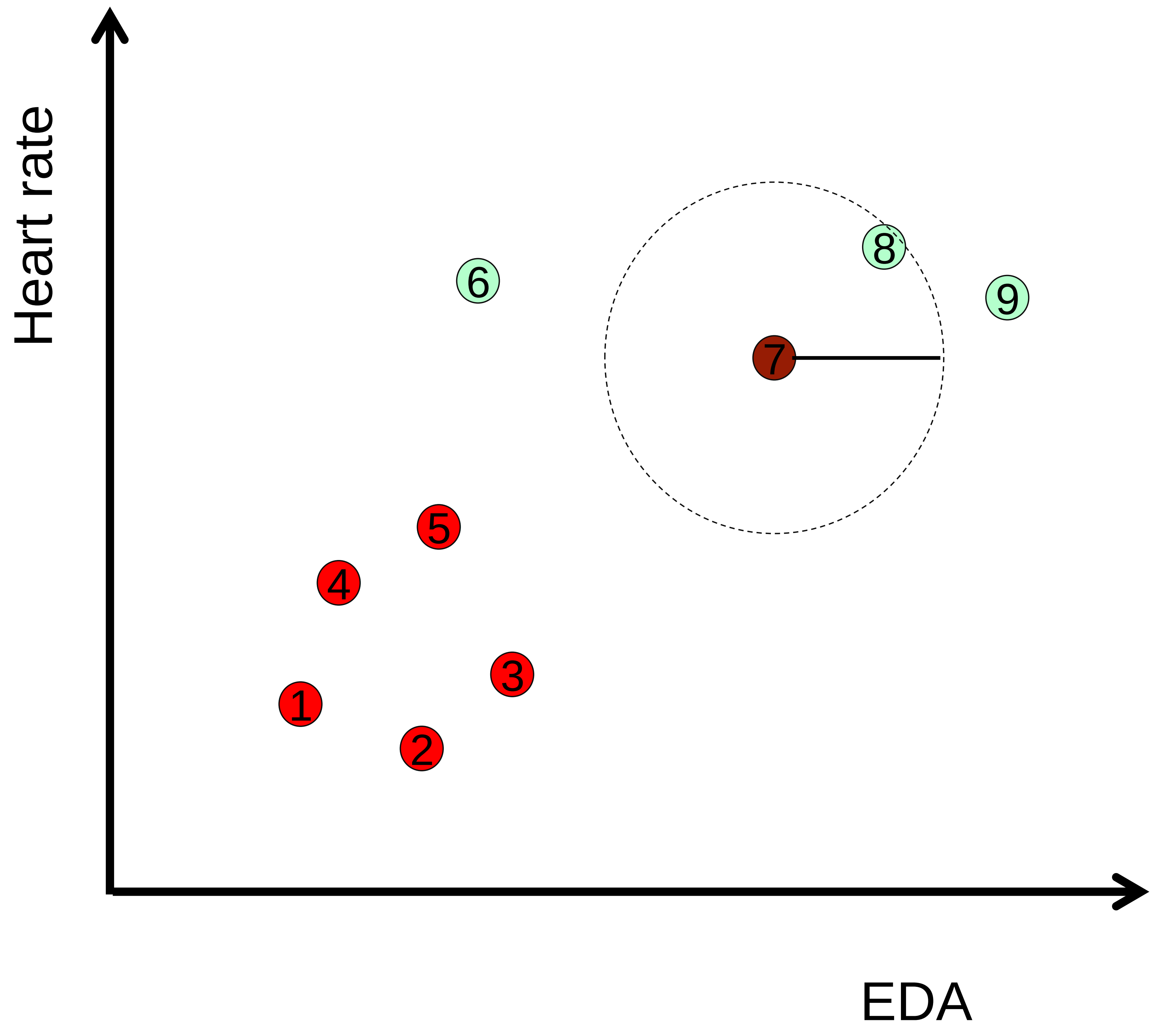
Clustering

For a center



ε = 1 cm

m = 2



Scanning point

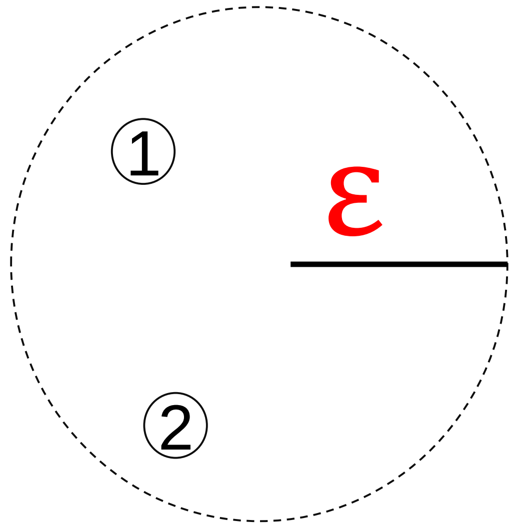
\# 7,

Points in cluster:

