Агломеративная иерахическая кластеризация

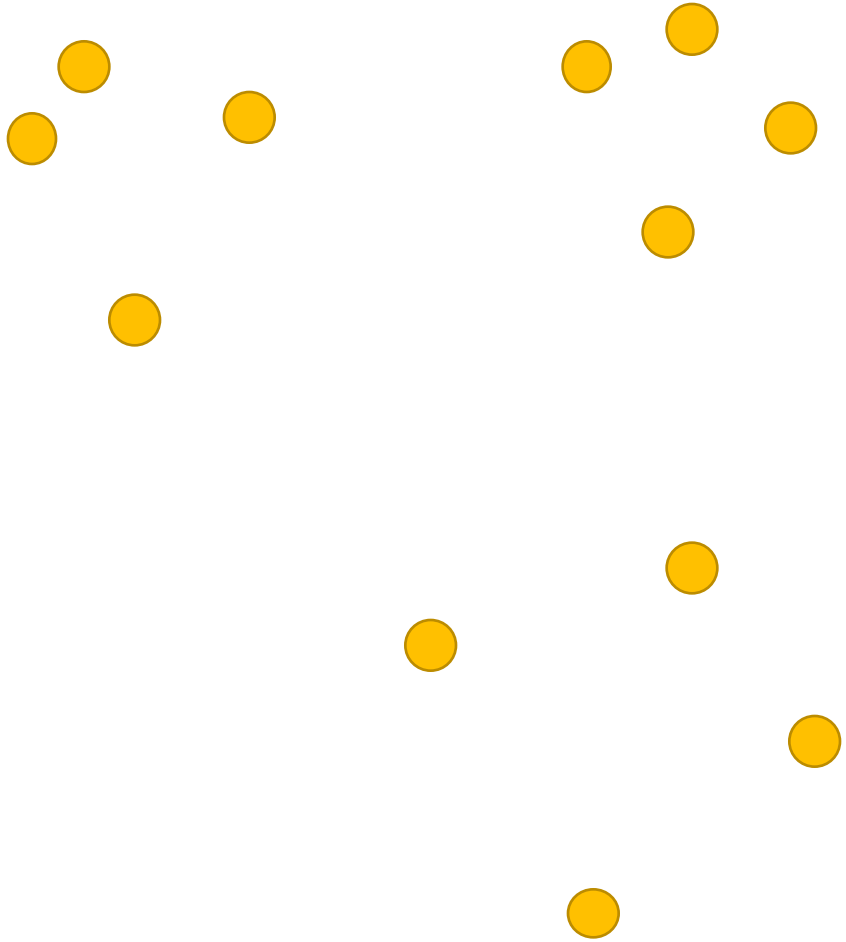
План

1. Иерархическая кластеризация
2. Как устроена агломеративная кластеризация
3. Расстояние между кластерами
4. Формула Ланса-Уильямса
5. Дендрограммы
6. Примеры работы

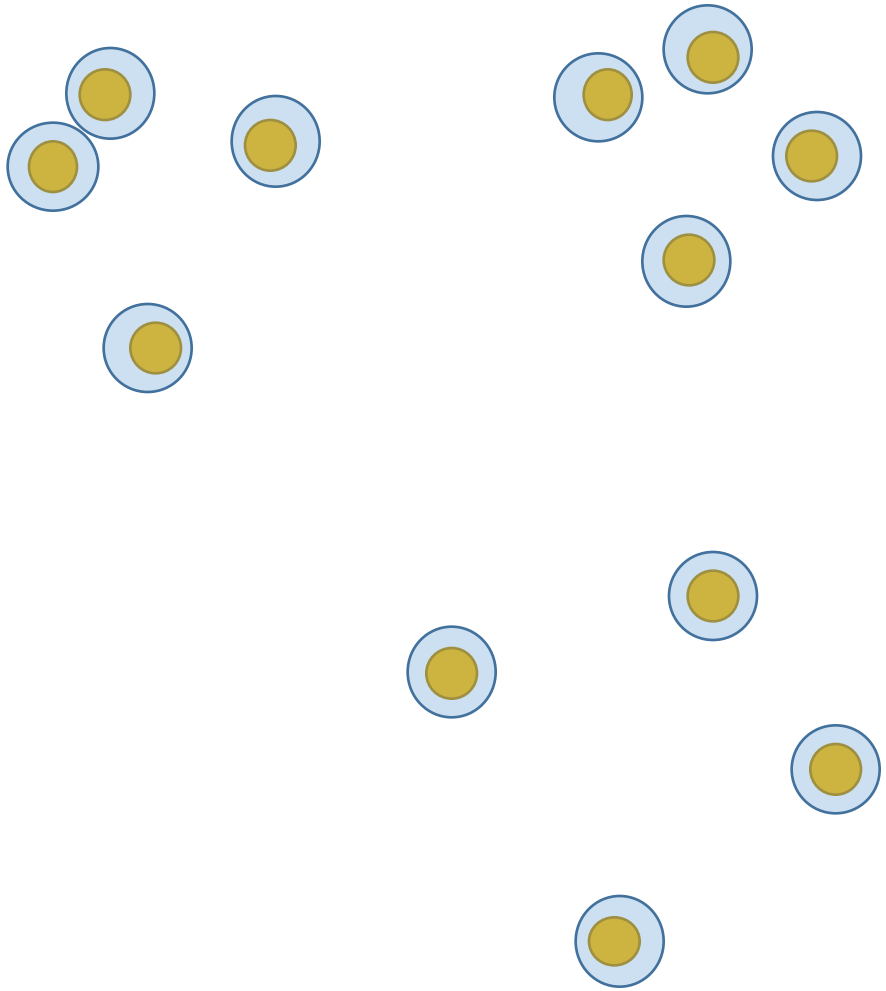
Иерархическая кластеризация

- Агломеративная
- Дивизионная или дивизимная

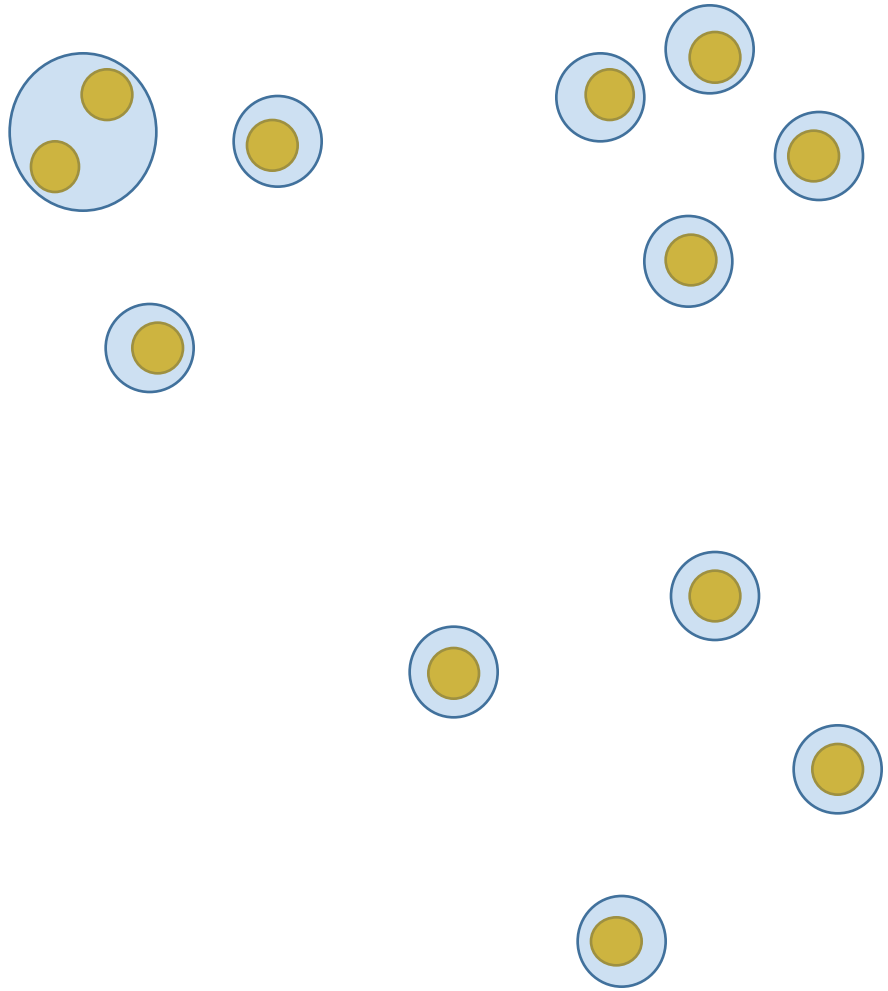
Агломеративная кластеризация



Агломеративная кластеризация



Агломеративная кластеризация



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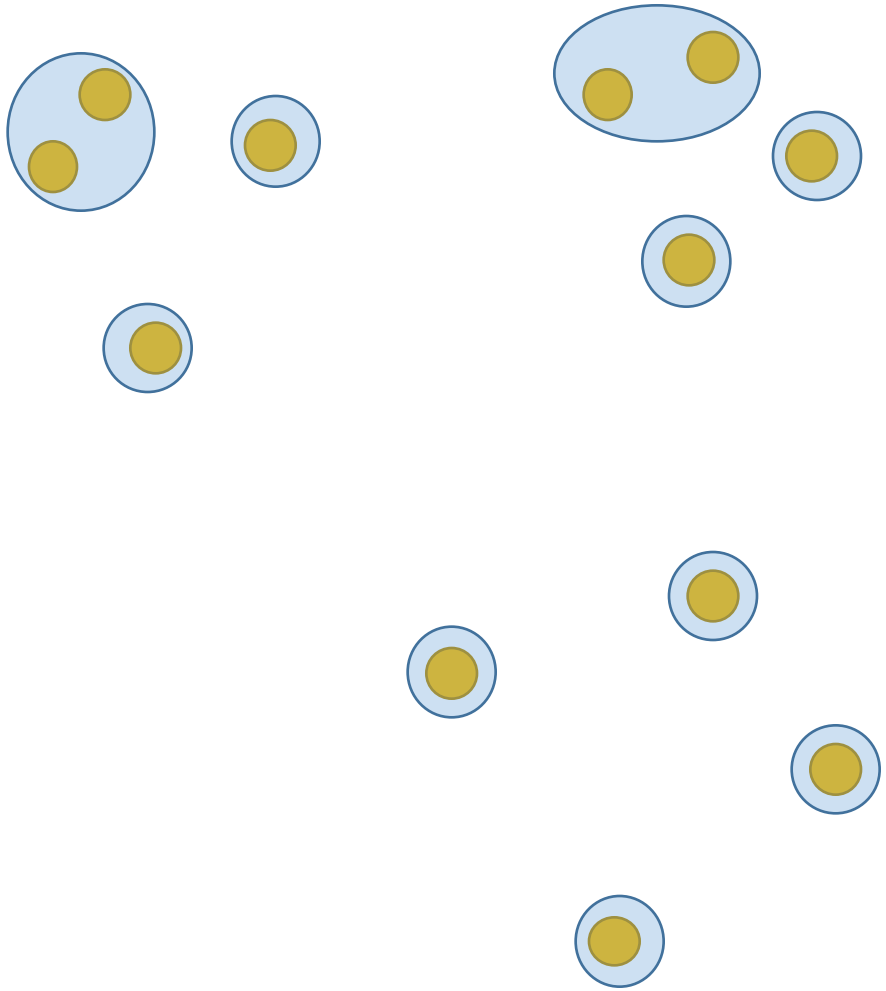

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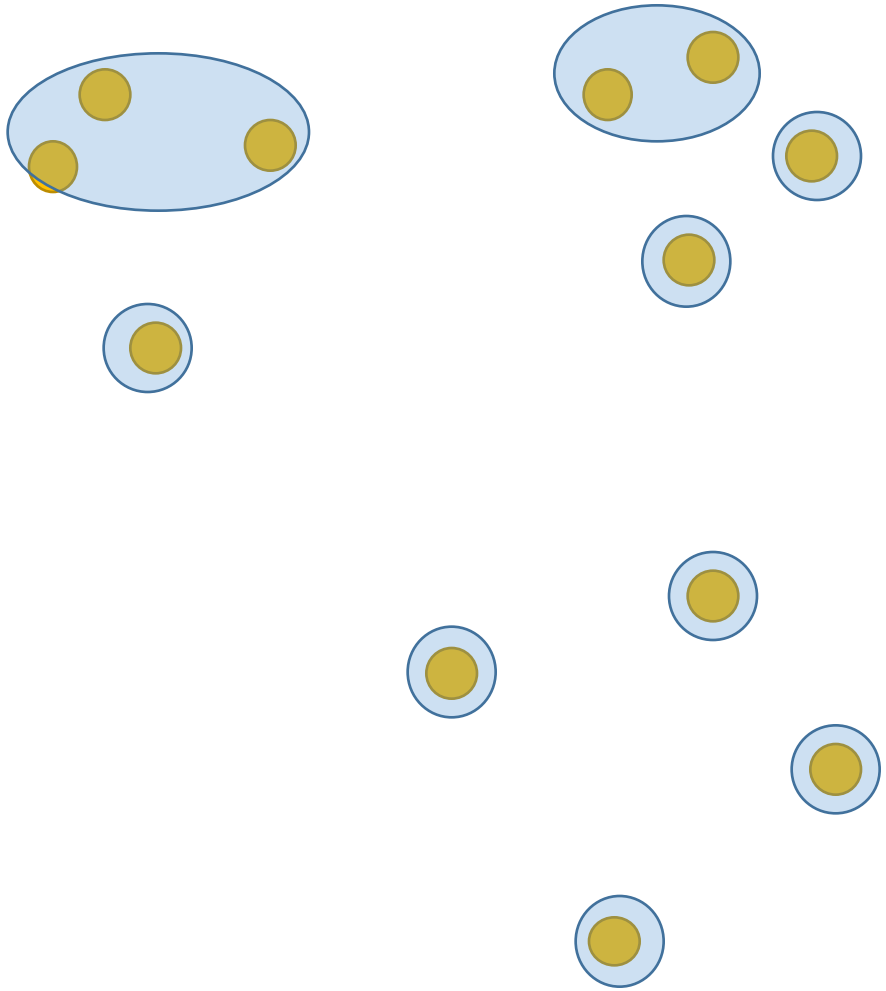

