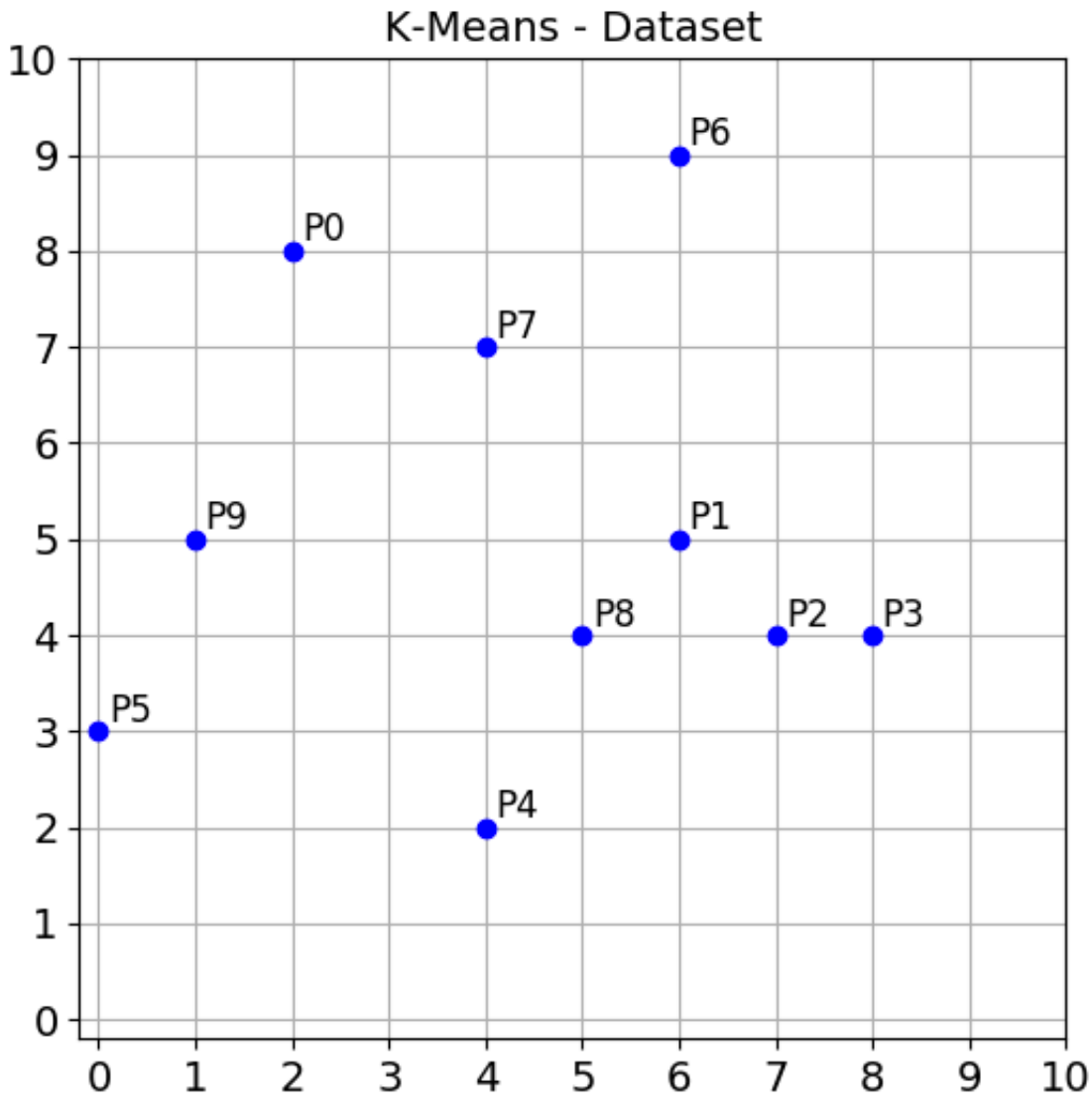
Ex. - Clustering

K-means simulation

Initial centroids:
C1 = P2 =(7,4)
C2 = P8 =(5,4)



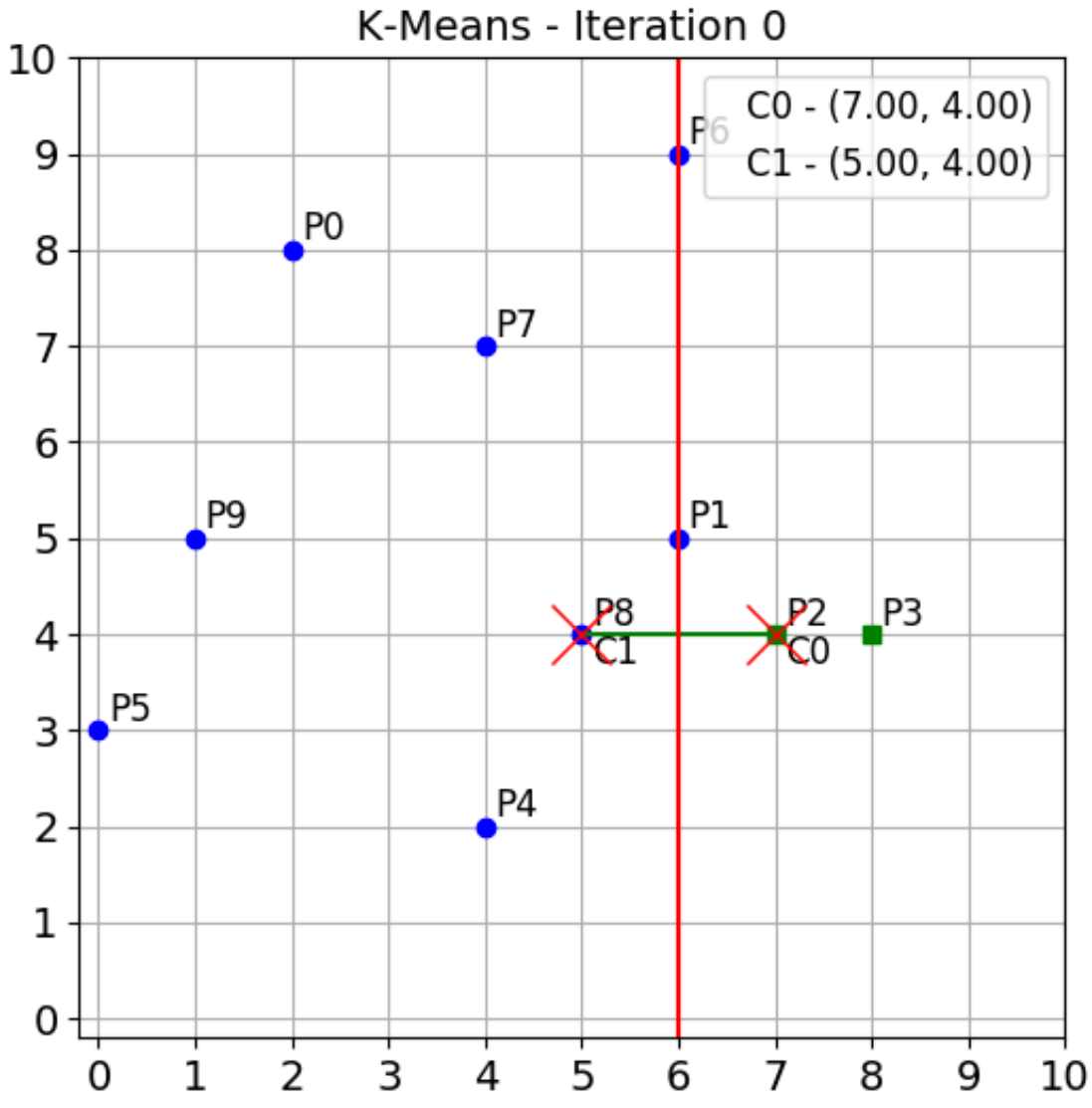
Solution: Identify the **Bisecting lines** dividing the plane between pairs of centroids

Cluster1
P0,P7,P9,P8,P5,P4,P1,P6

Cluster2
P2,P3

Centrod1:
X1 = (0+1+2+4+4+5+6+6)/8 = 3.5
Y1 = (2+3+4+5+5+7+8+9)/8 = 5.38

Centrod2:
X2 = (7+8)/2 = 7.5
Y2 = (4+4)/2 = 4



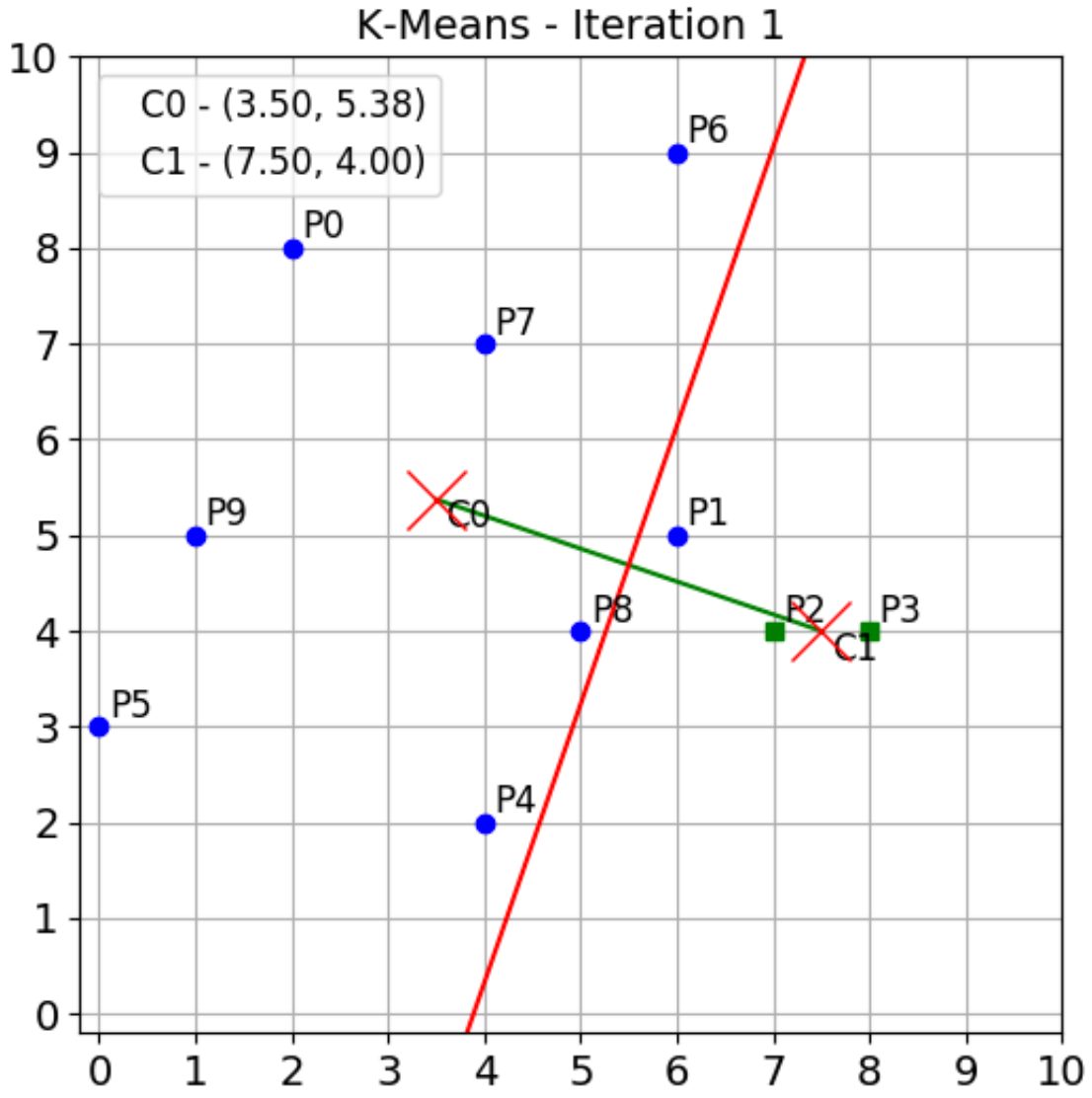
Solution: Identify the **Bisecting lines** dividing the plane between pairs of centroids