7 -> 8

Clustering (DBSCAN)

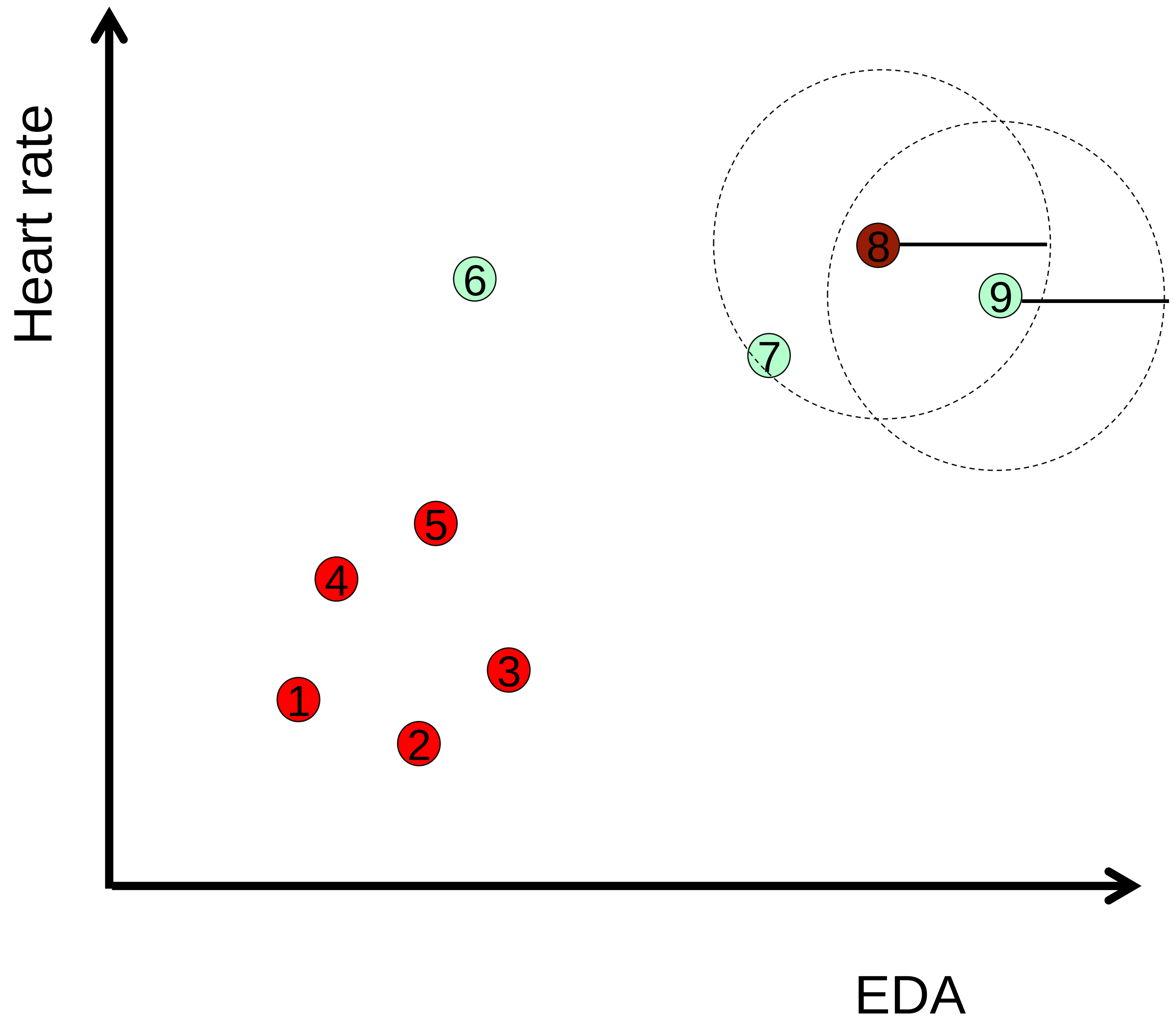
For a center



ε = 1 cm

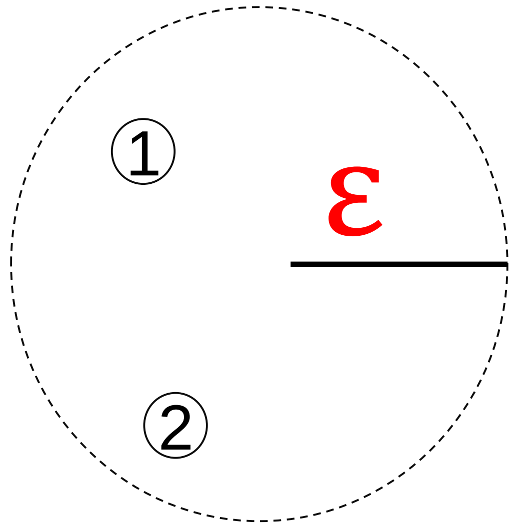
m = 2

Scanning point	Points in cluster:
# 8,	8 -> 7, 9
#9	9 -> 8



Clustering (DBSCAN)