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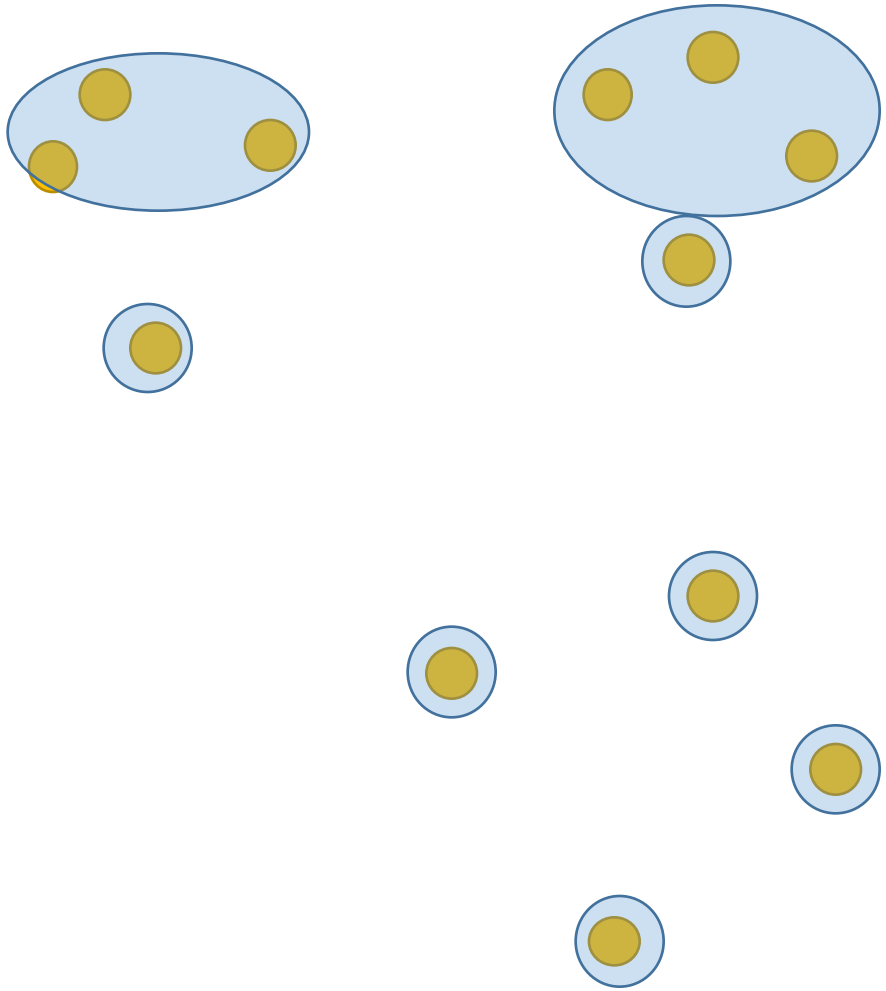

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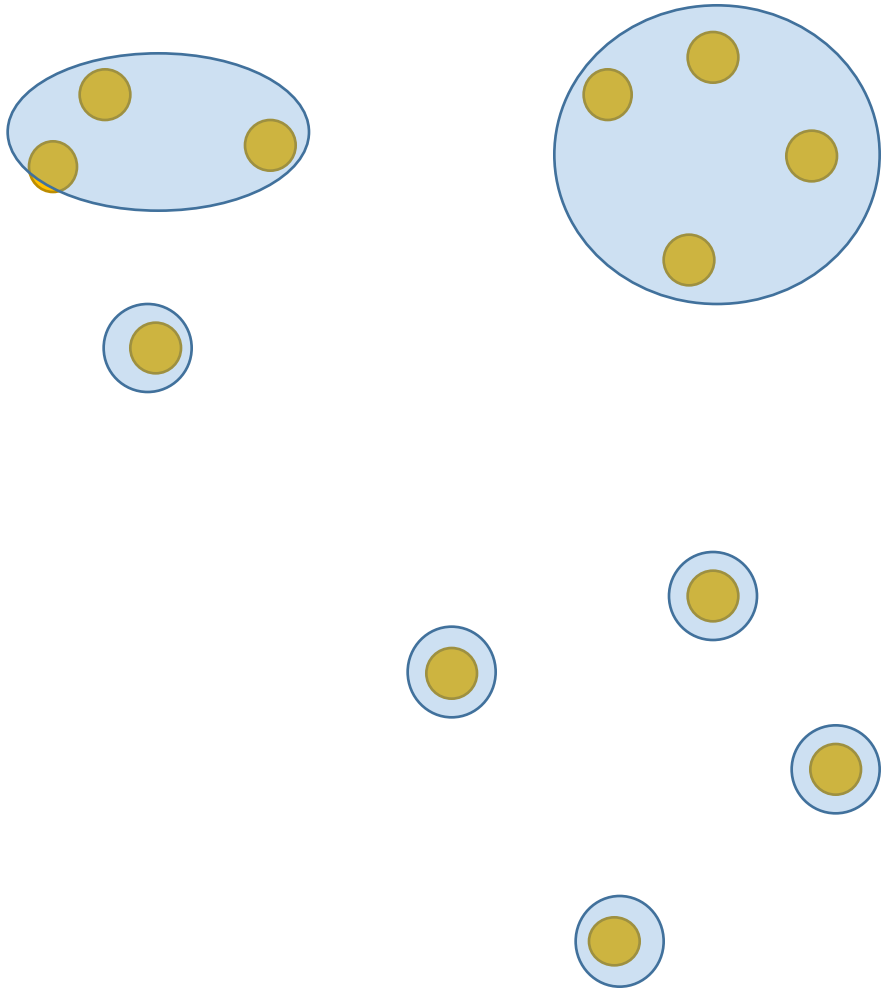

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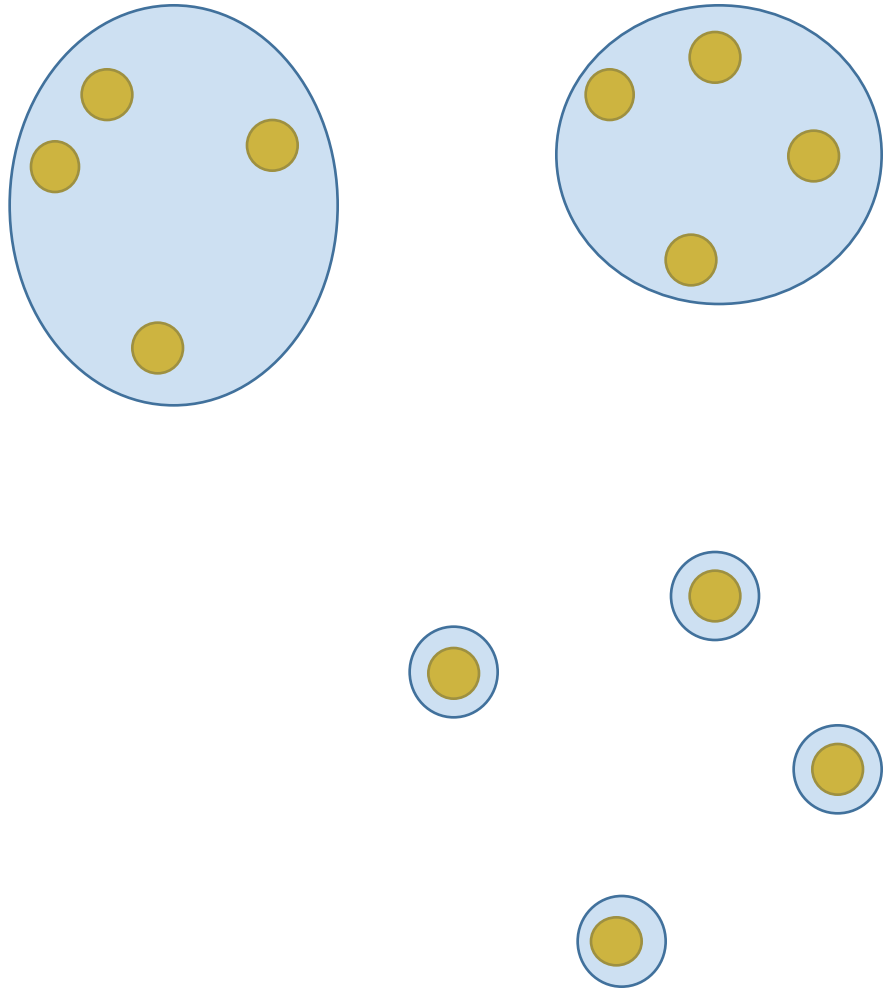

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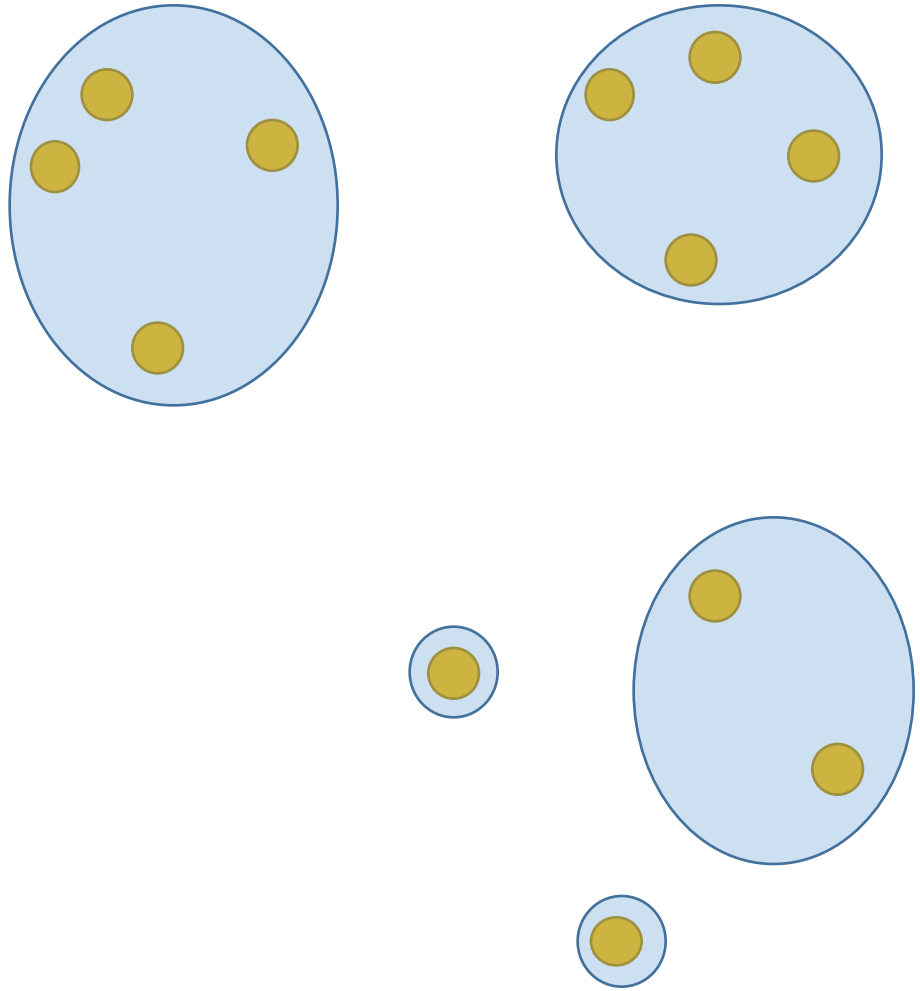

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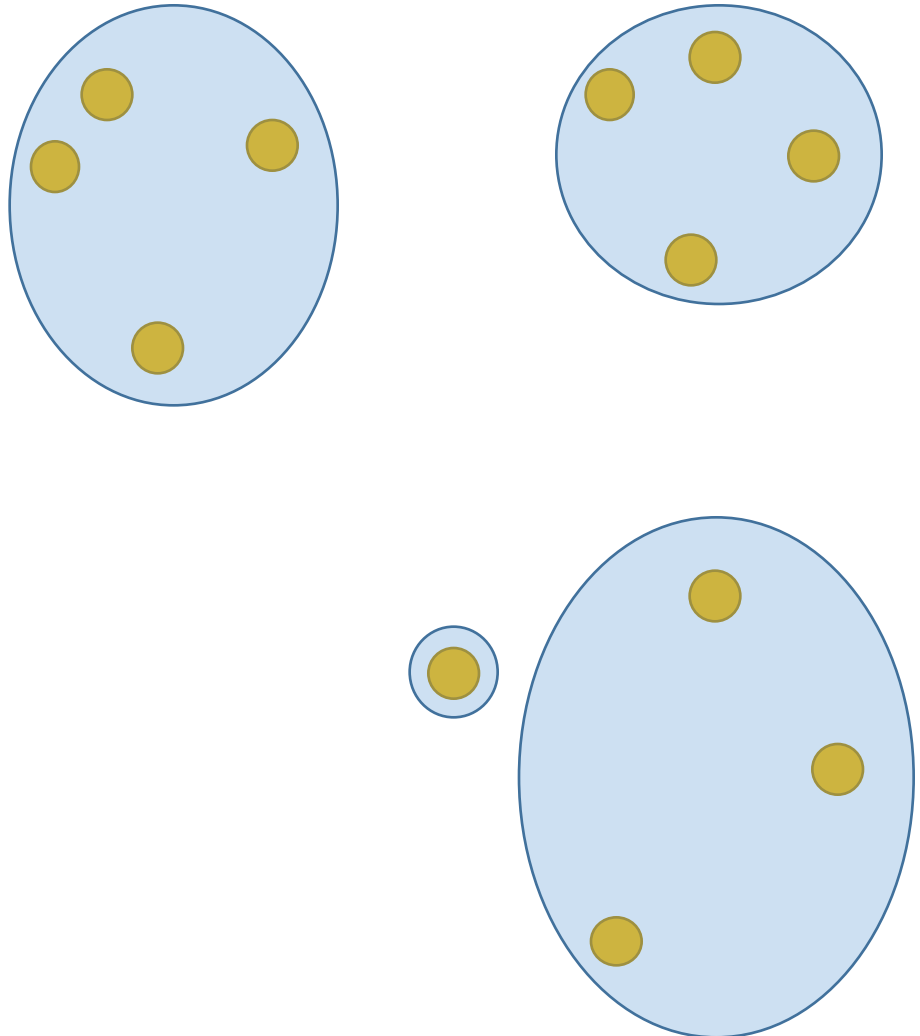

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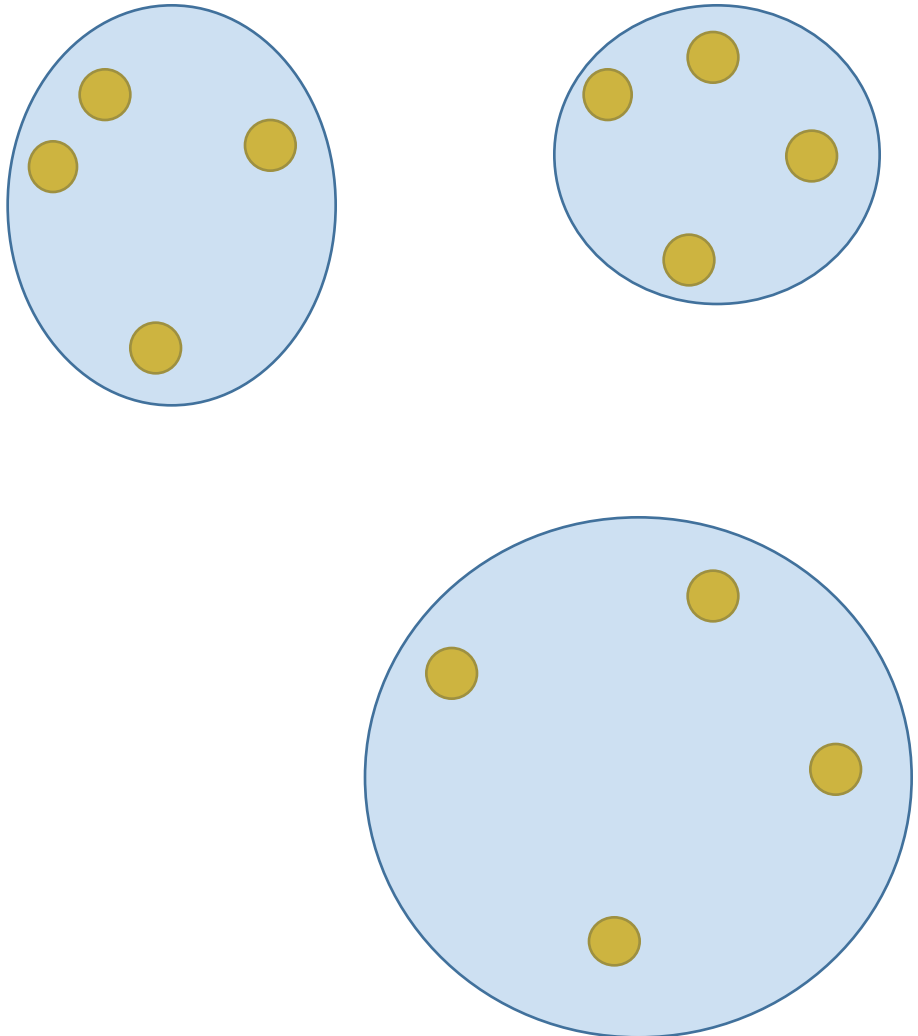