Cluster1
P0,P7,P9,P8,P5,P4,P6

Cluster2
P1,P2,P3

Centrod1:
X1 = (0+1+2+4+4+5+6)/7 = 3.14
Y1 = (2+3+4+5+7+8+9)/7 = 5.43

Centrod2:
X2 = (6+7+8)/3 = 7
Y2 = (5+4+4)/3 = 4.33



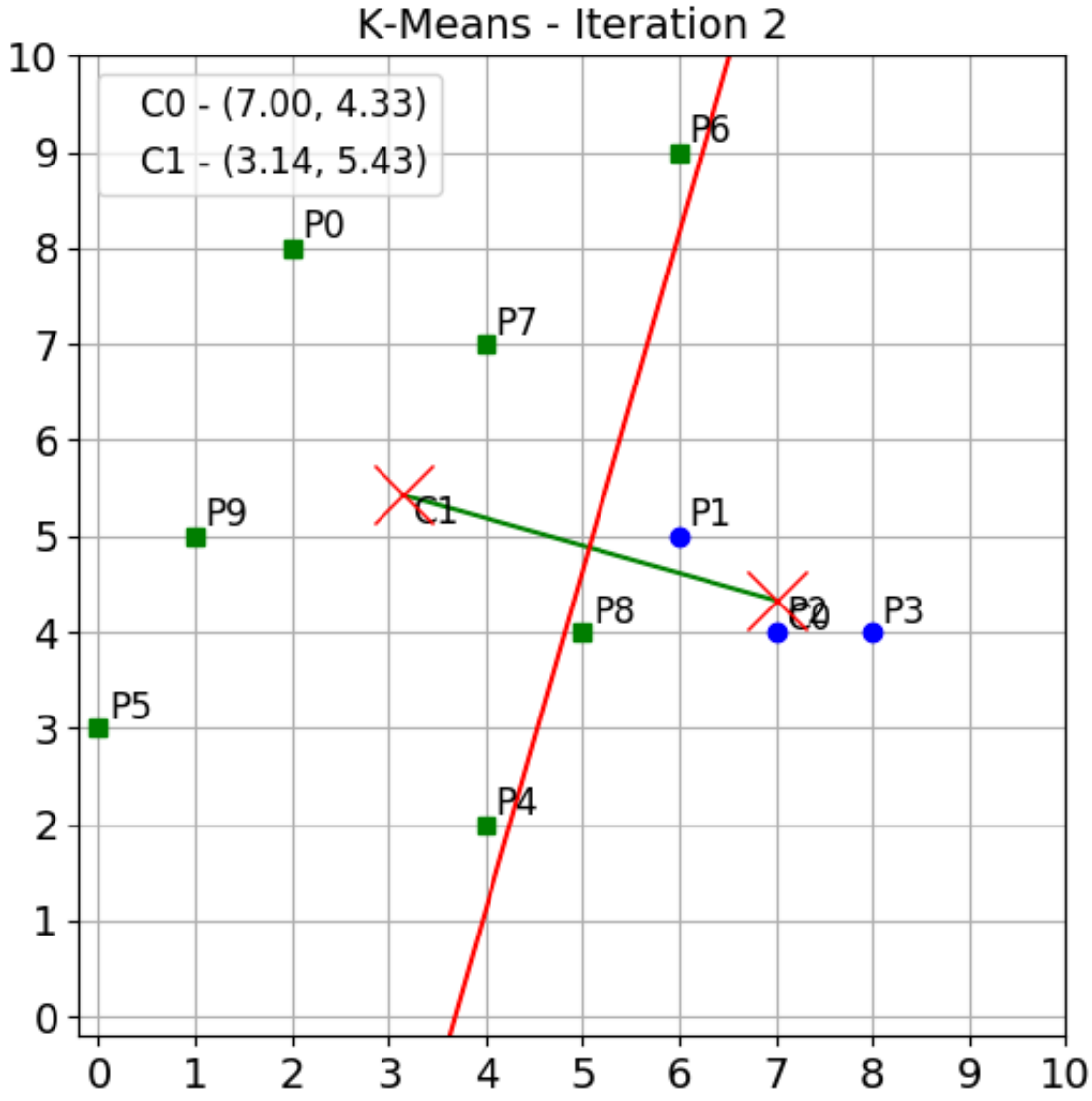
Solution: Identify the **Bisecting lines** dividing the plane between pairs of centroids

Cluster1
P0,P7,P9,P5,P4,P6

Cluster2
P1,P2,P3,P8

Centrod1:
X1 = (0+1+2+4+4+6)/6 = 2.83
Y1 = (2+3+5+7+8+9)/6 = 5.67

Centrod2:
X2 = (6+7+8+5)/4 = 6.5
Y2 = (5+4+4+4)/4= 4.25



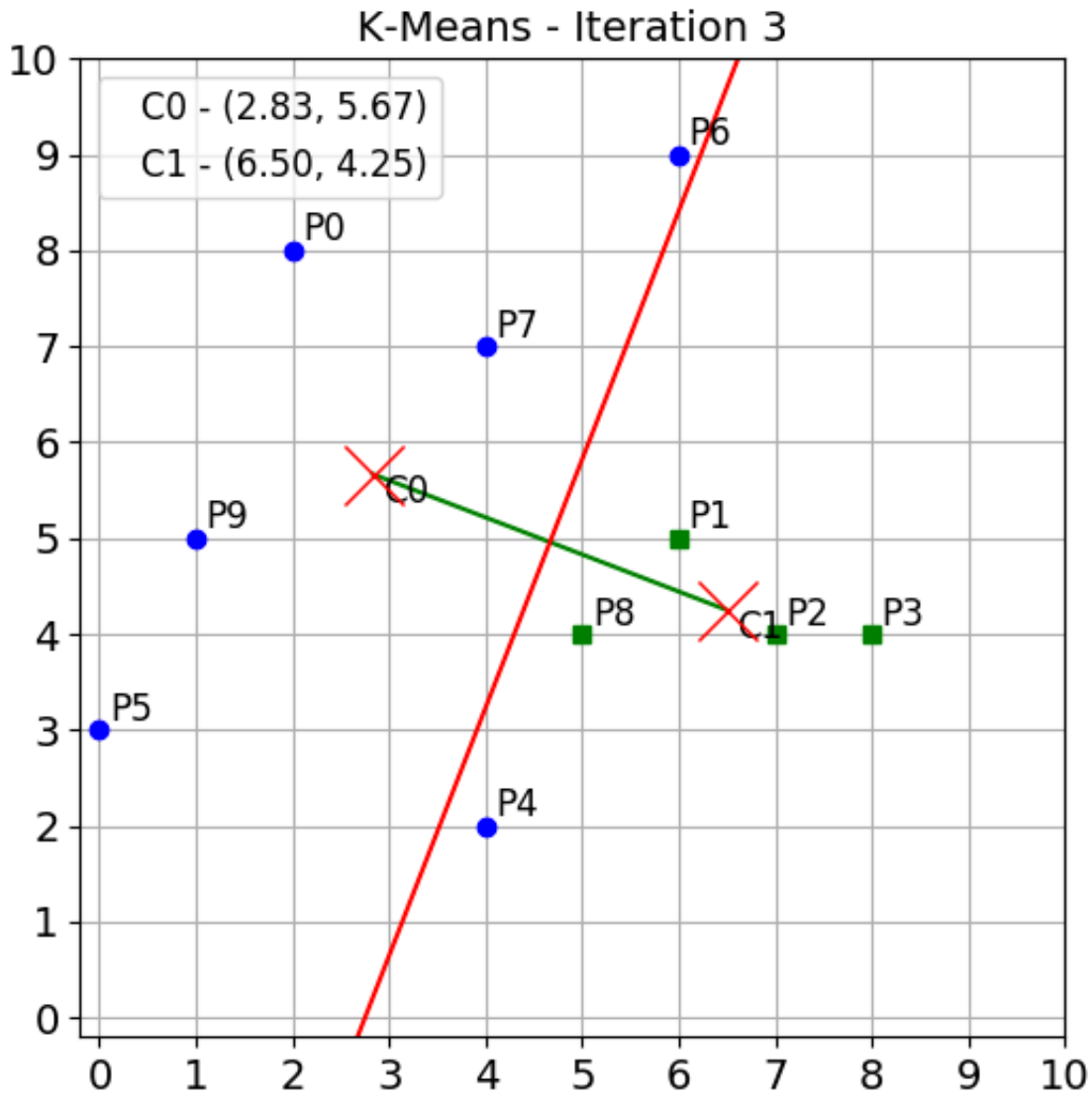
Solution: Identify the **Bisecting lines** dividing the plane between pairs of centroids