For a center



ε = 1 cm

m = 2

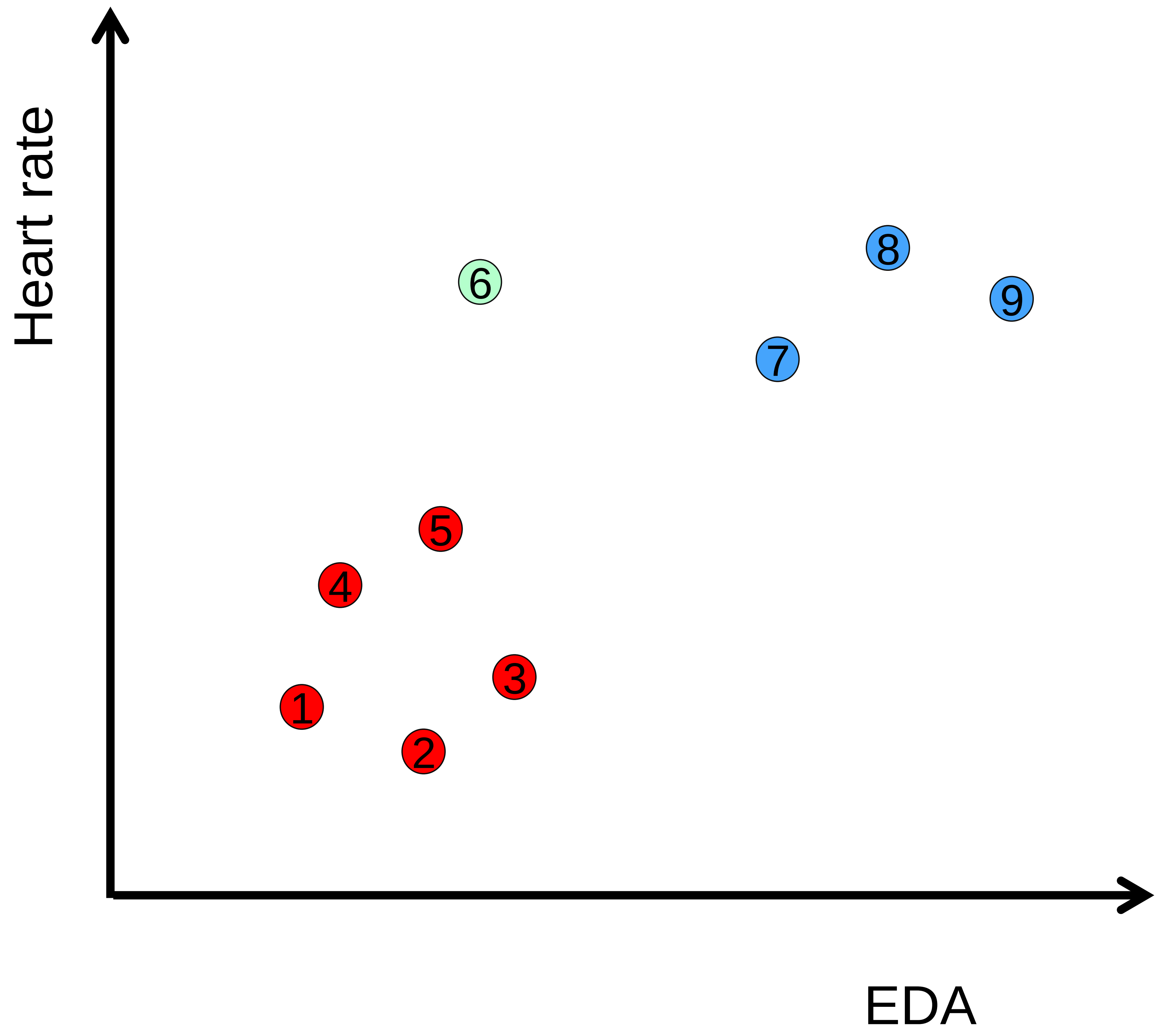
Scanning point

Finish

Total cluster 2

red

blue



Thank you!

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