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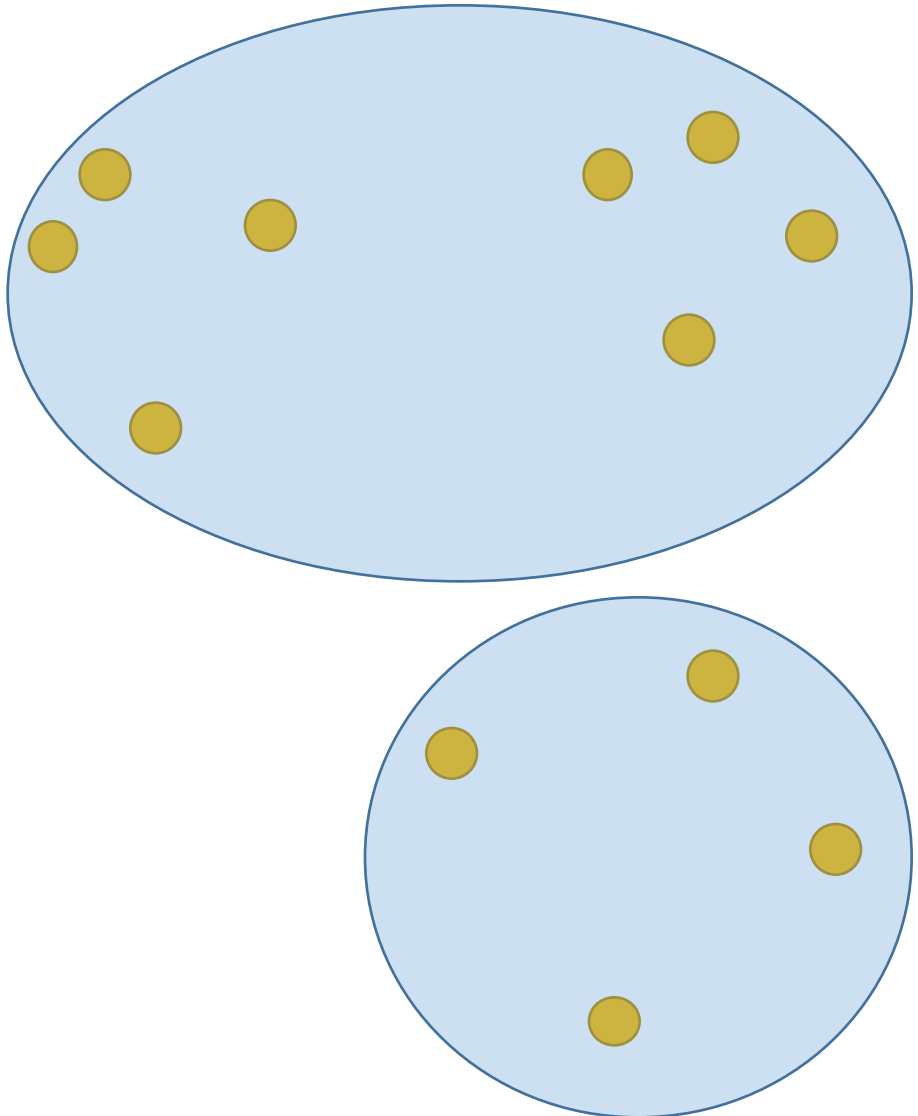
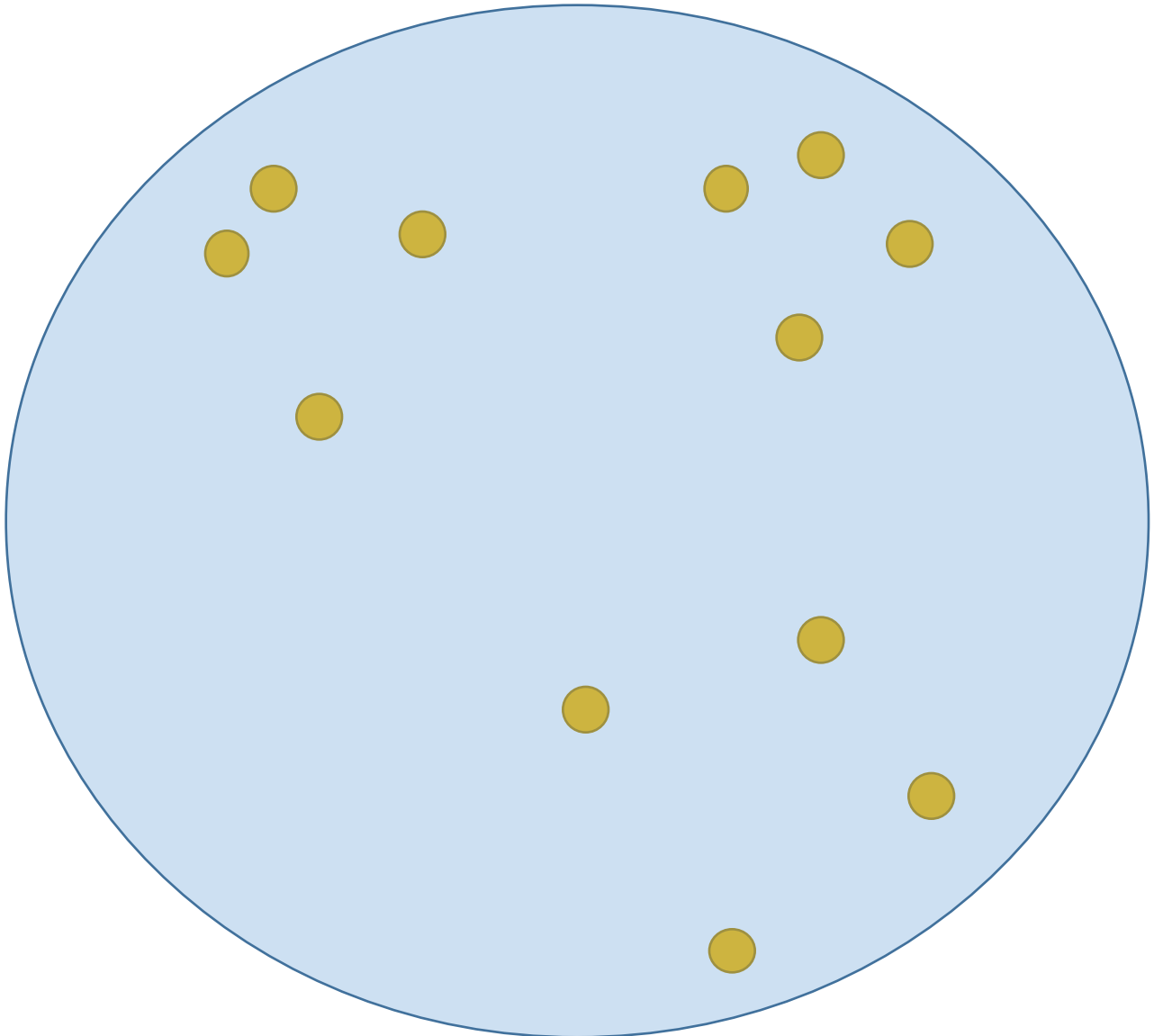
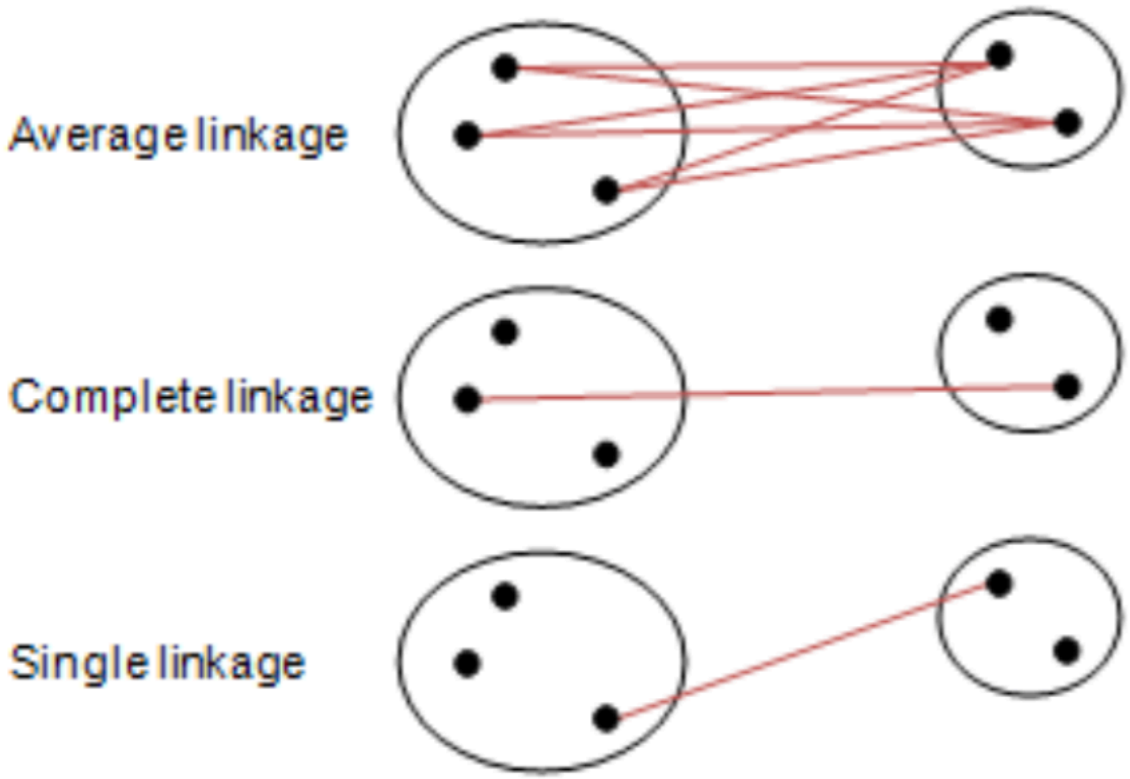


Агломеративная кластеризация



Расстояния между кластерами



Формула Ланса-Уильямса

$$R(U \cup V, S) = \alpha_U R(U, S) + \alpha_V R(V, S) + \beta R(U, V) + \gamma |R(U, S) - R(V, S)|$$

Формула Ланса-Уильямса

$$R(U \cup V, S) = \alpha_U R(U, S) + \alpha_V R(V, S) + \beta R(U, V) + \gamma |R(U, S) - R(V, S)|$$

Расстояние ближнего соседа:

$$R^{\text{б}}(W, S) = \min_{w \in W, s \in S} \rho(w, s); \qquad \alpha_U = \alpha_V = \tfrac{1}{2},\ \beta = 0,\ \gamma = -\tfrac{1}{2}.$$

Расстояние дальнего соседа:

$$R^{\text{д}}(W, S) = \max_{w \in W, s \in S} \rho(w, s); \qquad \alpha_U = \alpha_V = \tfrac{1}{2},\ \beta = 0,\ \gamma = \tfrac{1}{2}.$$

Среднее расстояние:

$$R^{\text{с}}(W, S) = \frac{1}{|W||S|} \sum_{w \in W} \sum_{s \in S} \rho(w, s); \qquad \alpha_U = \frac{|U|}{|W|},\ \alpha_V = \frac{|V|}{|W|},\ \beta = \gamma = 0.$$

Формула Ланса-Уильямса

$$R(U \cup V, S) = \alpha_U R(U, S) + \alpha_V R(V, S) + \beta R(U, V) + \gamma |R(U, S) - R(V, S)|$$

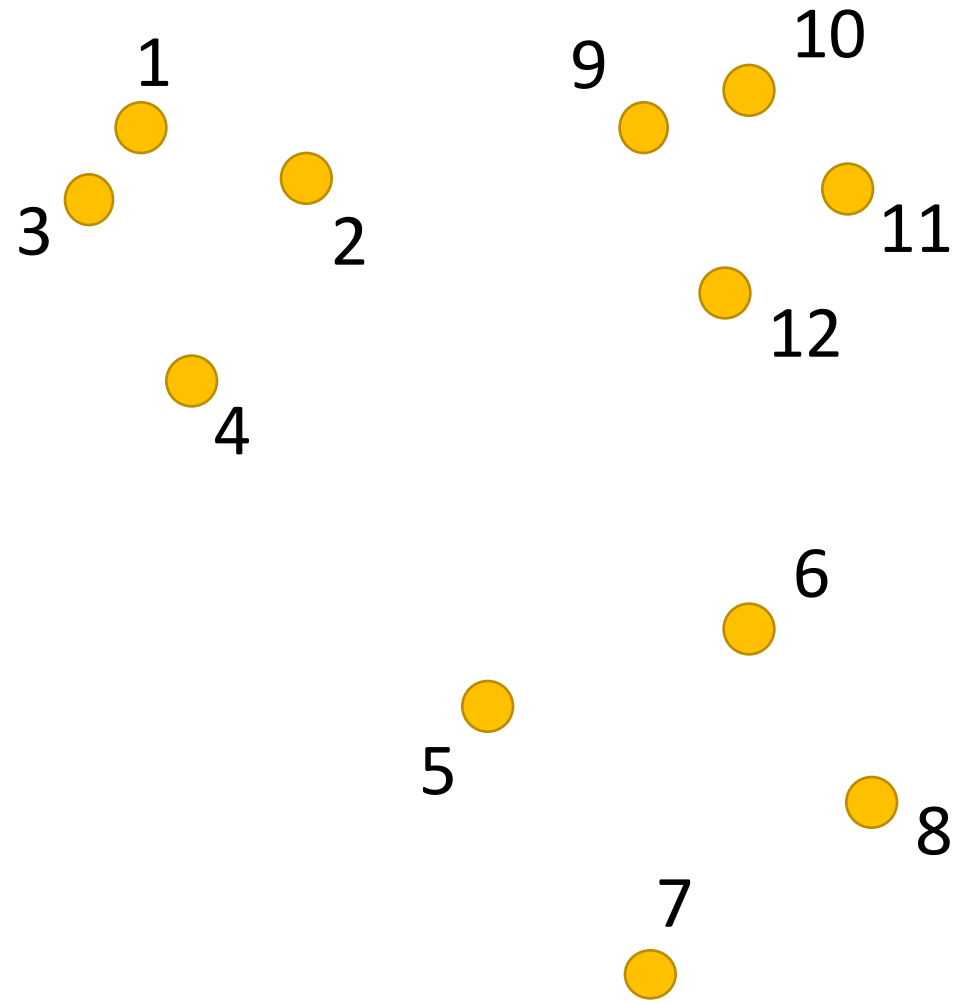
Расстояние между центрами:

$$R^{\text{ц}}(W, S) = \rho^2\Big(\sum_{w \in W} \frac{w}{|W|}, \sum_{s \in S} \frac{s}{|S|}\Big); \qquad \alpha_U = \frac{|U|}{|W|},\ \alpha_V = \frac{|V|}{|W|},\ \beta = -\alpha_U \alpha_V,\ \gamma = 0.$$