Cluster1
P0,P7,P9,P5,P6

Cluster2
P1,P2,P3,P8,P4

Centrod1:
X1 = (0+1+2+4+6)/5 = 2.6
Y1 = (3+5+7+8+9)/5 = 6.4

Centrod2:
X2 = (6+7+8+5+4)/5 = 6
Y2 = (5+4+4+4+2)/5 = 3,8

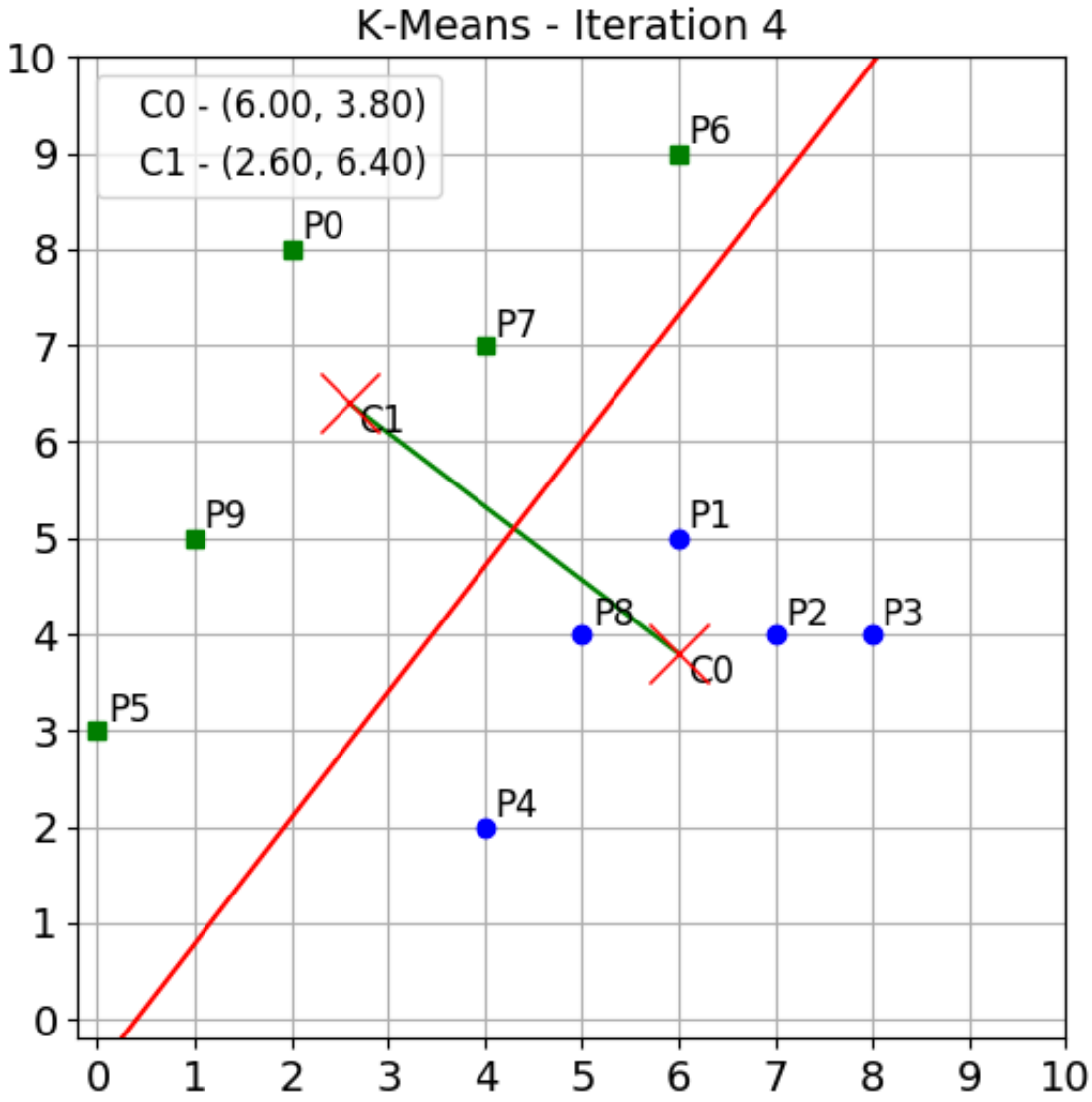


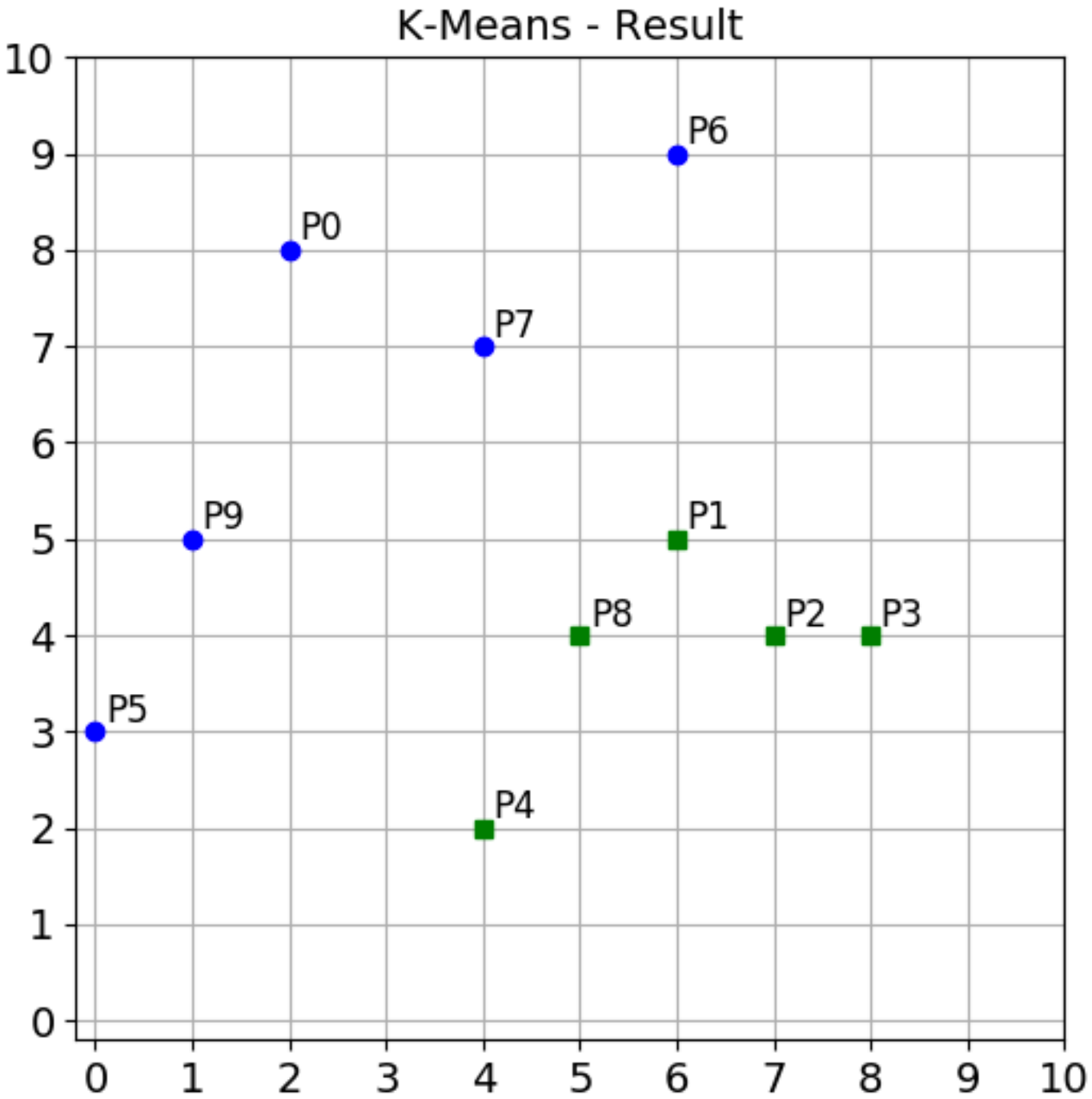
Solution: Identify the **Bisecting lines** dividing the plane between pairs of centroids

Cluster1
P0,P7,P9,P5,P6

Cluster2
P1,P2,P3,P8,P4

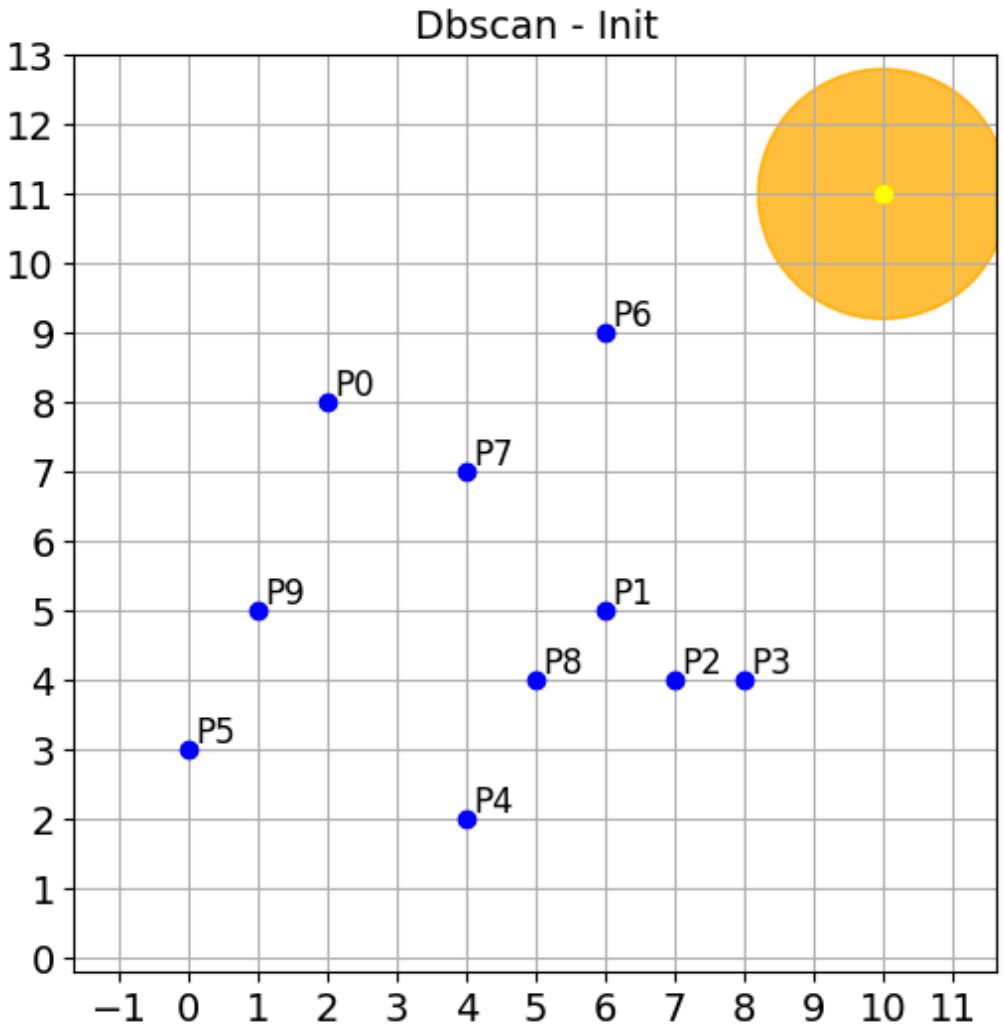
The cluster composition does not change, so K-means stops




K-Means - Result
P6
P0
P7
P9
P1
P8
P2
P3
P5
P4
0
1
2
3
4
5
6
7
8
9
10

DBSCAN - Simulation

- Eps = 1.8
- MinPoints=3
  - (included the point)



DBSCAN

- Eps = 1.8
- MinPoints=3
  - (included the point)

CORE POINTS:

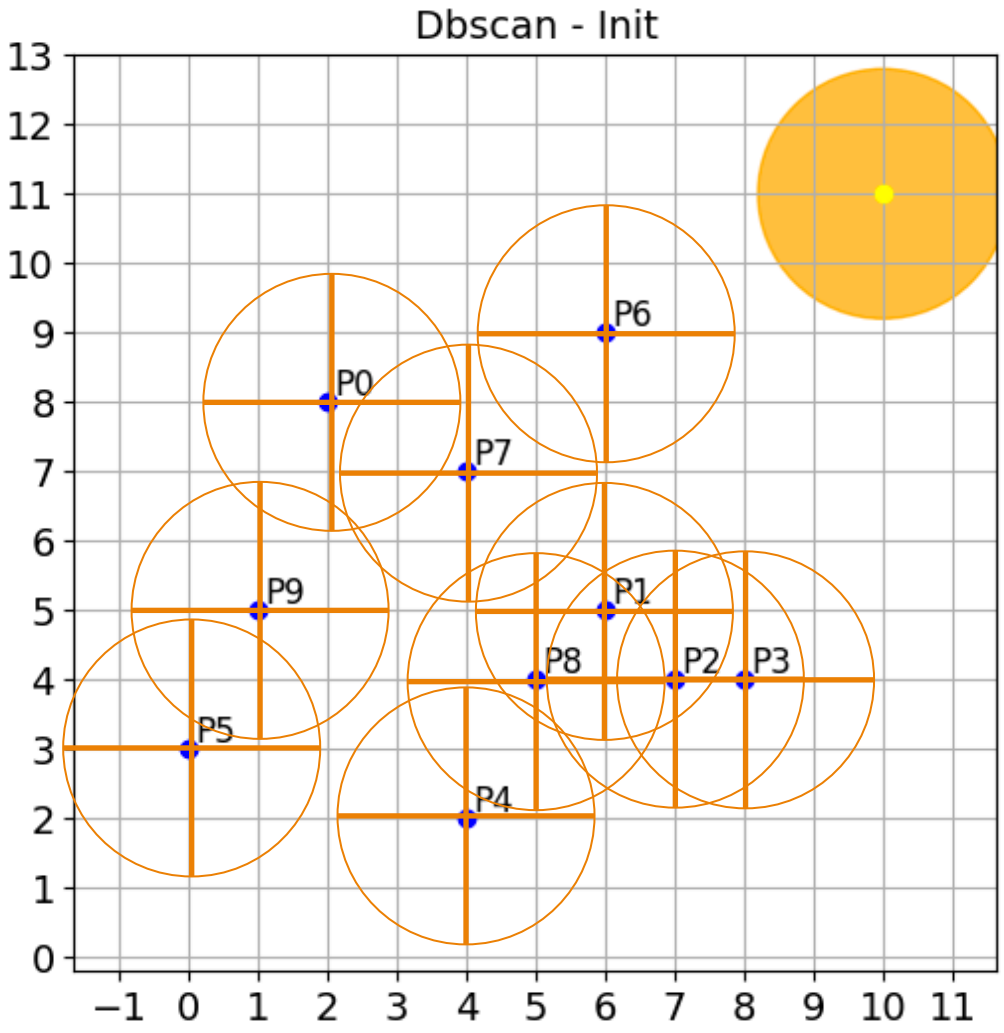
- P1
- P2

BORDER POINTS

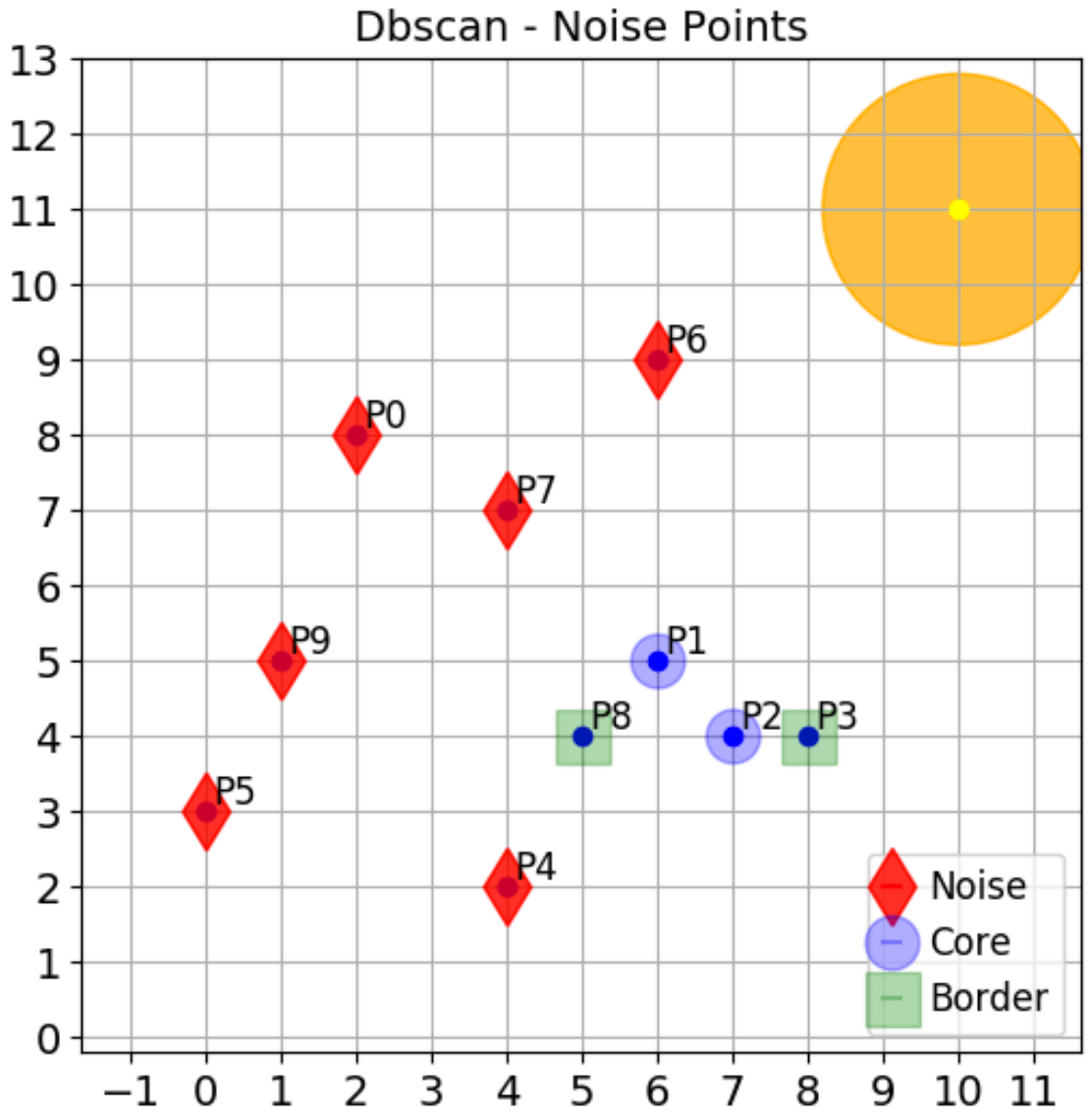
- P3
- P8

NOISE POINTS

- P4,P5, P9, P0, P6, P7

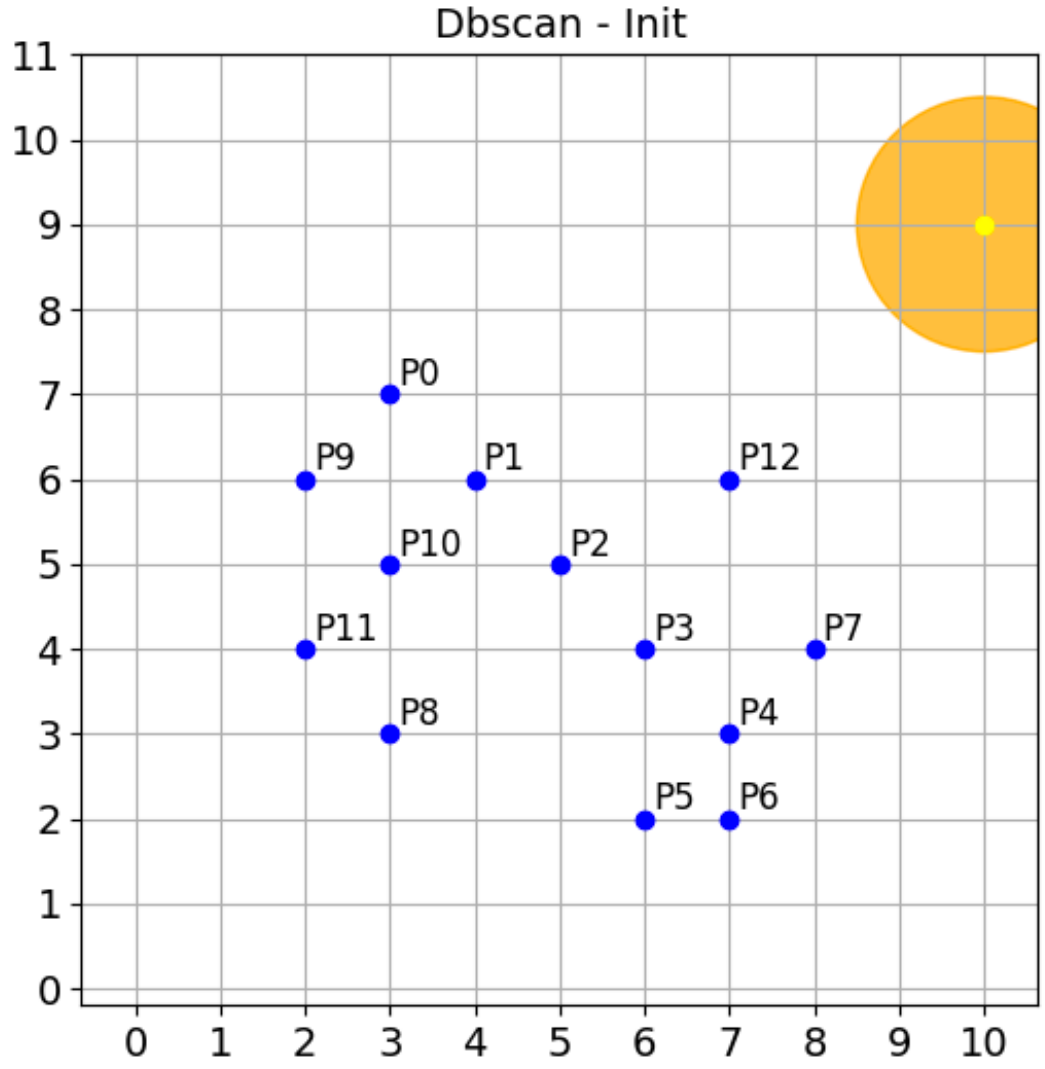


DBSCAN


Dbscan - Noise Points
P0
P1
P2
P3
P4
P5
P6
P7
P8
P9
Noise
Core
Border

DBSCAN EX. 2

- Eps = 1.5
- MinPoints=3
  - (included the point)



DBSCAN 2

- Eps = 1.8
- MinPoints=3
  - (included the point)

CORE POINTS:

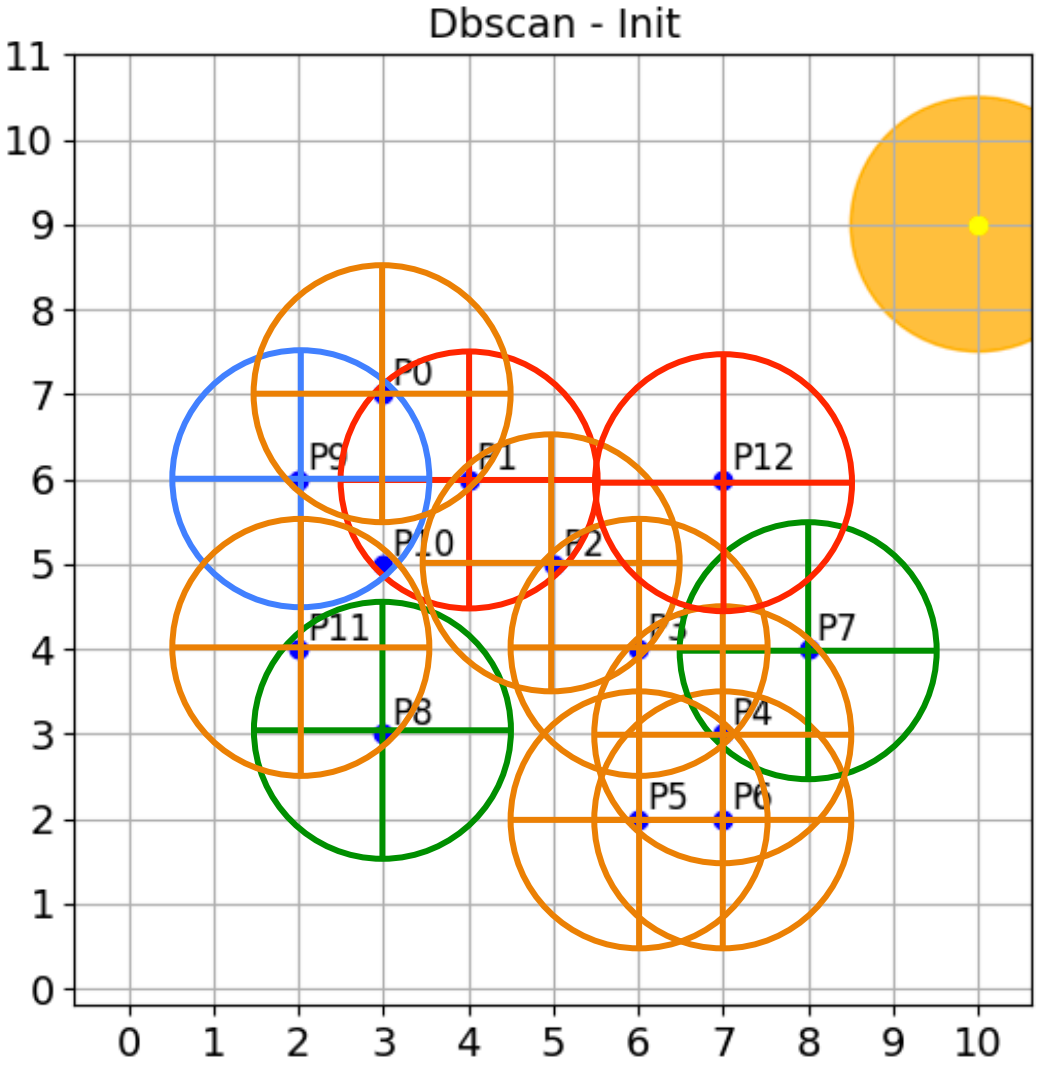
- P5
- P6
- P4
- P3
- P2
- P1
- P0
- P9
- P11