Расстояние Уорда:

$$R^{\text{у}}(W, S) = \frac{|S||W|}{|S|+|W|}\rho^2\Big(\sum_{w \in W} \frac{w}{|W|}, \sum_{s \in S} \frac{s}{|S|}\Big); \quad \alpha_U = \frac{|S|+|U|}{|S|+|W|},\ \alpha_V = \frac{|S|+|V|}{|S|+|W|},\ \beta = \frac{-|S|}{|S|+|W|},\ \gamma = 0.$$

Дендрограмма



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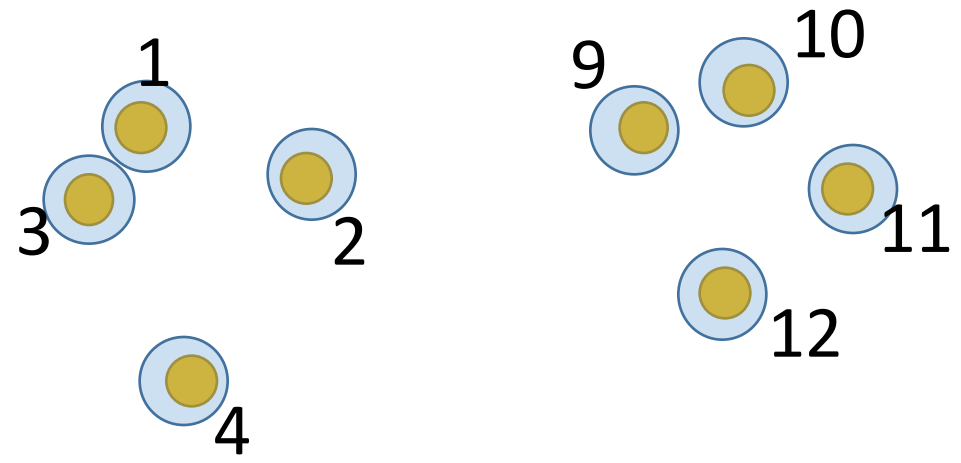
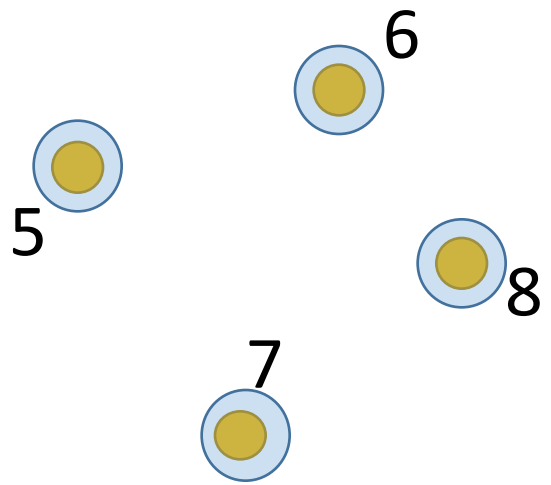
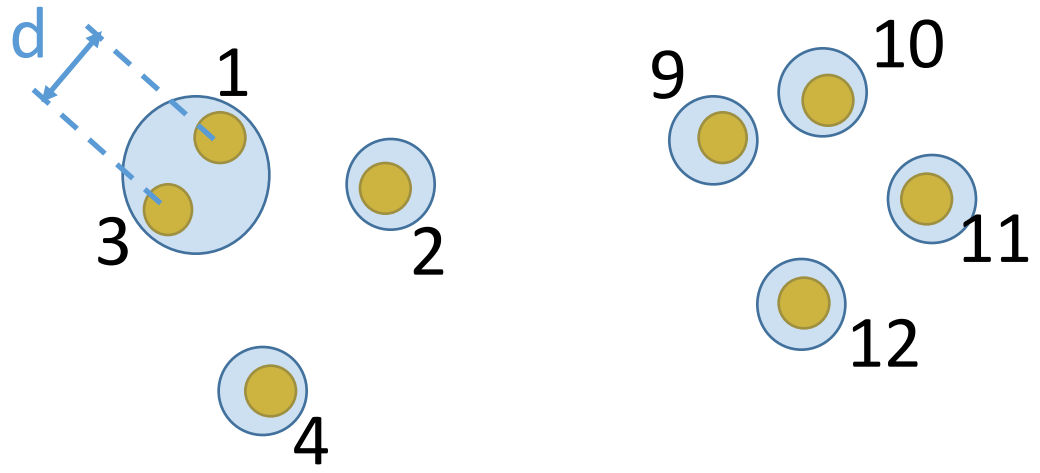
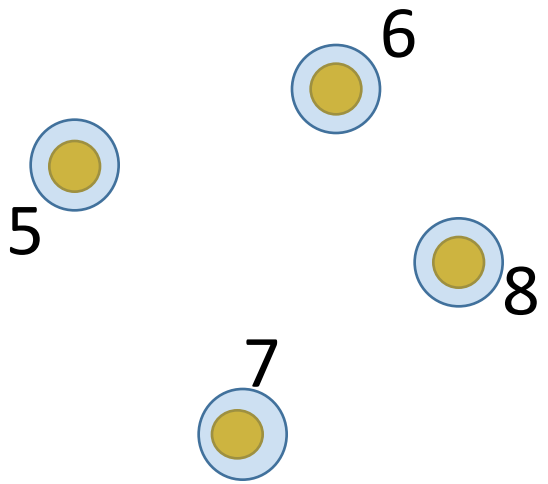




1 3 2 4 9 10 11 12 6 8 7 5

Дендрограмма





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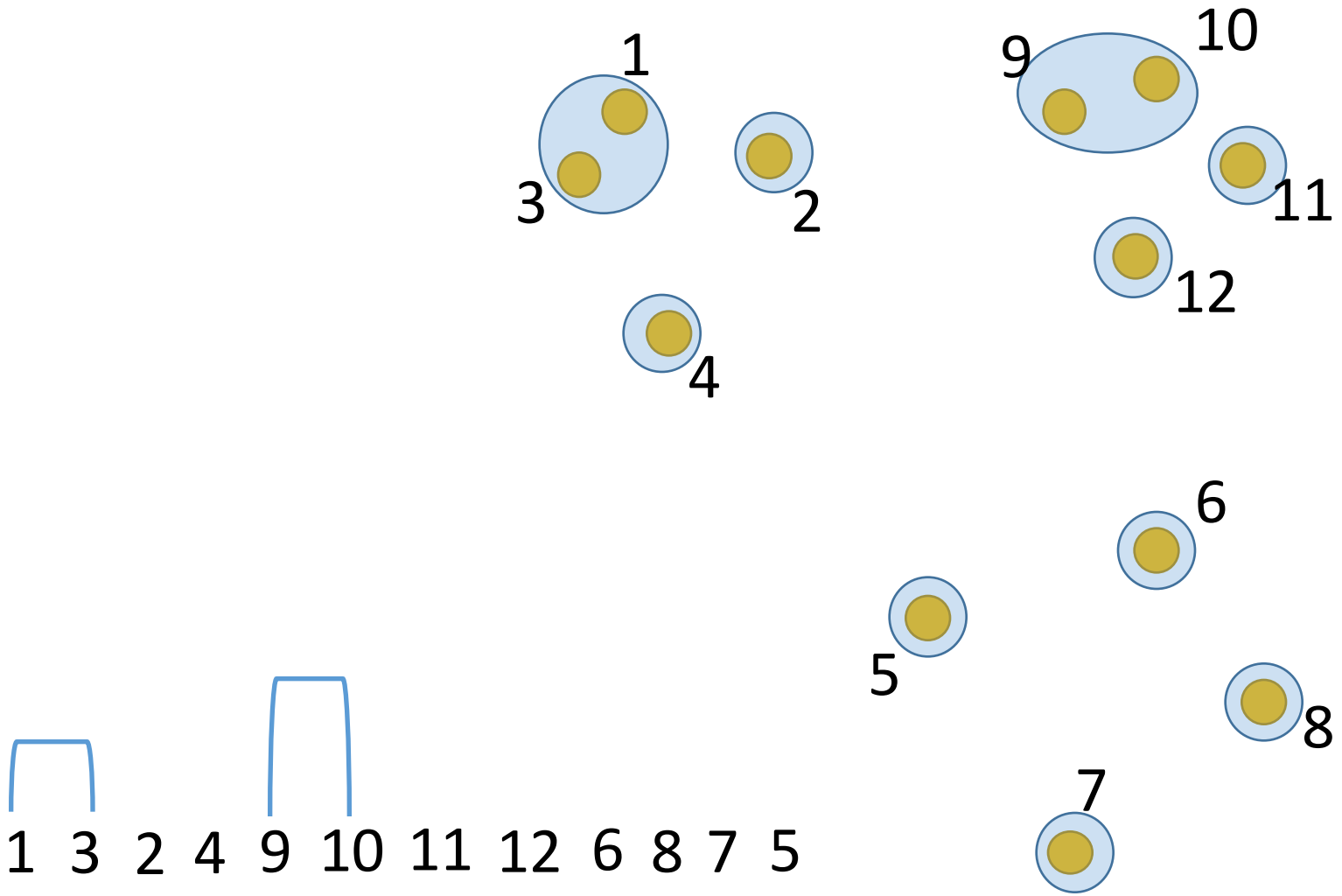

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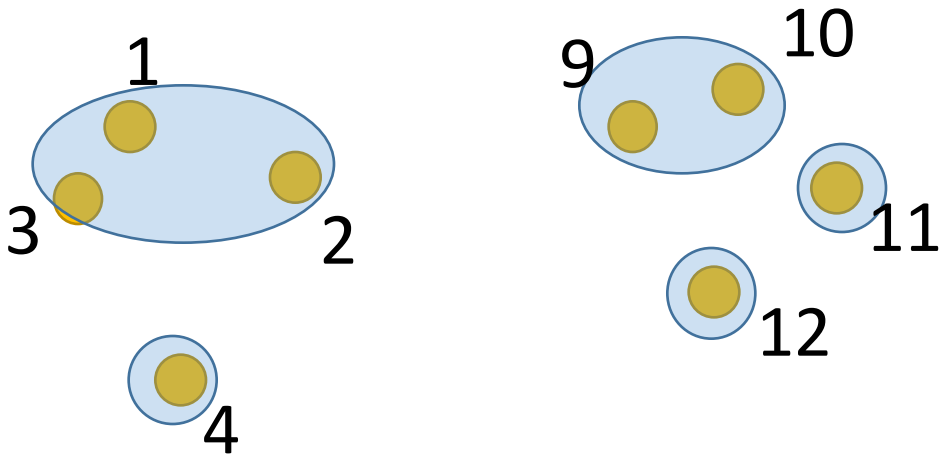

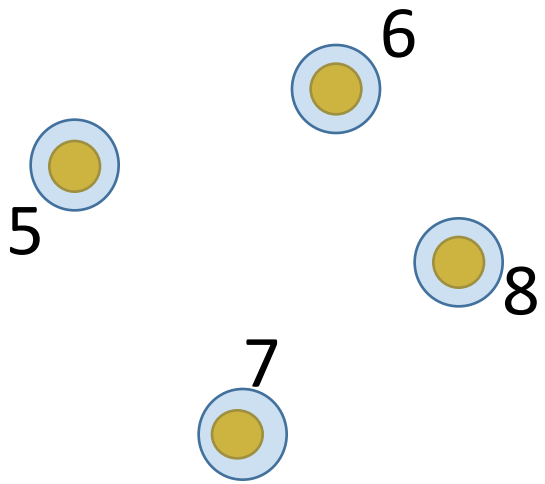

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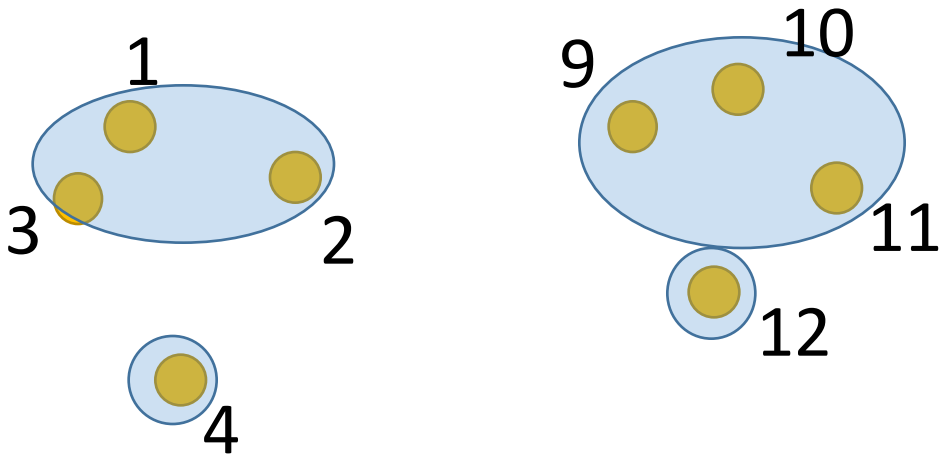