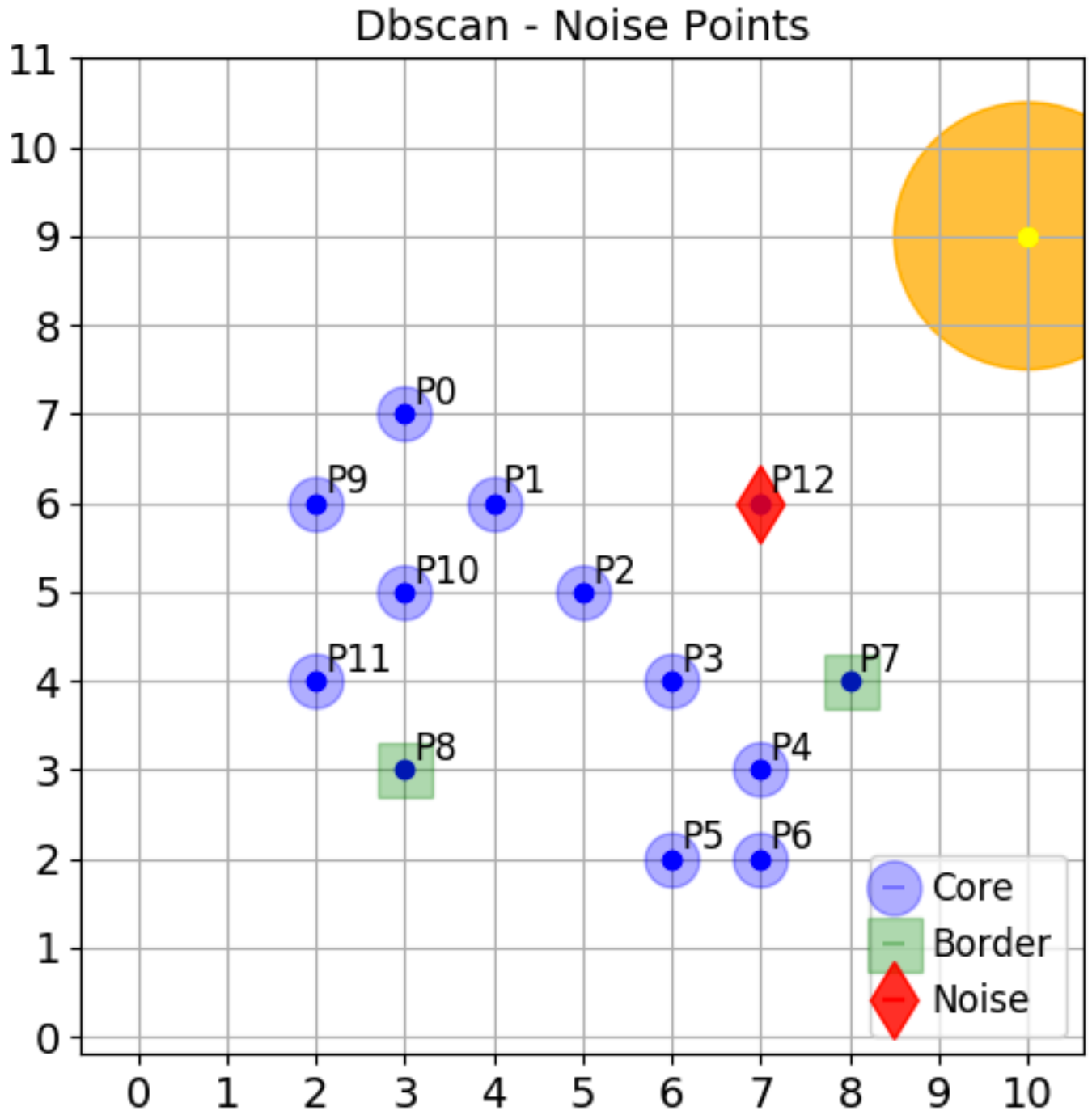
BORDER POINTS

- P8
- P7

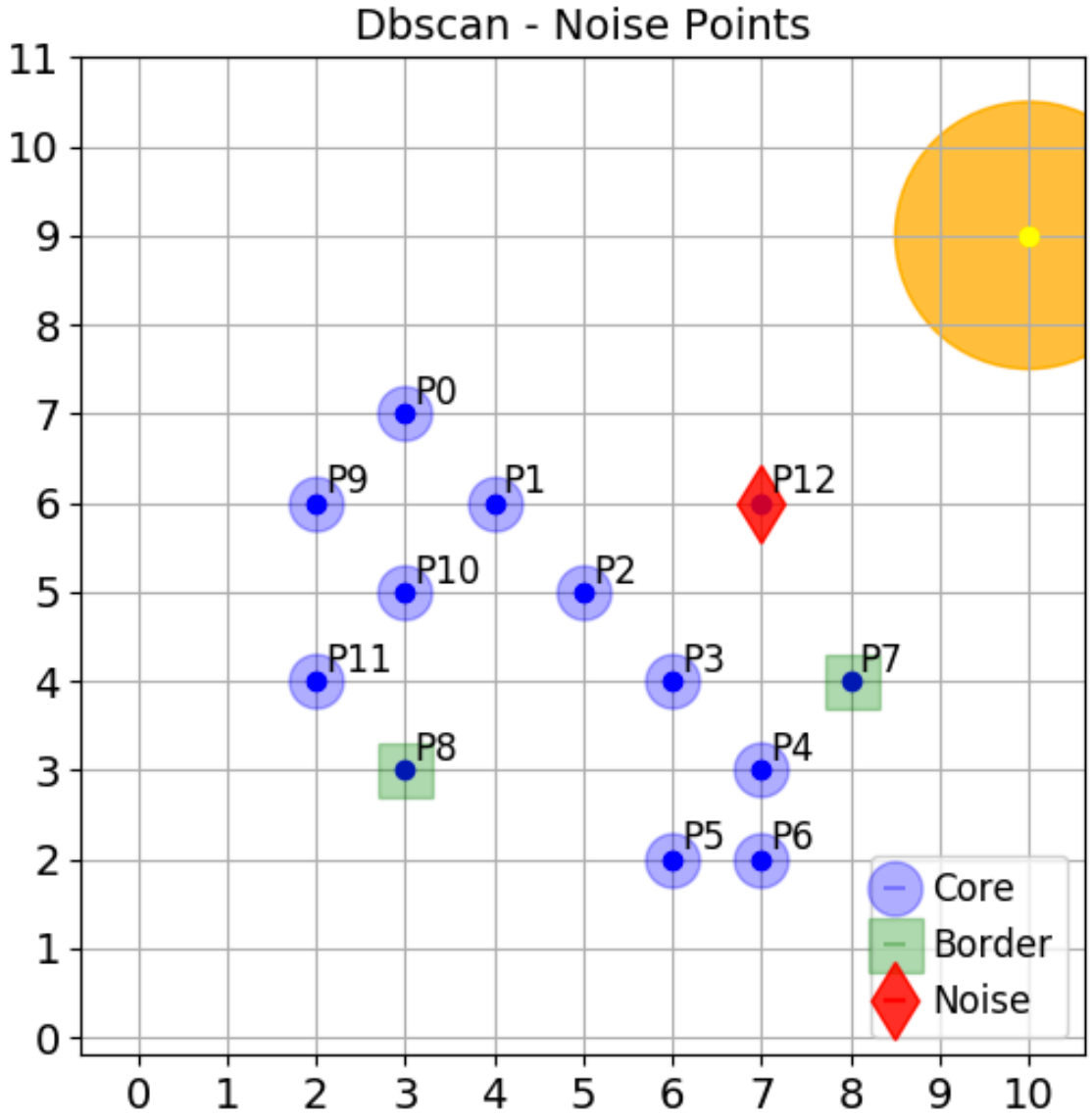
NOISE POINTS

- P12

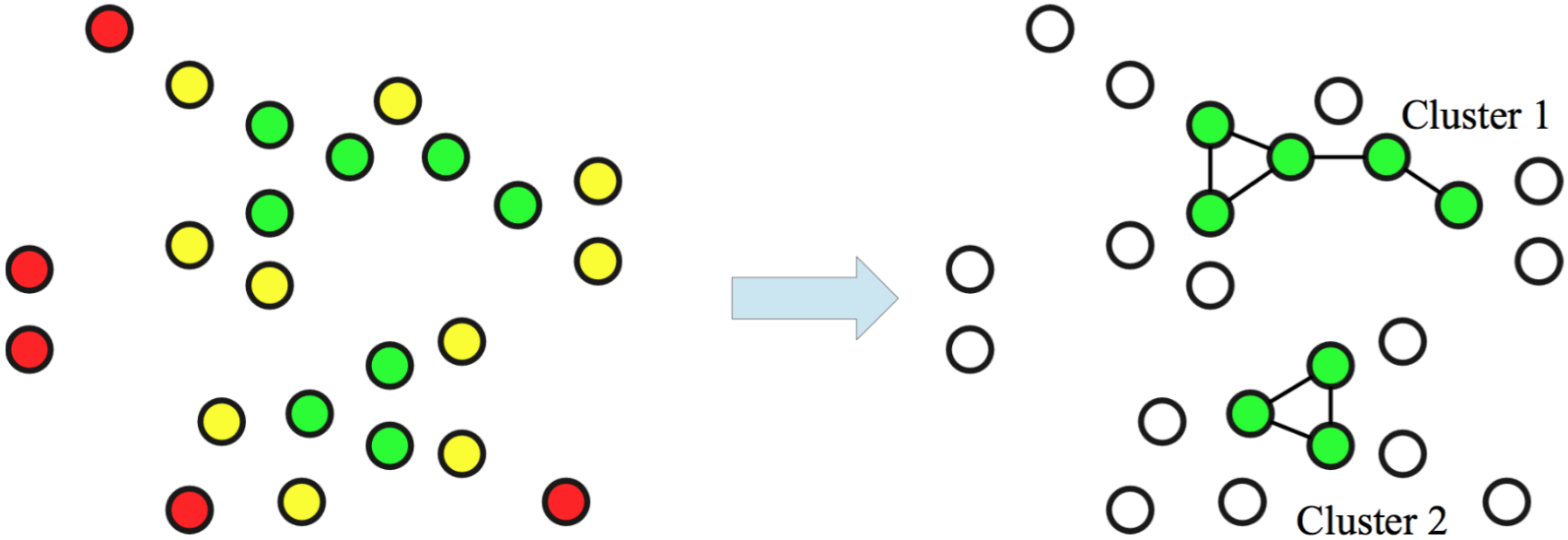



Dbscan - Noise Points
P0
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
Core
Border
Noise

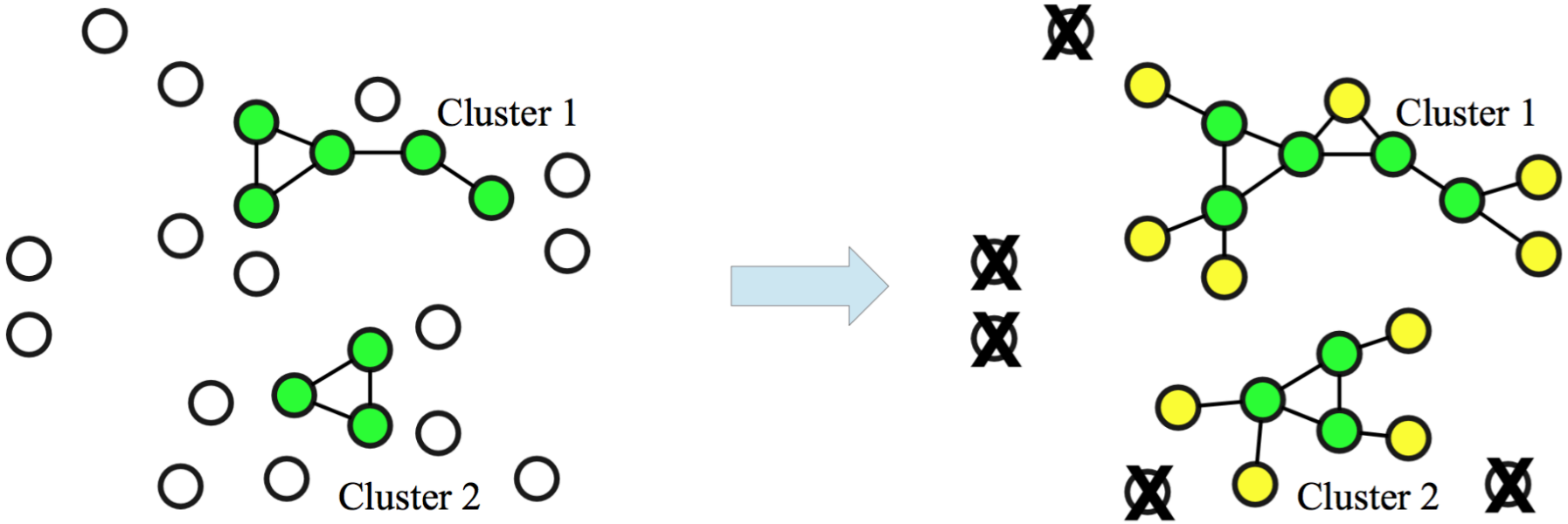
How to construct clusters in DBSCAN?



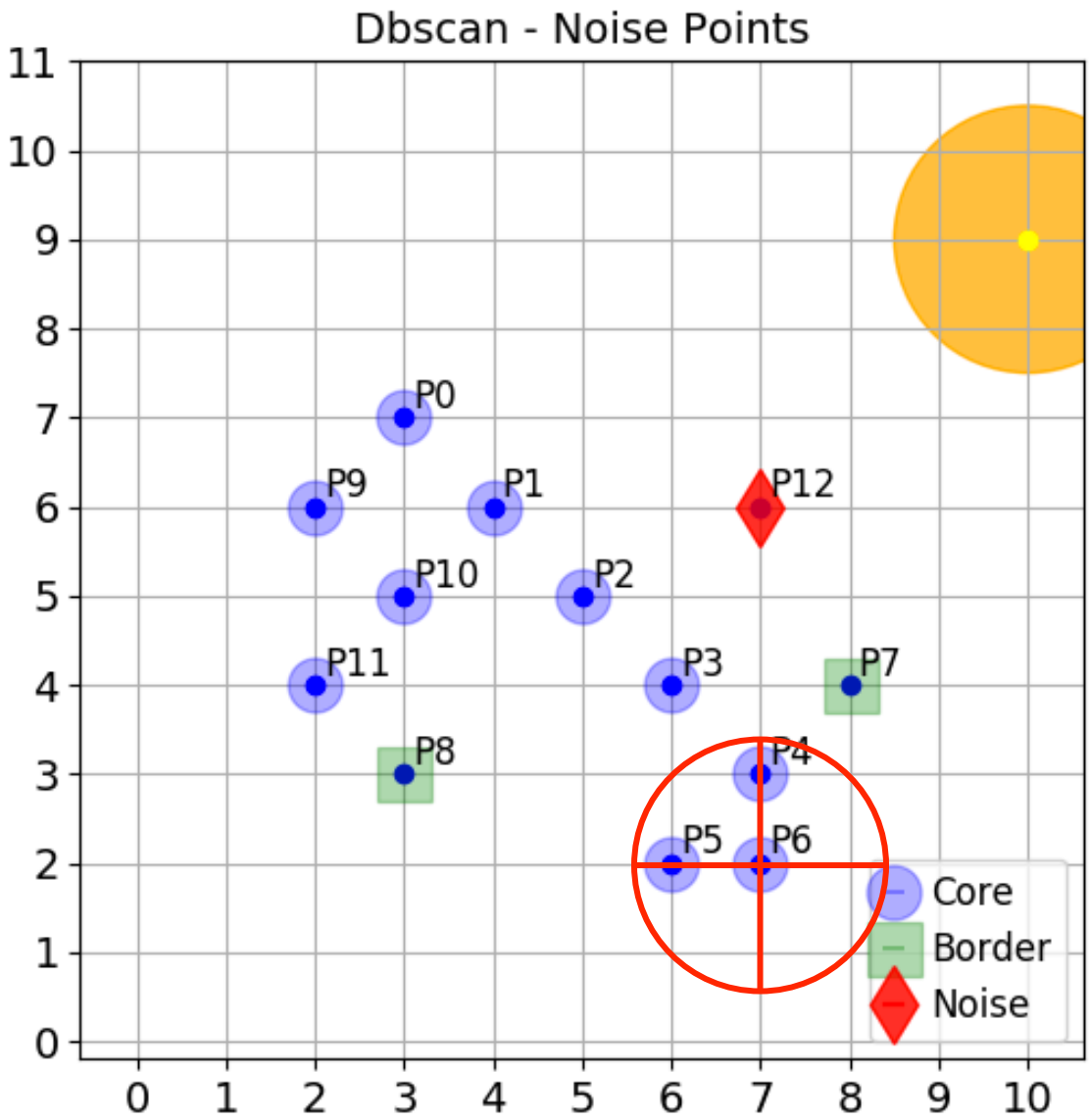
Connect core points that are neighbors, and put them in the same cluster