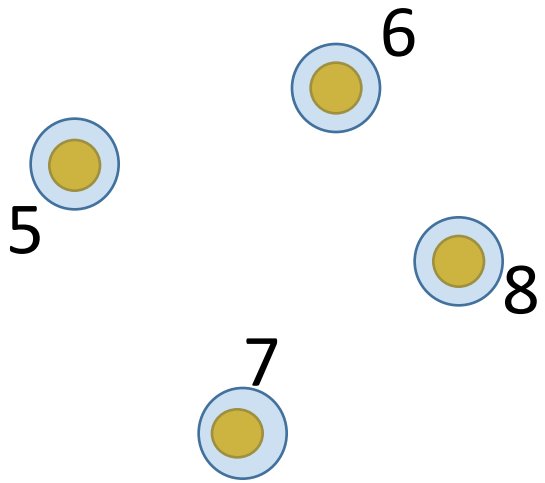

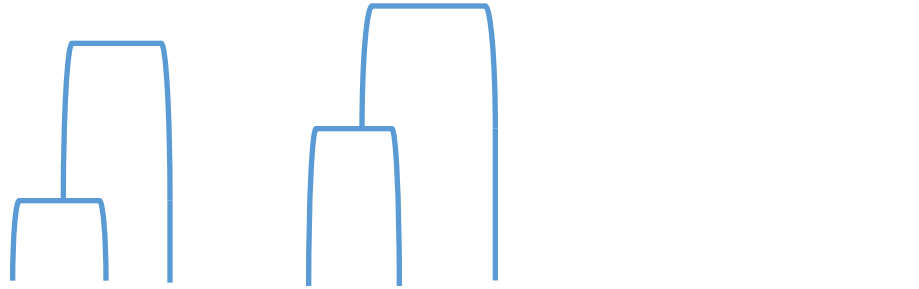

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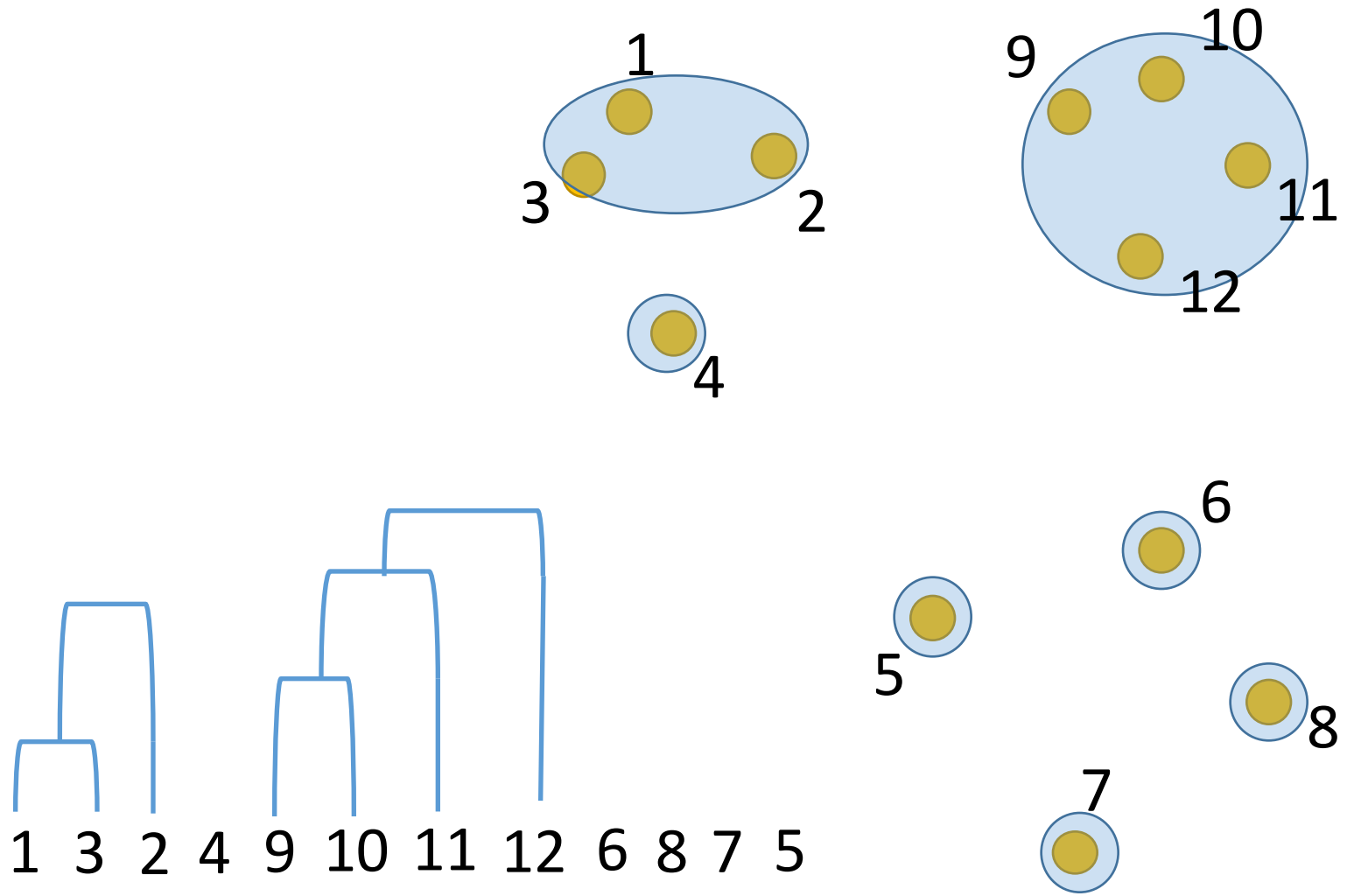

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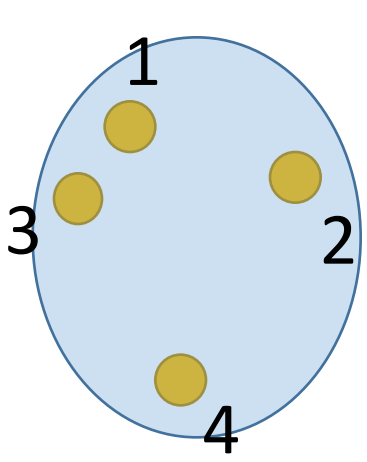

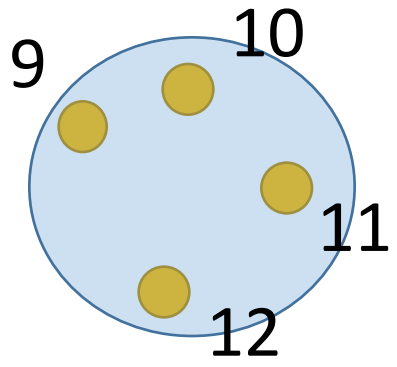

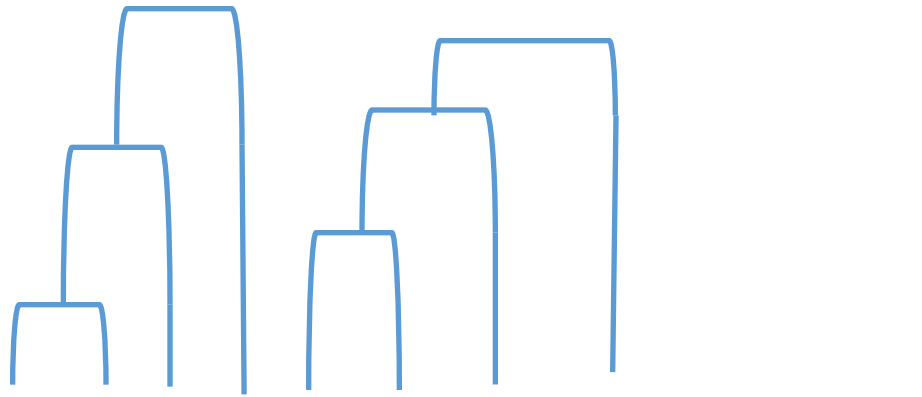

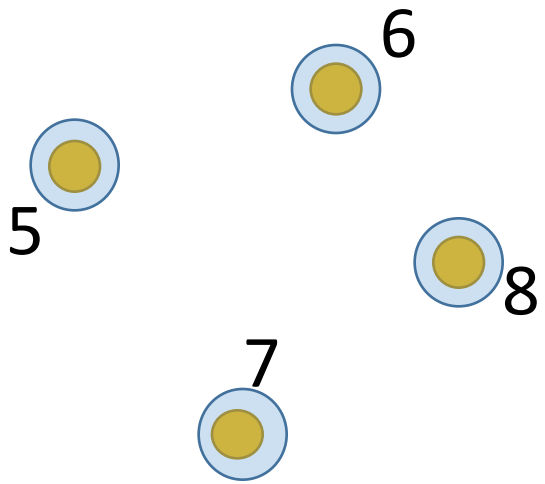

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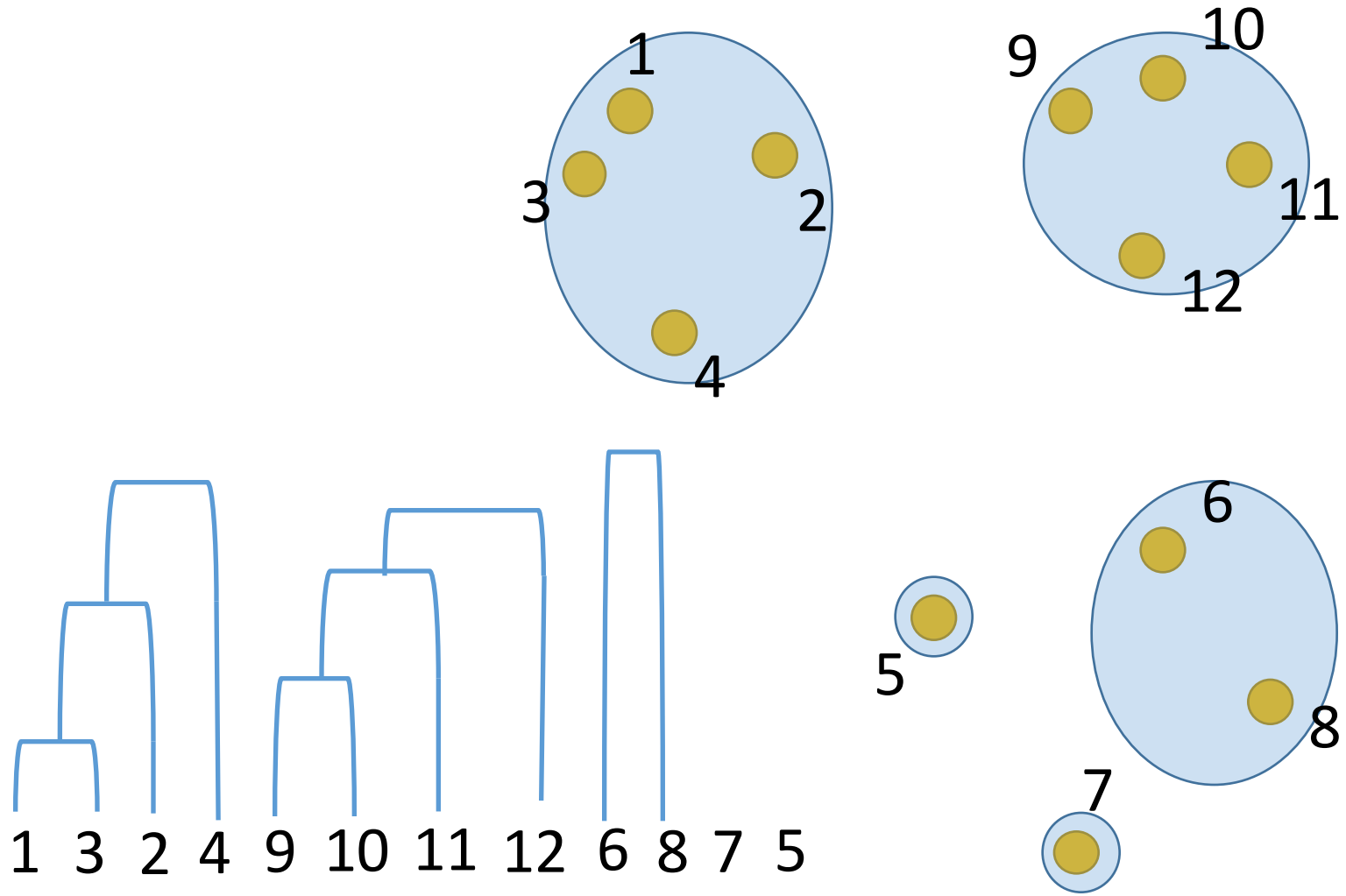

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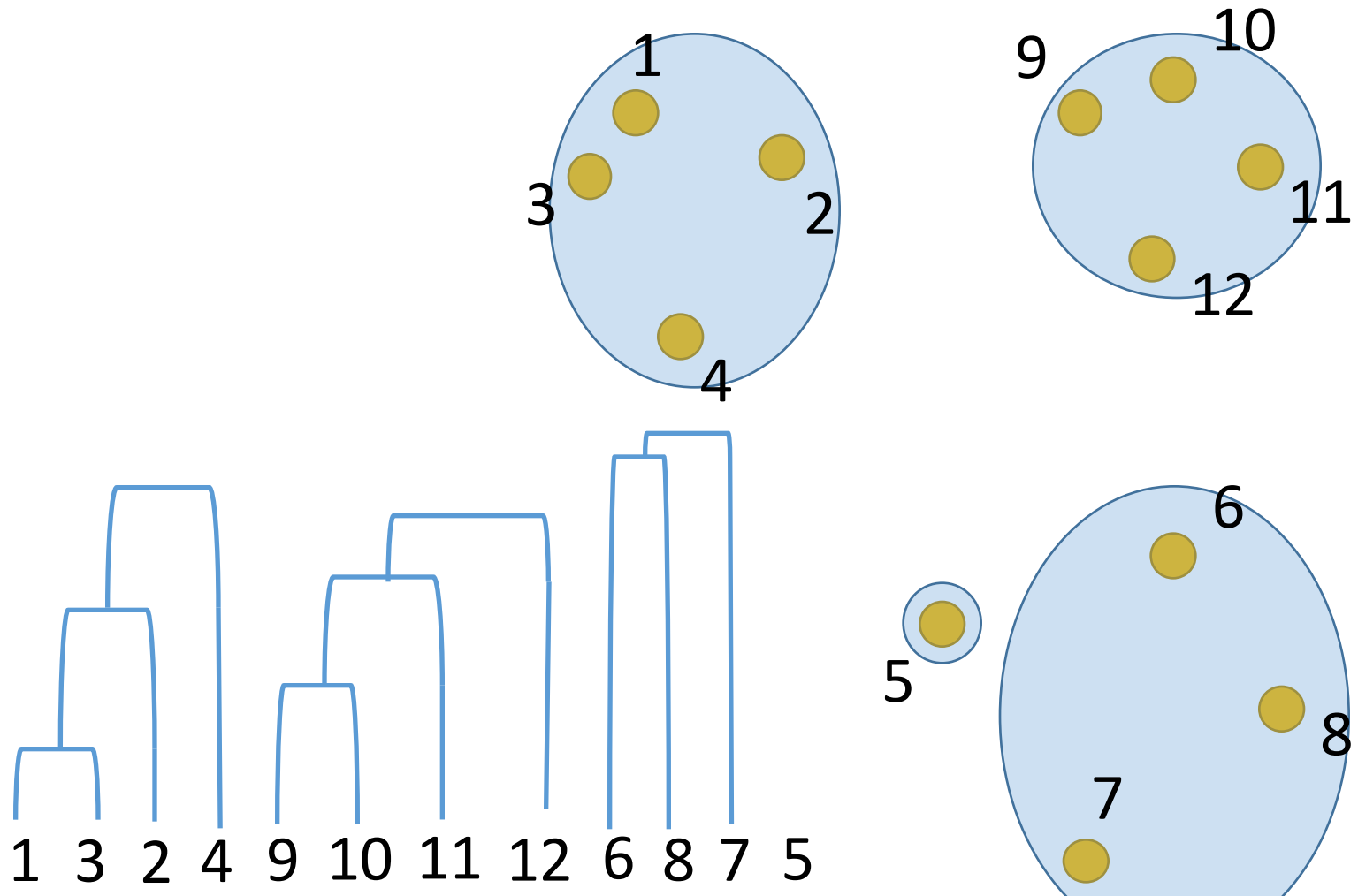