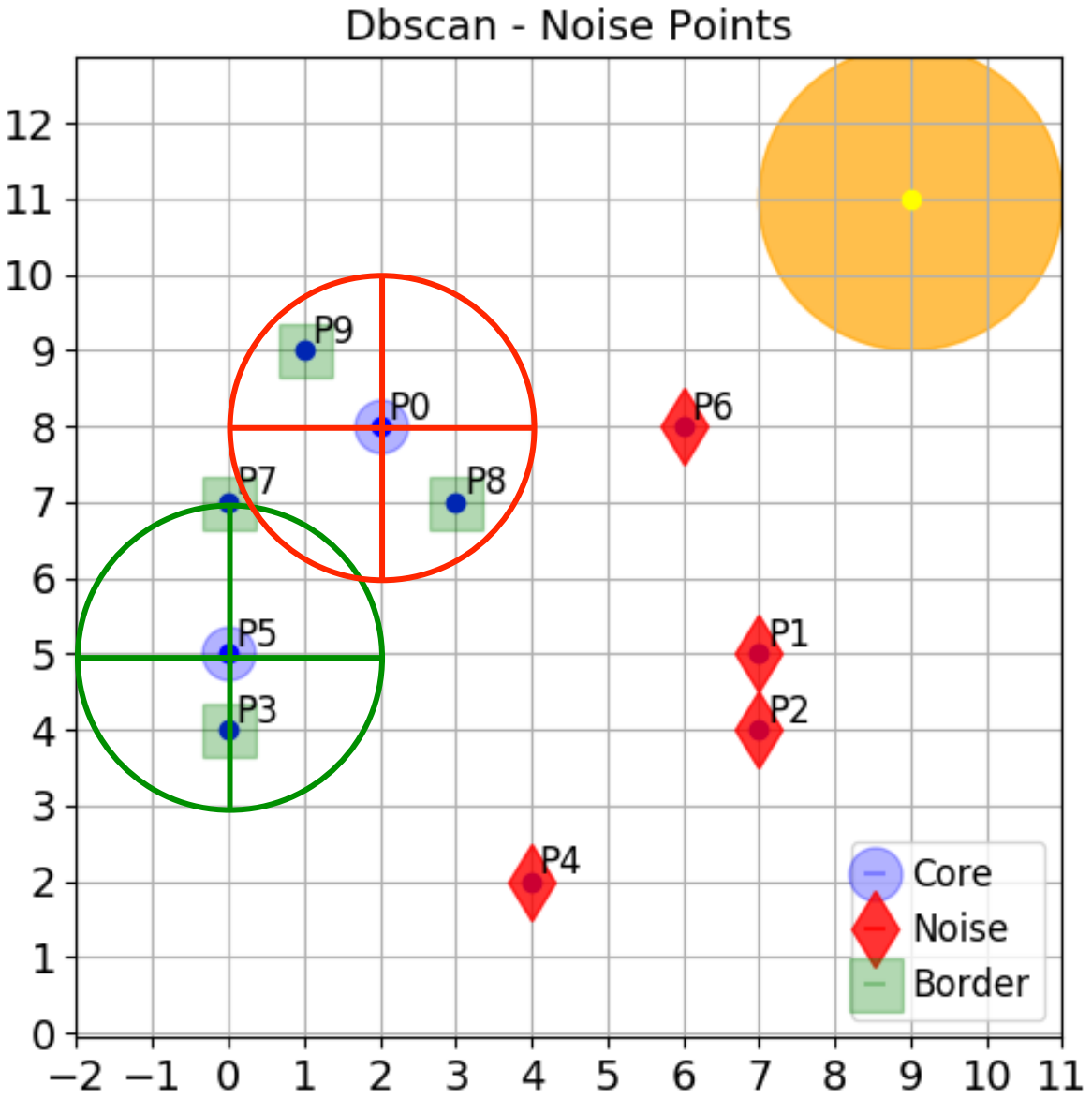
Associate border points to (one of) their core(s), and remove noise



How to construct clusters in DBSCAN?



How much clusters here?



C1 = P0,P8, P9

C2 = P5, P3, P7

Hierarchical

P0	X	1	Y	3
P1	X	5	Y	5
P2	X	4	Y	3
P3	X	4	Y	1
P4	X	3	Y	1
P5	X	3	Y	2

Euclidean Distance

$$\left((x_0-x_1)^2 + (y_0-y_1)^2\right)^{1/2}$$

Distance Matrix

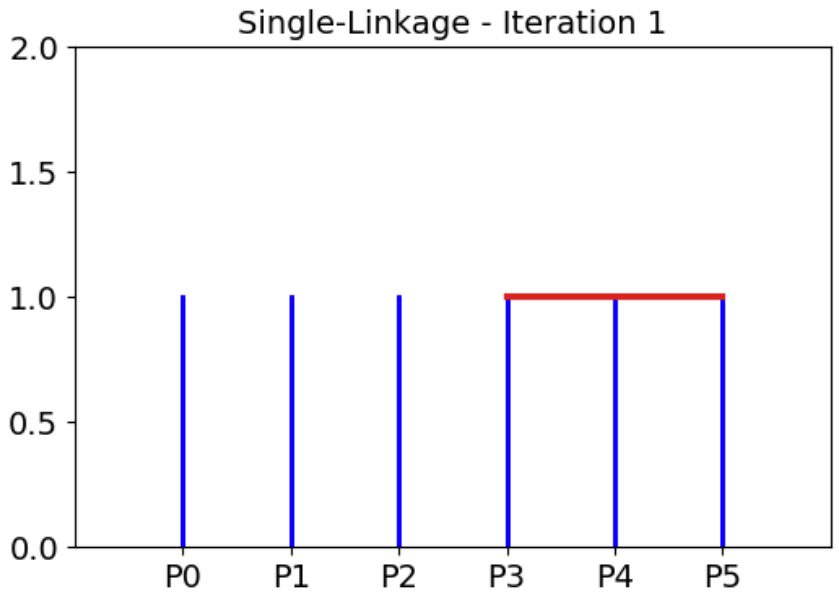
	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
P0	0.0	4.47	3.0	3.61	2.83	2.24
P1	4.47	0.0	2.24	4.12	4.47	3.61
P2	3.0	2.24	0.0	2.0	2.24	1.41
P3	3.61	4.12	2.0	0.0	1.0	1.41
P4	2.83	4.47	2.24	1.0	0.0	1.0
P5	2.24	3.61	1.41	1.41	1.0	0.0

Hierarchical: Single-LINK

Distance Matrix

	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Minimum Distance



Hierarchical: Single-LINK

Distance Matrix

	(0,)	(1,)	(2,)	(3, 4, 5)
0	0.0	4.47	3.0	
1	4.47	0.0	2.24	
2	3.0	2.24	0.0	
(3,4,5)				0.0

D([3,4,5], 0) =

- D(3,0) = 3.61
- D(4,0) = 2.83
- D(5,0) = 2.24

Min Distance

	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Hierarchical: Single-LINK

Distance Matrix

	(0,)	(1,)	(2,)	(3, 4, 5)
0	0.0	4.47	3.0	2.24
1	4.47	0.0	2.24	
2	3.0	2.24	0.0	
(3,4,5)	2.24			0.0

D([3,4,5], 1) =

- D(3,1) = 4.12
- D(4,1) = 4.47
- D(5,1) = 3.61

Min Distance

	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Hierarchical: Single-LINK

Distance Matrix

	(0,)	(1,)	(2,)	(3, 4, 5)
0	0.0	4.47	3.0	2.24
1	4.47	0.0	2.24	3.61
2	3.0	2.24	0.0	
(3,4,5)	2.24	3.61		0.0

D([3,4,5], 2) =

D(3,2) = 2

D(4,2) = 2.24

D(5,2) = 1.41

Min Distance

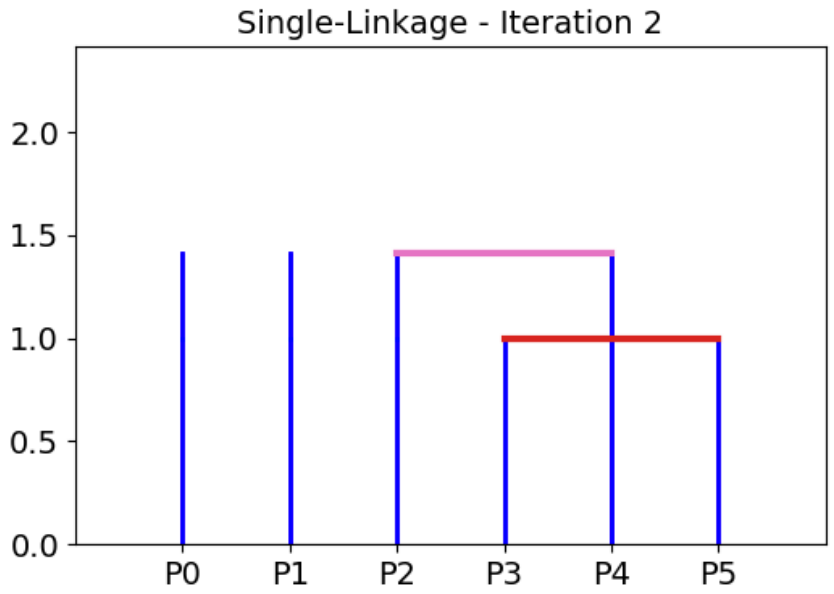
	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Hierarchical: Single-LINK

Distance Matrix

	(0,)	(1,)	(2,)	(3, 4, 5)
0	0.0	4.47	3.0	2.24
1	4.47	0.0	2.24	3.61
2	3.0	2.24	0.0	1.41
(3,4,5)	2.24	3.61	1.41	0.0

Minimum Distance



Hierarchical: Single-LINK

Distance Matrix

	((0),),)	((1),),)	((2,), (3, 4, 5))
0	0.0	4.47	
1	4.47	0.0	
(2,3,4,5)			0.0

D([2,3,4,5], 0) =

- D(2,0) = 3
- D(3,0) = 3.61
- D(4,0) = 2.83
- D(5,0) = 2.24

Min Distance

	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Hierarchical: Single-LINK

Distance Matrix

	((0),),)	((1),),)	((2,), (3, 4, 5))
0	0.0	4.47	2.24
1	4.47	0.0	
(2,3,4,5)	2.24		0.0

D([2,3,4,5], 1) =

- D(2,1) = 2.24
- D(3,1) = 4.12
- D(4,1) = 4.47
- D(5,1) = 3.61

Min Distance

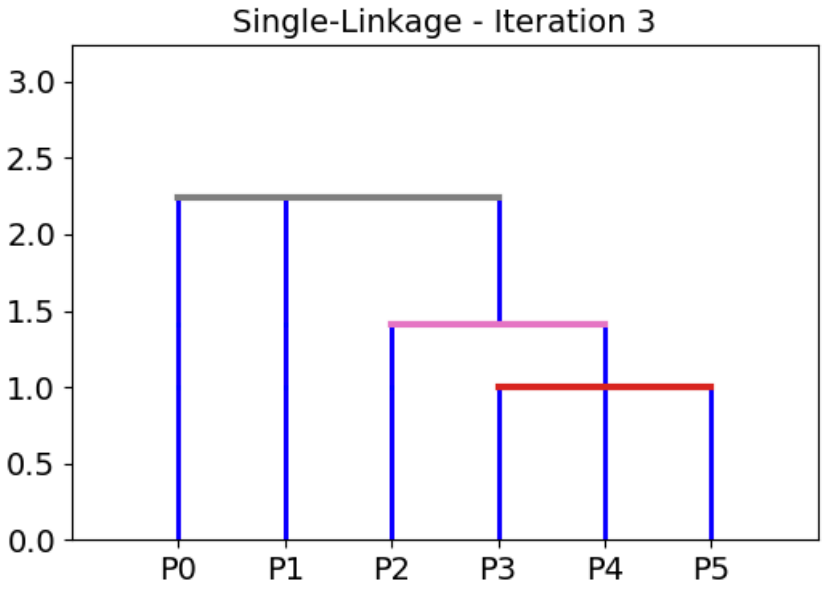
	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Hierarchical: Single-LINK

Distance Matrix

	((0),),)	((1),),)	((2,), (3, 4, 5))
0	0.0	4.47	2.24
1	4.47	0.0	2.24
(2,3,4,5)	2.24	2.24	0.0