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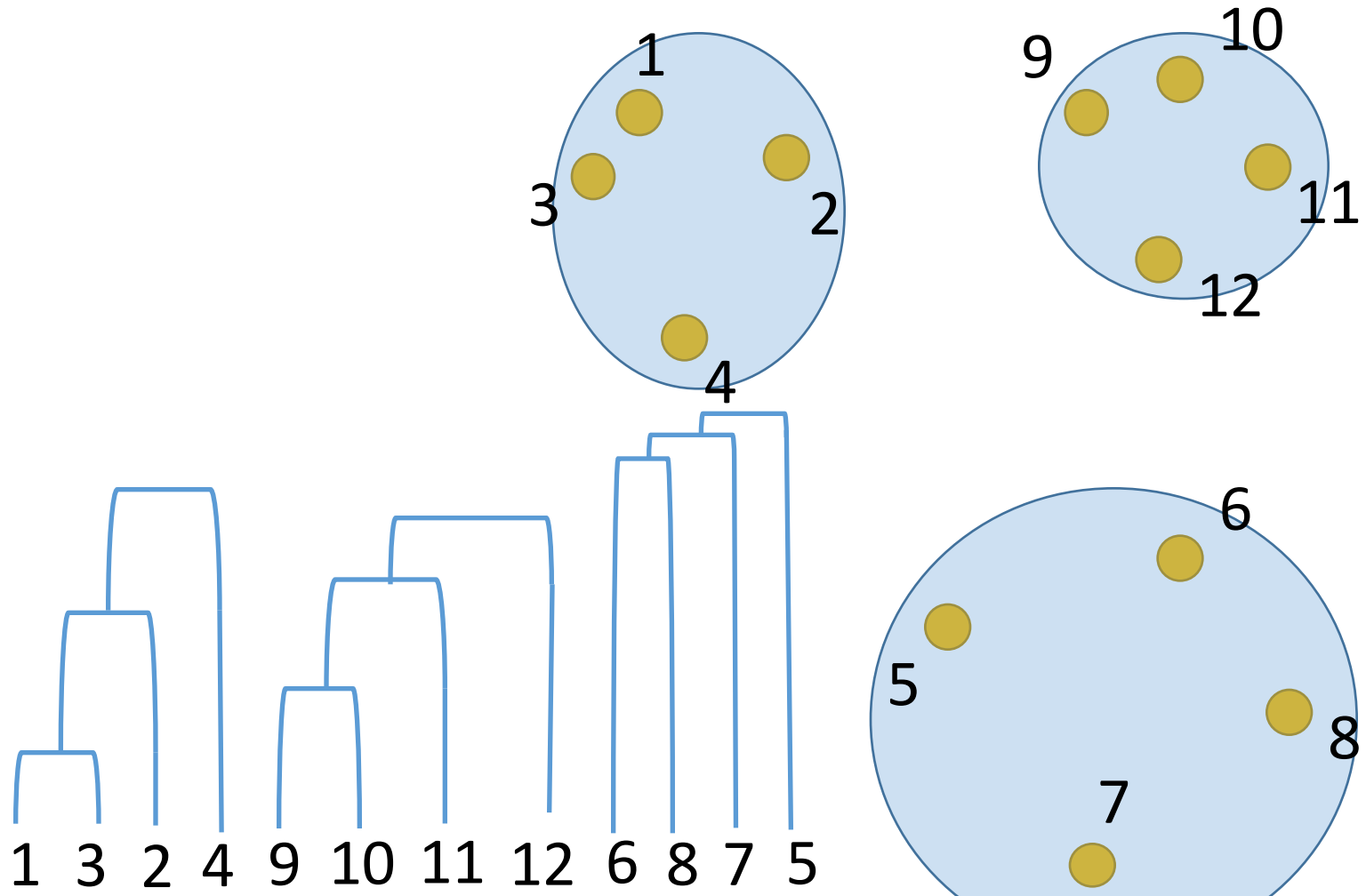

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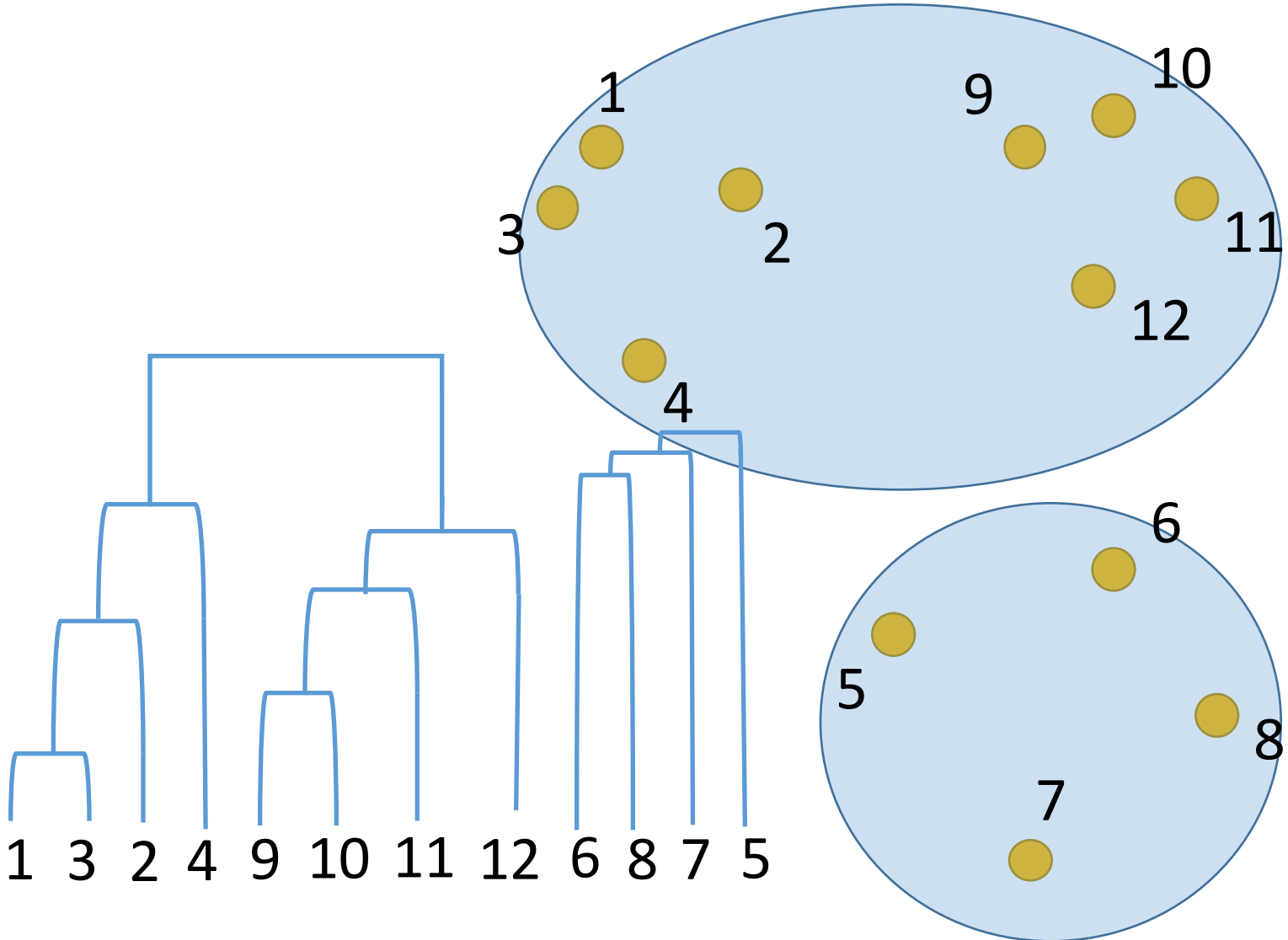

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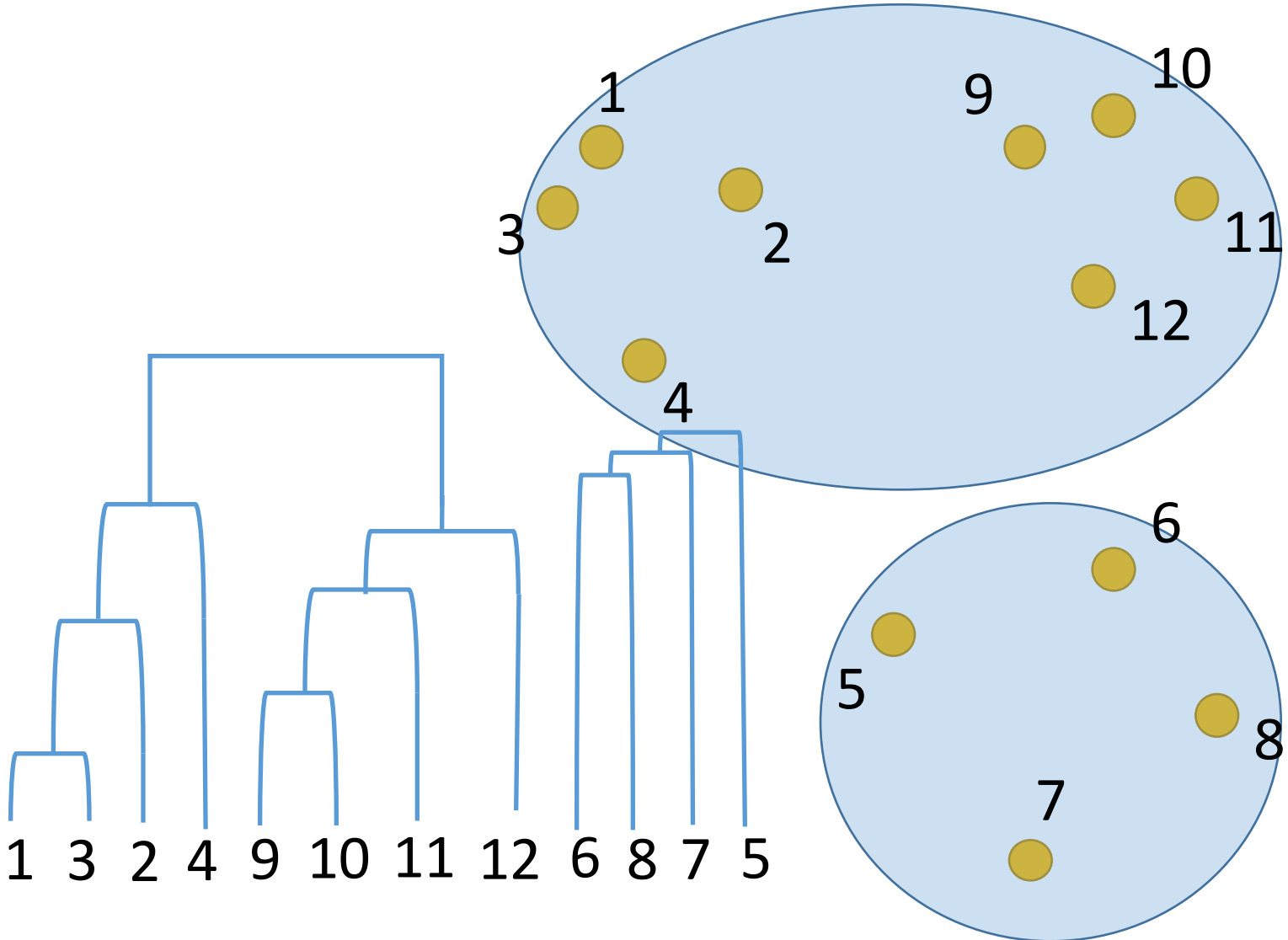

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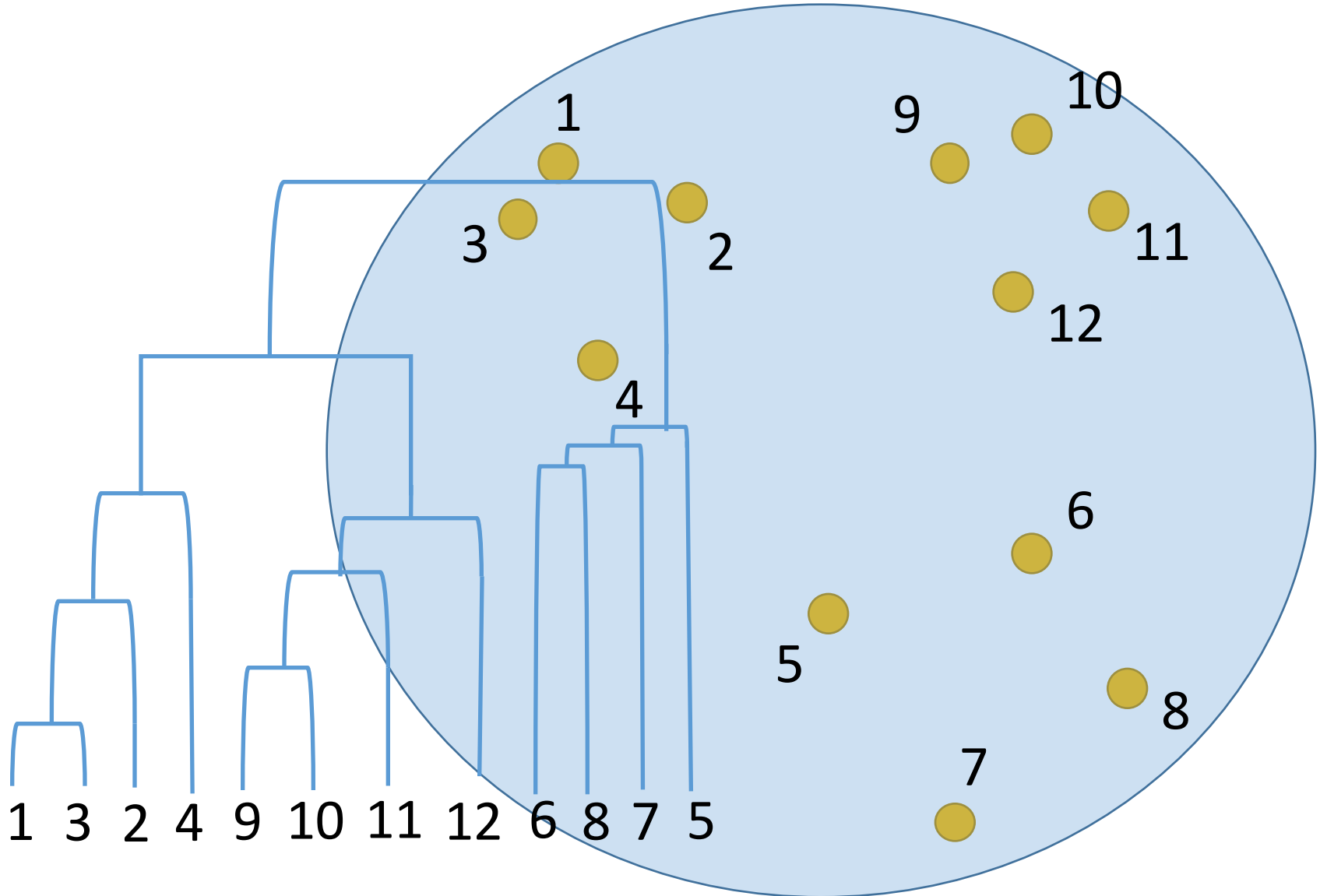

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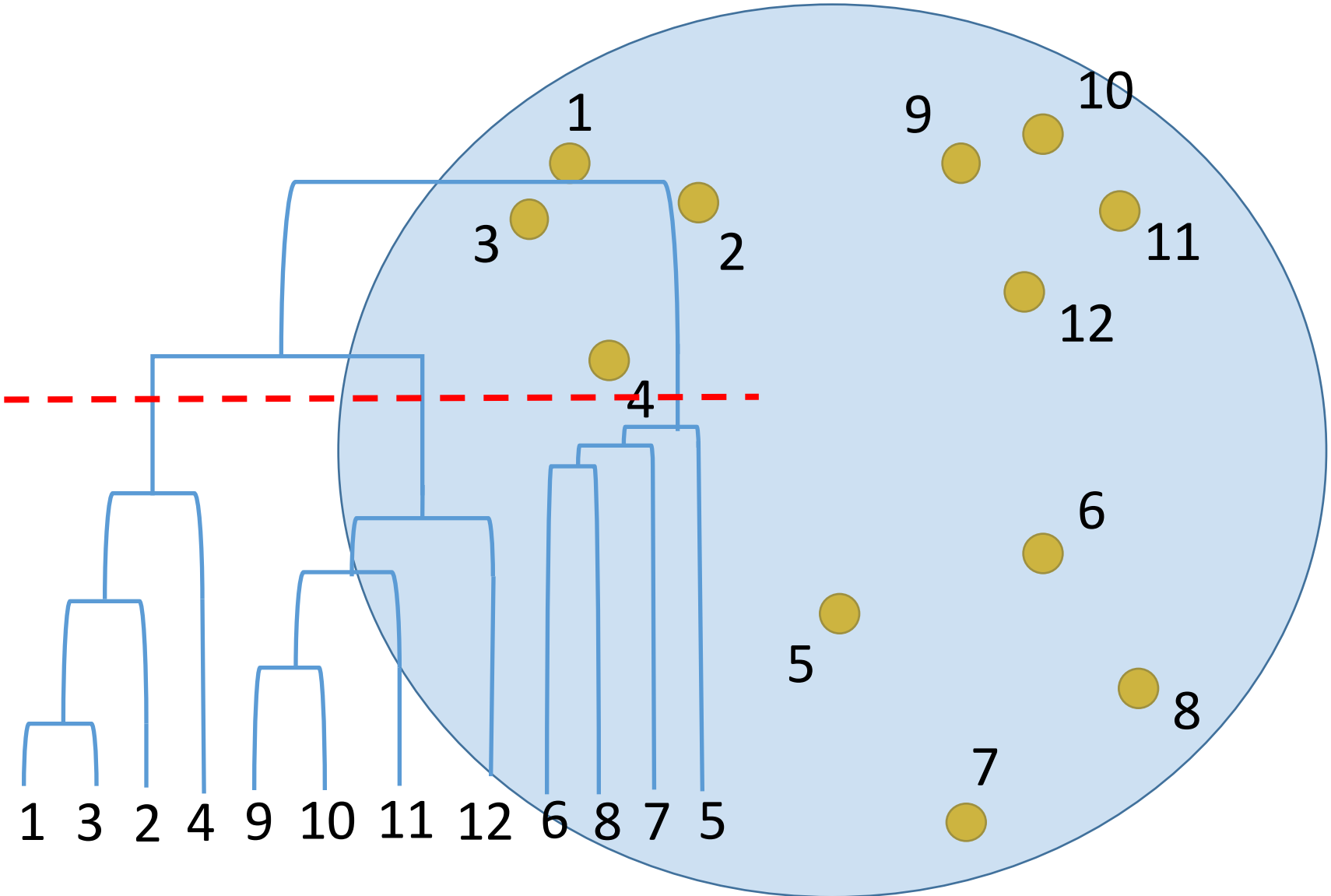
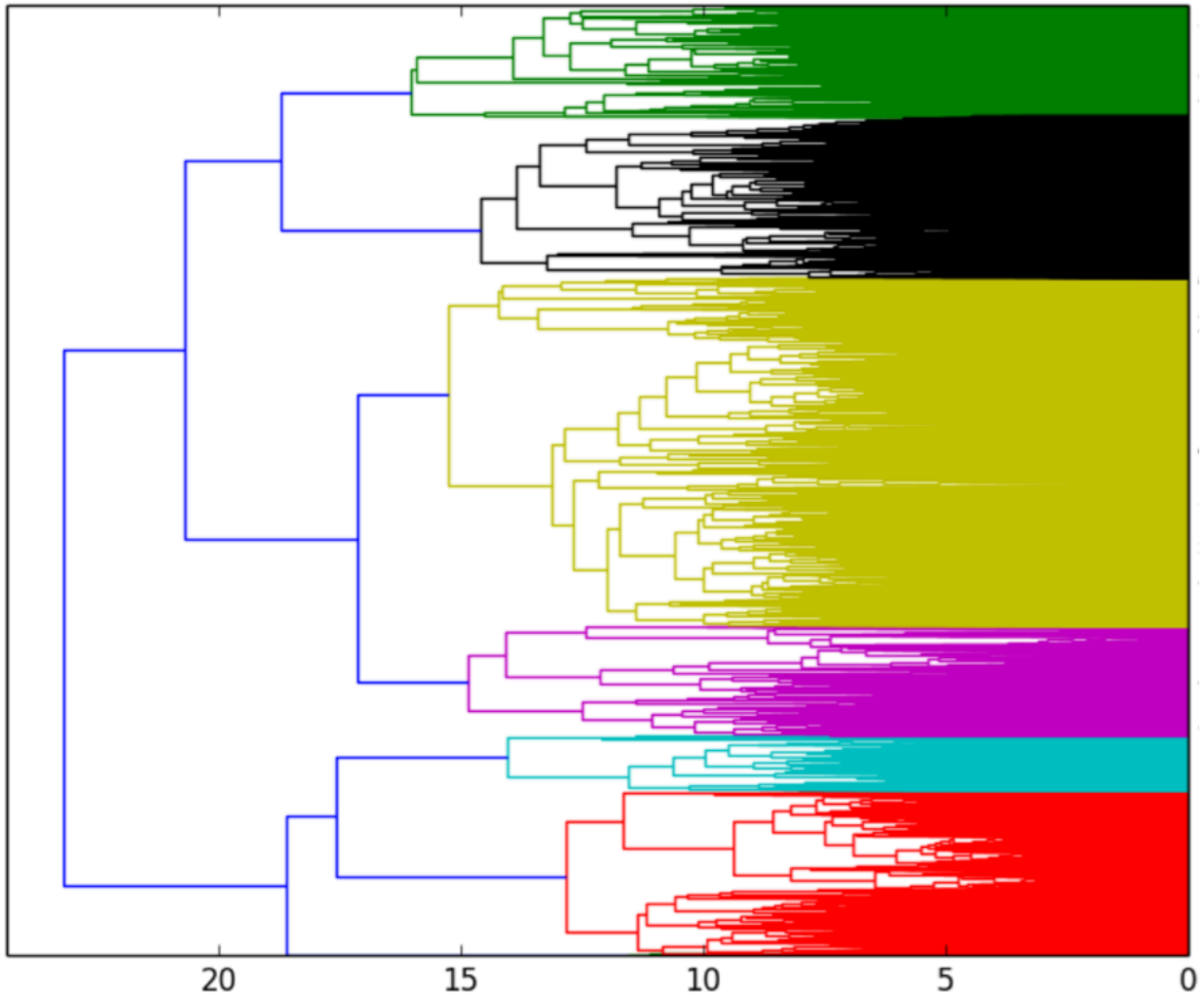
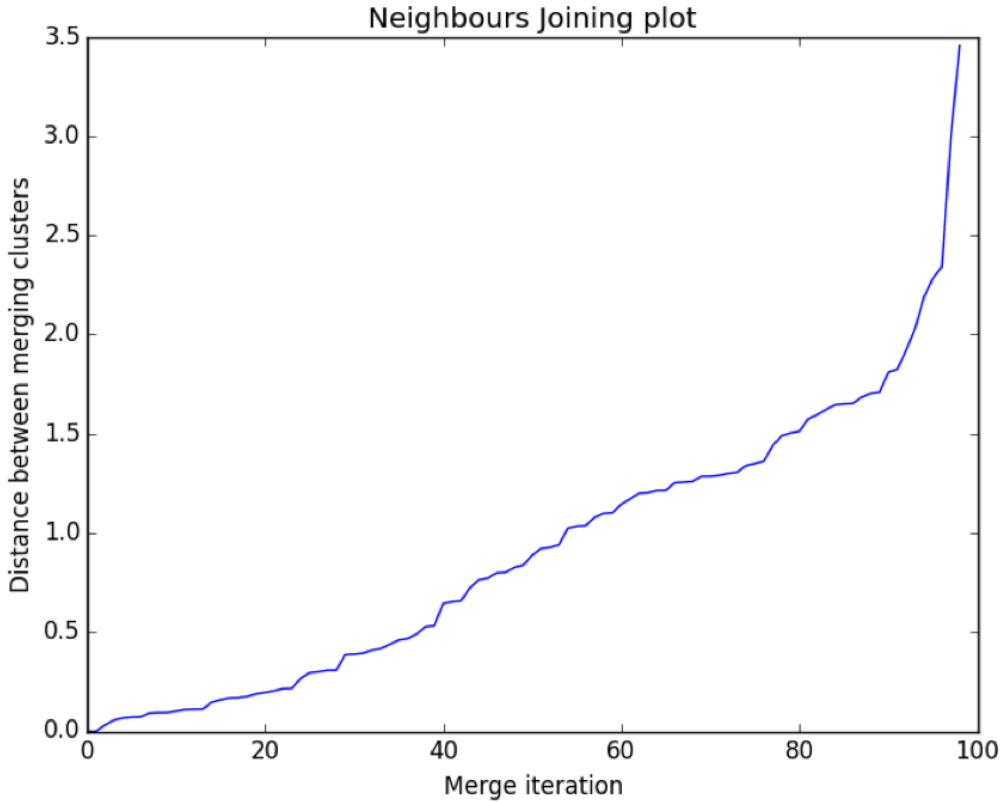