Minimum Distance



Hierarchical – Complete Link

P0	X	1	Y	3
P1	X	5	Y	5
P2	X	4	Y	3
P3	X	4	Y	1
P4	X	3	Y	1
P5	X	3	Y	2

Euclidean Distance

$$((x_0-x_1)^2 + (y_0-y_1)^2)^{1/2}$$

Distance Matrix

	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
P0	0.0	4.47	3.0	3.61	2.83	2.24
P1	4.47	0.0	2.24	4.12	4.47	3.61
P2	3.0	2.24	0.0	2.0	2.24	1.41
P3	3.61	4.12	2.0	0.0	1.0	1.41
P4	2.83	4.47	2.24	1.0	0.0	1.0
P5	2.24	3.61	1.41	1.41	1.0	0.0

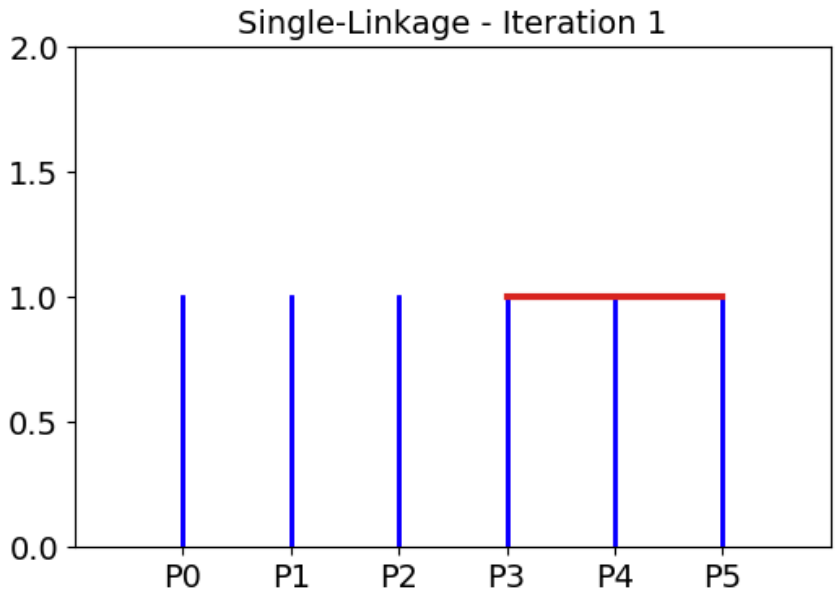
Hierarchical: Complete-LINK

Distance Matrix

	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Minimum Distance

First Step **equal** to SINGLE LINK



Hierarchical: Complete-LINK

Distance Matrix

	(0,)	(1,)	(2,)	(3, 4, 5)
0	0.0	4.47	3.0	
1	4.47	0.0	2.24	
2	3.0	2.24	0.0	
(3,4,5)				0.0

D([3,4,5], 0) =

- D(3,0) = 3.61
- D(4,0) = 2.83
- D(5,0) = 2.24

Max Distance

	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Hierarchical: Complete-LINK

Distance Matrix

	(0,)	(1,)	(2,)	(3, 4, 5)
0	0.0	4.47	3.0	3.61
1	4.47	0.0	2.24	
2	3.0	2.24	0.0	
(3,4,5)	3.61			0.0

$D([3,4,5], 1) =$

- D(3,1) = 4.12
- D(4,1) = 4.47
- D(5,1) = 3.61

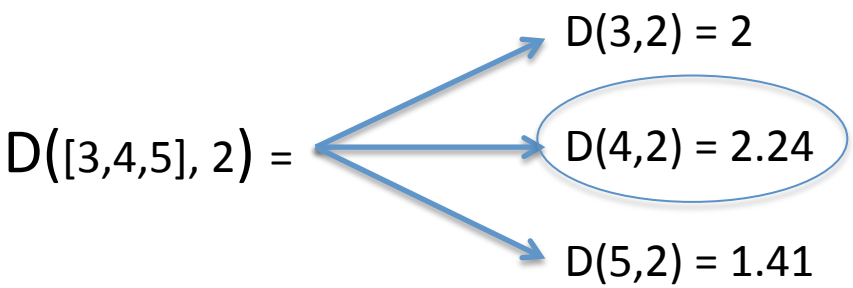
Max Distance

	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Hierarchical: Complete-LINK

Distance Matrix

	(0,)	(1,)	(2,)	(3, 4, 5)
0	0.0	4.47	3.0	3.61
1	4.47	0.0	2.24	
2	3.0	2.24	0.0	
(3,4,5)	3.61	4.47		0.0



Max Distance

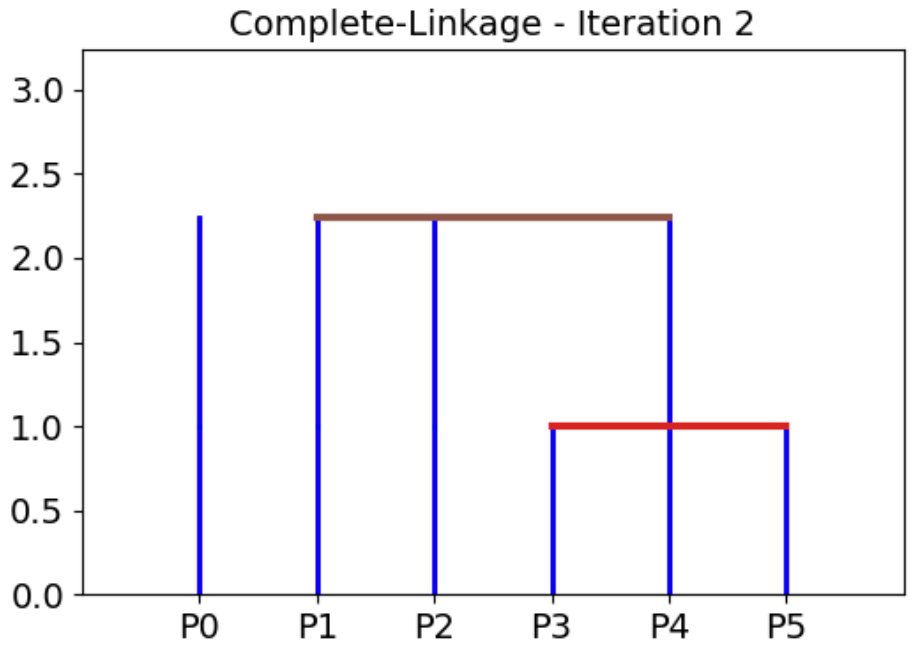
	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Hierarchical: Complete-LINK

Distance Matrix

	(0,)	(1,)	(2,)	(3, 4, 5)
0	0.0	4.47	3.0	3.61
1	4.47	0.0	2.24	4.47
2	3.0	2.24	0.0	2.24
(3,4,5)	3.61	4.47	2.24	0.0

Minimum Distance



Hierarchical: Complete-LINK

Distance Matrix

	((0,),)	((1,), (2,), (3, 4, 5))
0	0.0	
(1,2,3,4,5)		0.0

D([1,2,3,4,5], 0) =

- D(1,0) = 4.47
- D(2,0) = 3
- D(3,0) = 3.61
- D(4,0) = 2.83
- D(5,0) = 2.24

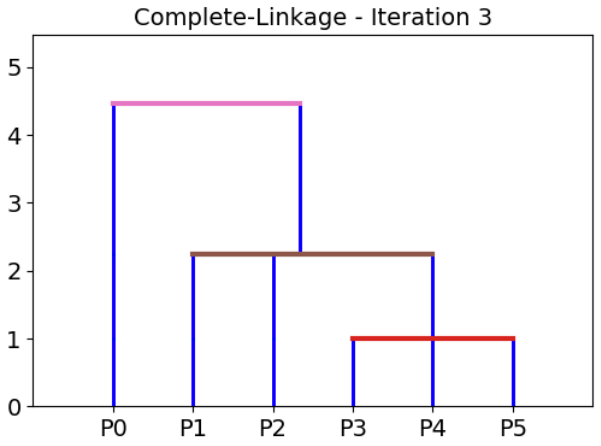
Max Distance

	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Hierarchical: Complete-LINK

Distance Matrix

	((0,),)	((1,), (2,), (3, 4, 5))
0	0.0	4.47
(1,2,3,4,5)	4.47	0.0



D([1,2,3,4,5], 0) =

- D(1,0) = 4.47
- D(2,0) = 3
- D(3,0) = 3.61
- D(4,0) = 2.83
- D(5,0) = 2.24

Max Distance

	(0,)	(1,)	(2,)	(3,)	(4,)	(5,)
0	0.0	4.47	3.0	3.61	2.83	2.24
1	4.47	0.0	2.24	4.12	4.47	3.61
2	3.0	2.24	0.0	2.0	2.24	1.41
3	3.61	4.12	2.0	0.0	1.0	1.41
4	2.83	4.47	2.24	1.0	0.0	1.0
5	2.24	3.61	1.41	1.41	1.0	0.0

Hierarchical Clustering

P0	1	7
P1	6	2
P2	7	1
P3	7	3
P4	8	1
P5	6	5
P6	8	6
P7	8	5

Distance Matrix

	P0	P1	P2	P3	P4	P5	P6	P7
P0	0							
P1	7,07	0						
P2	8,49	1,41	0					
P3	7,21	1,41	2	0				
P4	**9,22**	2,24	1	2,24	0			
P5	5,39	3	4,12	2,24	4,47	0		
P6	7,07	4,47	5,1	3,16	5	2,24	0	
P7	7,28	3,61	4,12	2,24	4	2	1	0

Transform Distance in Similarity Matrix

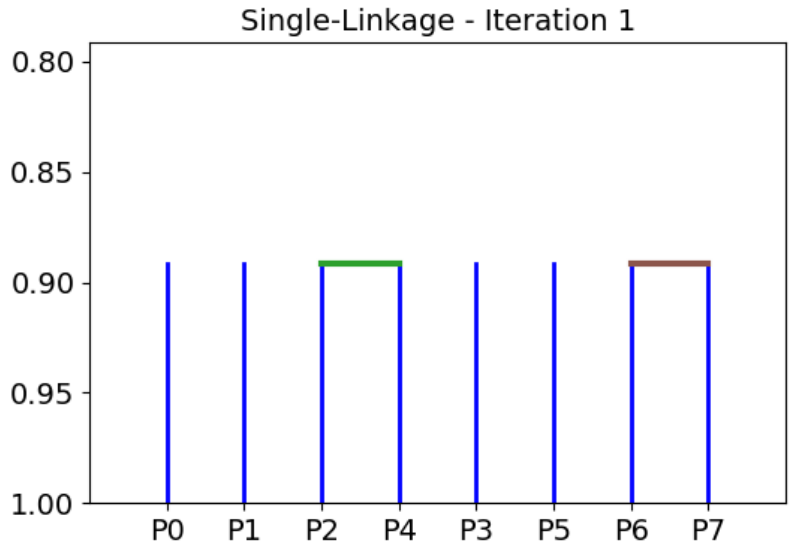
Similarity = 1- (D /D_max)

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK with Similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	**0,89**	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Closest clusters = Max Similarity



Hierarchical: Single-LINK

	P0	P1	P2,P4	P3	P5	P6,P7
P0	1,00					
P1	0,23	1,00				
P2,P4			1,00			
P3	0,22	0,85		1,00		
P5	0,42	0,67		0,76	1,00	
P6, P7						1,00

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

	P0	P1	P2,P4	P3	P5	P6,P7
P0	1,00					
P1	0,23	1,00				
P2,P4	**0,08**		1,00			
P3	0,22	0,85		1,00		
P5	0,42	0,67		0,76	1,00	
P6, P7						1,00

$S([2,4], 0) =$ S(2,0) = 0,08

S(4,0) = 0

Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

	P0	P1	P2,P4	P3	P5	P6,P7
P0	1,00					
P1	0,23	1,00				
P2,P4	**0,08**	**0,85**	1,00			
P3	0,22	0,85		1,00		
P5	0,42	0,67		0,76	1,00	
P6, P7						1,00

S([2,4], 1) =

S(2,1) = 0,85

S(4,1) = 0,76

Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

	P0	P1	P2,P4	P3	P5	P6,P7
P0	1,00					
P1	0,23	1,00				
P2,P4	**0,08**	**0,85**	1,00			
P3	0,22	0,85	**0,78**	1,00		
P5	0,42	0,67		0,76	1,00	
P6, P7						1,00

S([2,4], 3) =

S(2,3) = 0, 8

S(4,3) = 0,76

Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

	P0	P1	P2,P4	P3	P5	P6,P7
P0	1,00					
P1	0,23	1,00				
P2,P4	**0,08**	**0,85**	1,00			
P3	0,22	0,85	**0,78**	1,00		
P5	0,42	0,67	**0,55**	0,76	1,00	
P6, P7						1,00

S([2,4], 5) =

S(2,5) = 0,

S(4,5) = 0,52

Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

	P0	P1	P2,P4	P3	P5	P6,P7
P0	1,00					
P1	0,23	1,00				
P2,P4	**0,08**	**0,85**	1,00			
P3	0,22	0,85	**0,78**	1,00		
P5	0,42	0,67	**0,55**	0,76	1,00	
P6, P7			**0,57**			1,00

S([2,4], [6,7]) =

- S(2,6) = 0,
- S(2,7) = 0,55
- S(4,6) = 0,46
- S(4,7) = 0,57

Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

	P0	P1	P2,P4	P3	P5	P6,P7
P0	1,00					
P1	0,23	1,00				
P2,P4	**0,08**	**0,85**	1,00			
P3	0,22	0,85	**0,78**	1,00		
P5	0,42	0,67	**0,55**	0,76	1,00	
P6, P7	**0,23**		**0,57**			1,00

S([6,7], 0) =

S(6,0) = 0,

S(7,0) = 0,21

Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

	P0	P1	P2,P4	P3	P5	P6,P7
P0	1,00					
P1	0,23	1,00				
P2,P4	**0,08**	**0,85**	1,00			
P3	0,22	0,85	**0,78**	1,00		
P5	0,42	0,67	**0,55**	0,76	1,00	
P6, P7	**0,23**	**0,61**	**0,57**			1,00

S([6,7], 1) =

S(6,1) = 0,

S(7,1) = 0,61

Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

	P0	P1	P2,P4	P3	P5	P6,P7
P0	1,00					
P1	0,23	1,00				
P2,P4	**0,08**	**0,85**	1,00			
P3	0,22	0,85	**0,78**	1,00		
P5	0,42	0,67	**0,55**	0,76	1,00	
P6, P7	**0,23**	**0,61**	**0,57**	**0,76**		1,00

S([6,7], 3) =

S(6,3) = 0,

S(7,3) = 0,76

Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

	P0	P1	P2,P4	P3	P5	P6,P7
P0	1,00					
P1	0,23	1,00				
P2,P4	0,08	0,85	1,00			
P3	0,22	0,85	0,78	1,00		
P5	0,42	0,67	0,55	0,76	1,00	
P6, P7	0,23	0,61	0,57	0,76	**0,78**	1,00

S([6,7], 3) =

S(6,5) = 0,

S(7,5) = 0,78

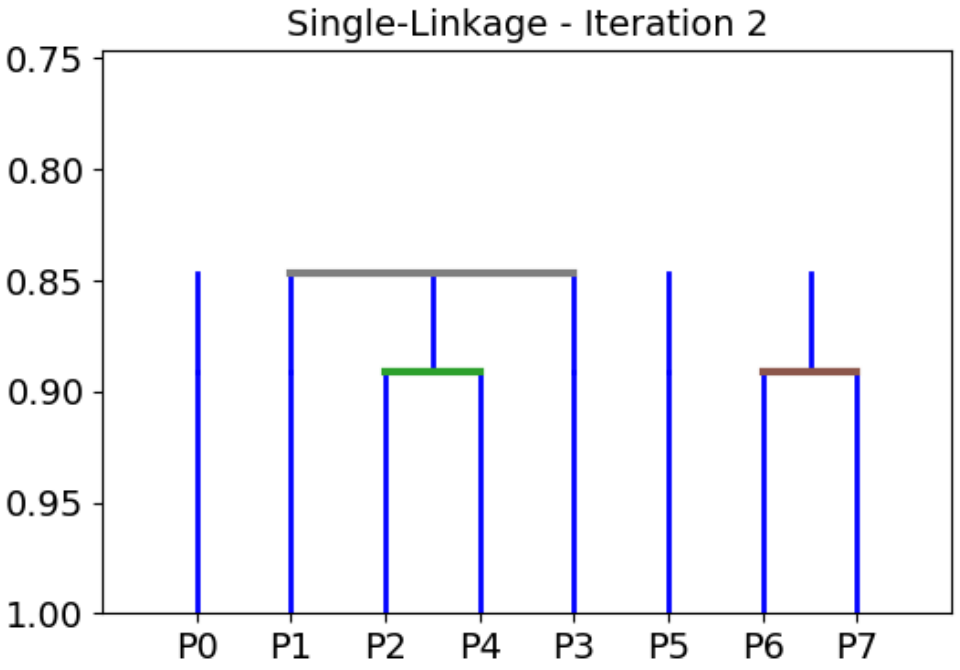
Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

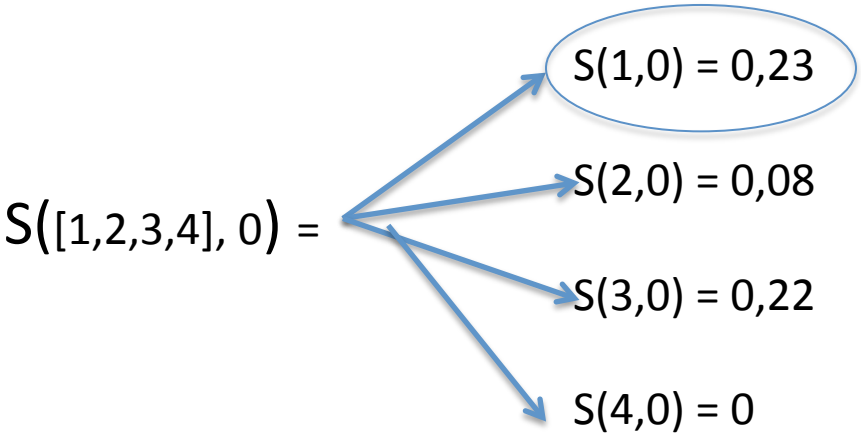
	P0	P1	P2,P4	P3	P5	P6,P7
P0	1,00					
P1	0,23	1,00				
P2,P4	0,08	0,85	1,00			
P3	0,22	0,85	0,78	1,00		
P5	0,42	0,67	0,55	0,76	1,00	
P6, P7	0,23	0,61	0,57	0,76		1,00

Closest clusters = Max Similarity



Hierarchical: Single-LINK

	P0	P1,P2,P3,P4	P5	P6,P7
P0	1,00			
P1,P2,P3,P4	**0,23**	1,00		
P5	0,42		1,00	
P6, P7	0,23		0,78	1,00



Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

	P0	P1,P2,P3,P4	P5	P6,P7
P0	1,00			
P1,P2,P3,P4	**0,23**	1,00		
P5	0,42	**0,76**	1,00	
P6, P7	0,23		0,78	1,00

$S([1,2,3,4], 5) =$

- S(1,5) = 0,67
- S(2,5) = 0,55
- S(3,5) = 0,76
- S(4,5) = 0,52

Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

Hierarchical: Single-LINK

	P0	P1,P2,P3,P4	P5	P6,P7
P0	1,00			
P1,P2,P3,P4	**0,23**	1,00		
P5	0,42	**0,76**	1,00	
P6, P7	0,23	**0,76**	0,78	1,00

D([1,2,3,4], [6,7]) =

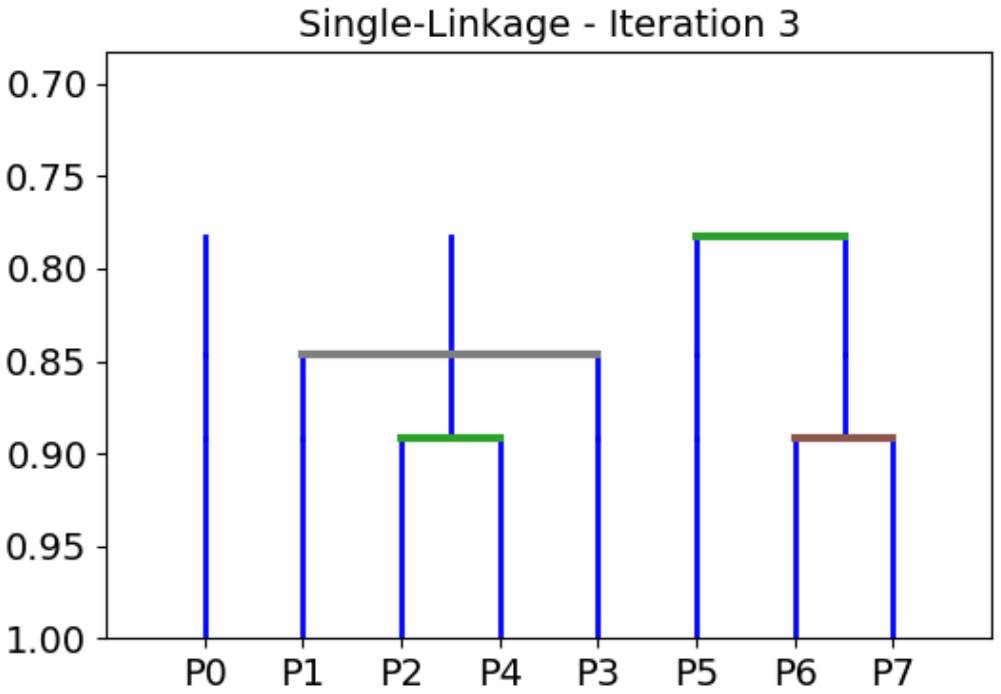
S(1,6) = 0,52
S(2,6) = 0,45
S(3,6) = 0,66
S(4,6) = 0,46
S(1,7) = 0,61
S(2,7) = 0,55
S(3,7) = 0,76
S(4,7) = 0,57

Max similarity

	P0	P1	P2	P3	P4	P5	P6	P7
P0	1,00							
P1	0,23	1,00						
P2	0,08	0,85	1,00					
P3	0,22	0,85	0,78	1,00				
P4	0,00	0,76	0,89	0,76	1,00			
P5	0,42	0,67	0,55	0,76	0,52	1,00		
P6	0,23	0,52	0,45	0,66	0,46	0,76	1,00	
P7	0,21	0,61	0,55	0,76	0,57	0,78	0,89	1,00

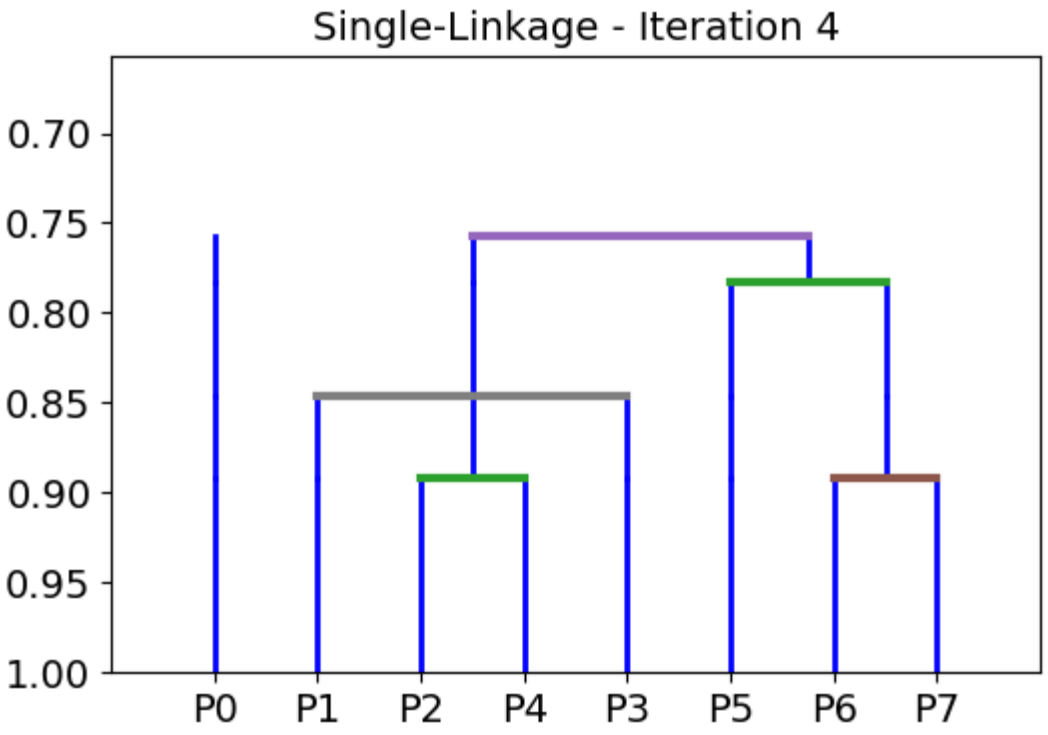
Hierarchical: Single-LINK

	P0	P1,P2,P3,P4	P5	P6,P7
P0	1,00			
P1,P2,P3,P4	0,23	1,00		
P5	0,42	0,76	1,00	
P6, P7	0,23	0,76	0,78	1,00



Hierarchical: Single-LINK

	P0	P1,P2,P3,P4	P5,P6,P7
P0	1,00		
P1,P2,P3,P4	0,23	1,00	
P5,P6, P7	0,23	0,76	1,00



Hierarchical: Single-LINK

	P0	P1,P2,P3,P4,P6,P7
P0	1,00	
P1,P2,P3,P4,P6,P7	0,42	1,00