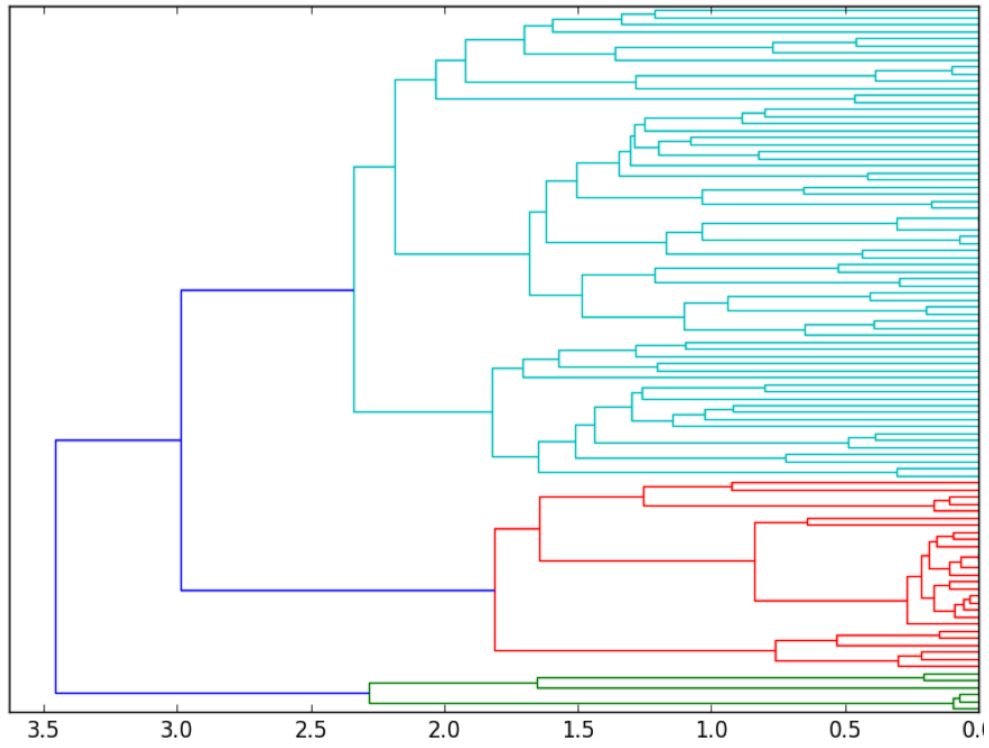
Пример: кластеризация писем



Пример: расстояние между кластерами

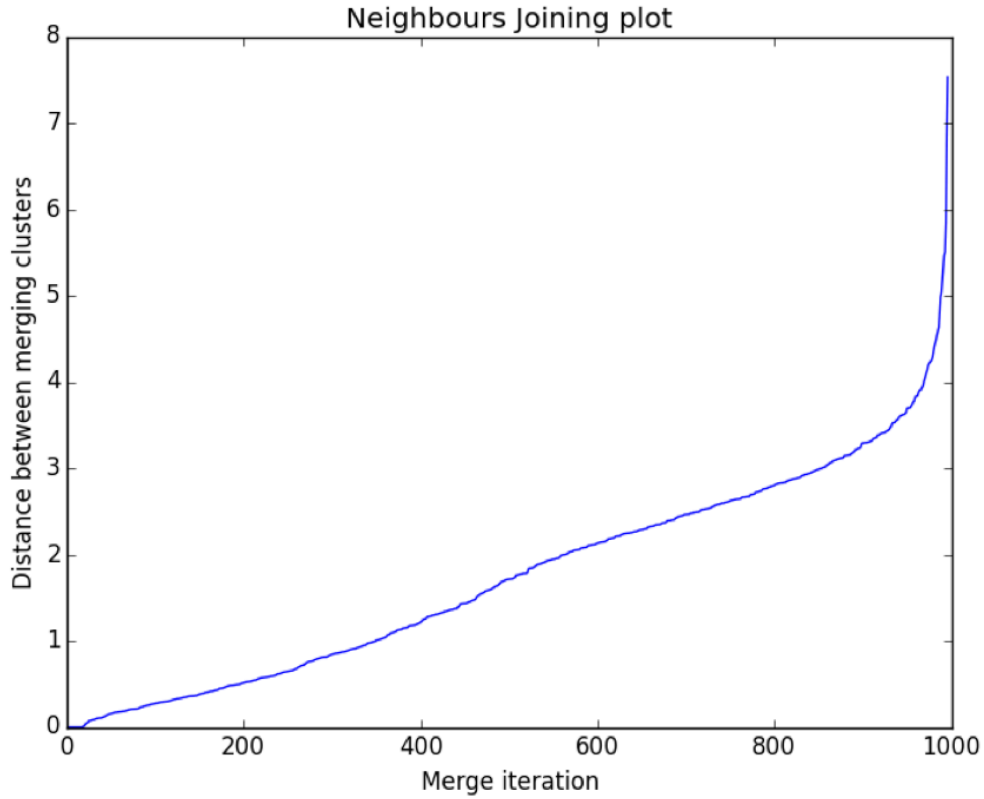
- На подвыборке из 100 писем

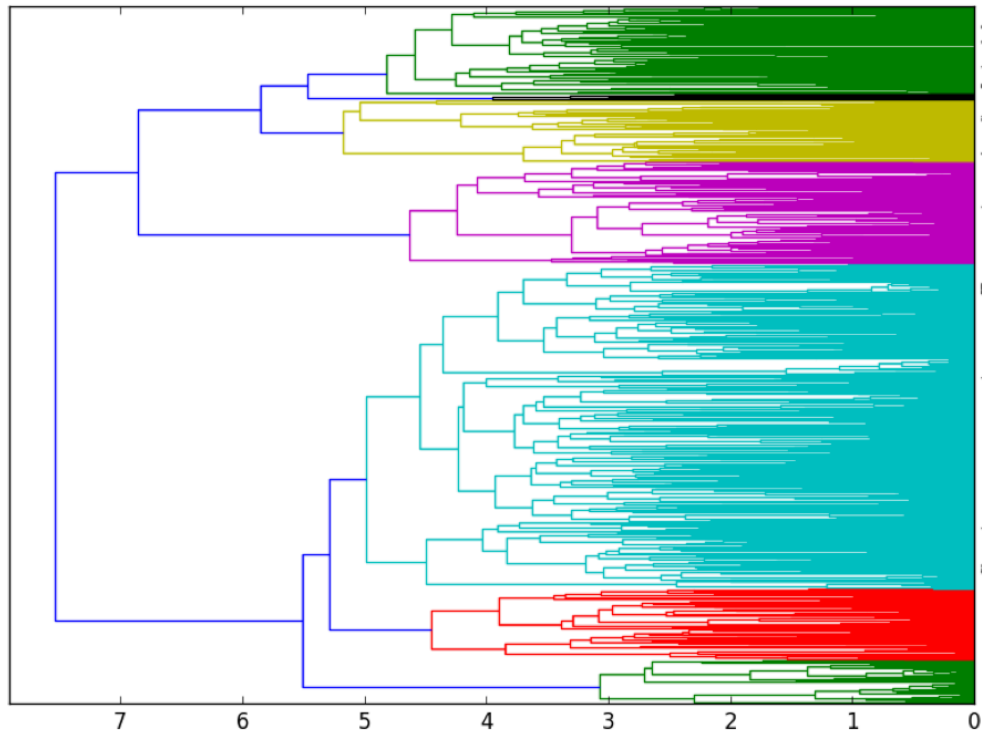




Пример: расстояние между кластерами

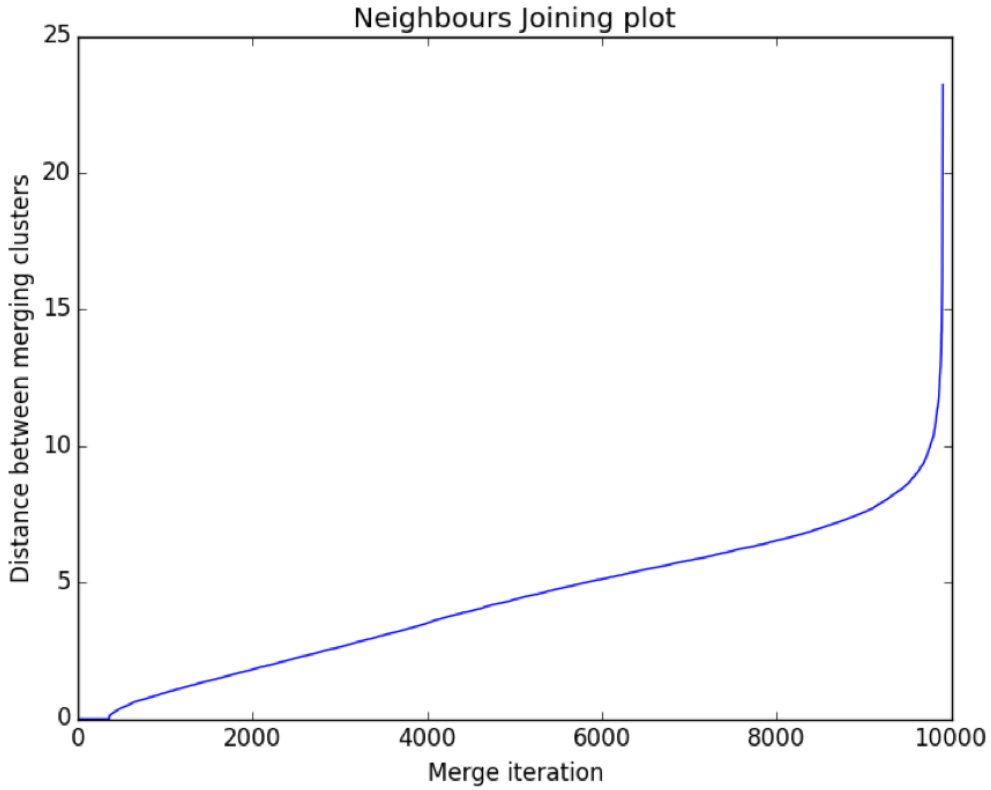
- На подвыборке из 1000 писем

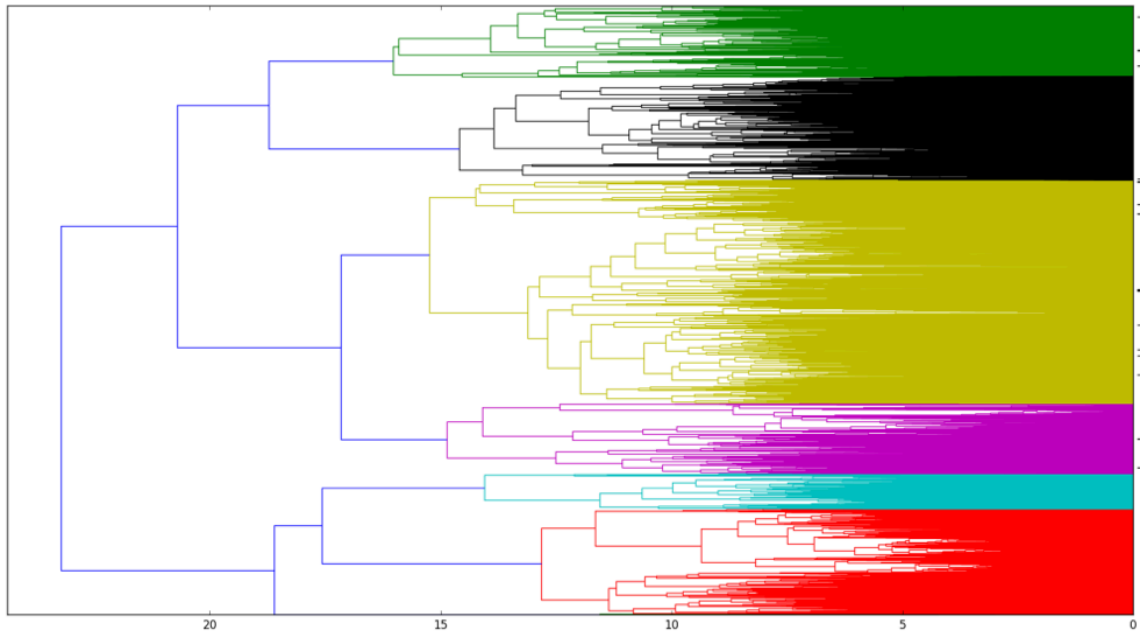




Пример: расстояние между кластерами

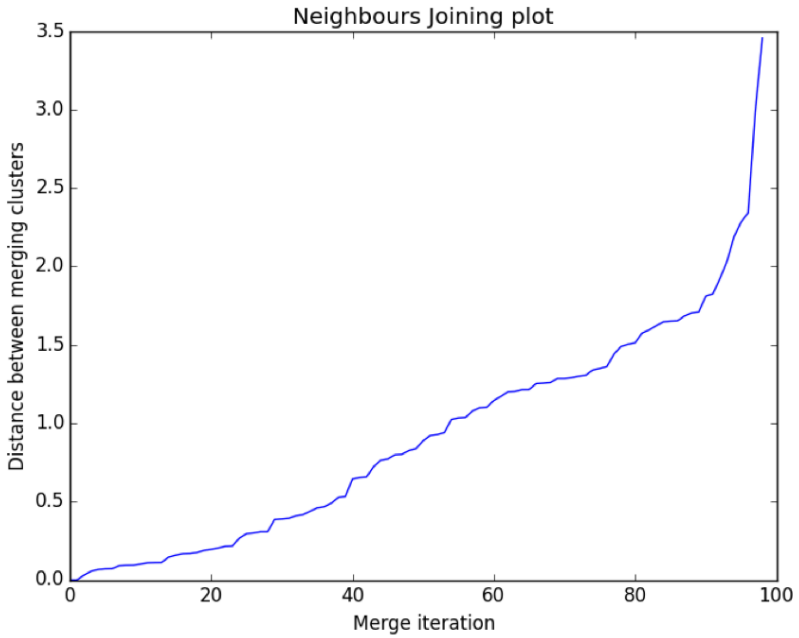
- На подвыборке из 10000 писем

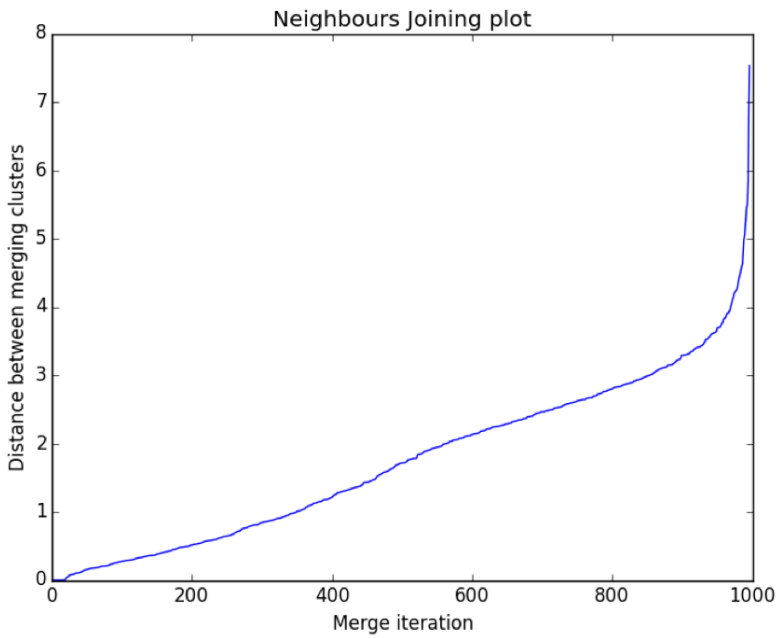


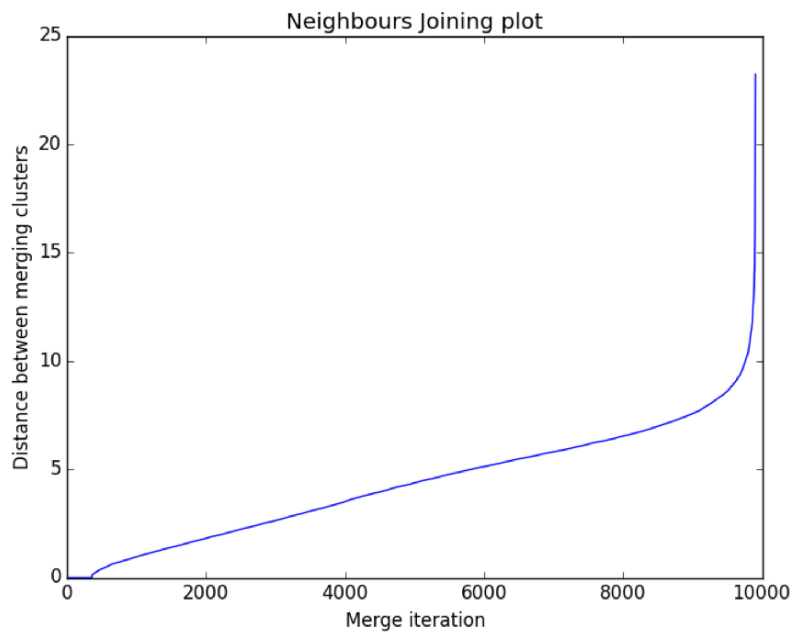


Пример: расстояние между кластерами

- Сравним графики: 100, 1000, 10000 писем

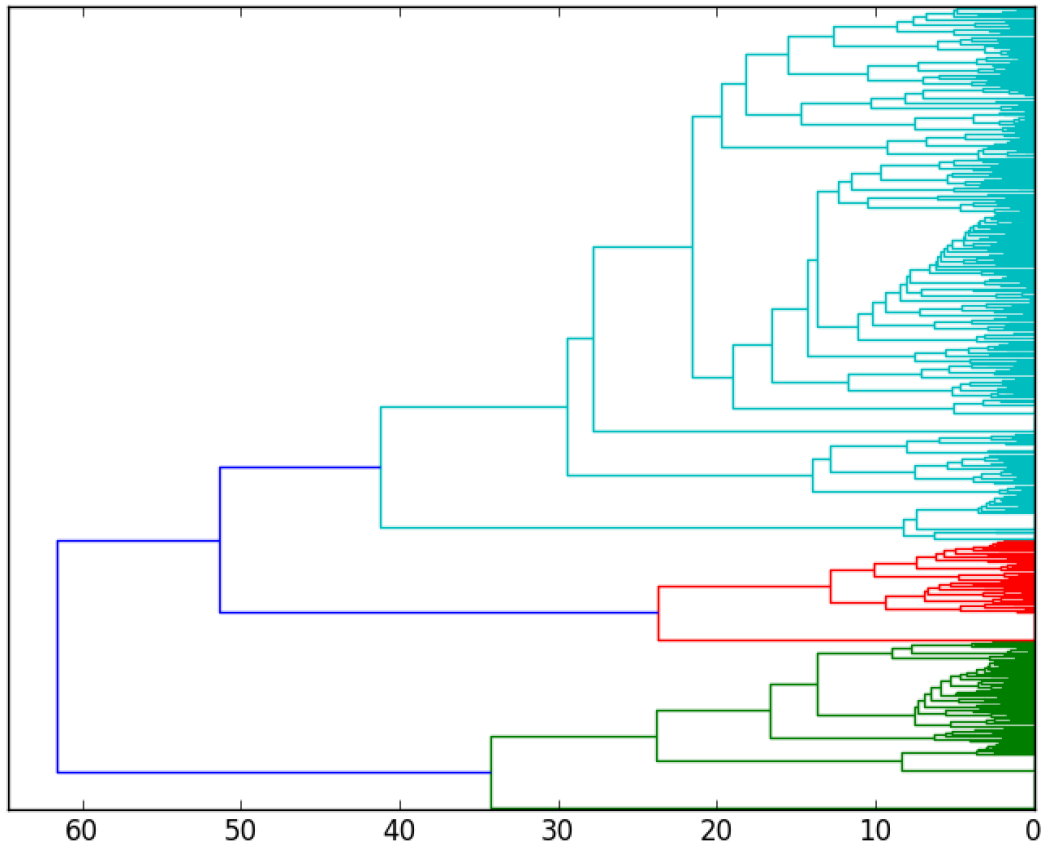




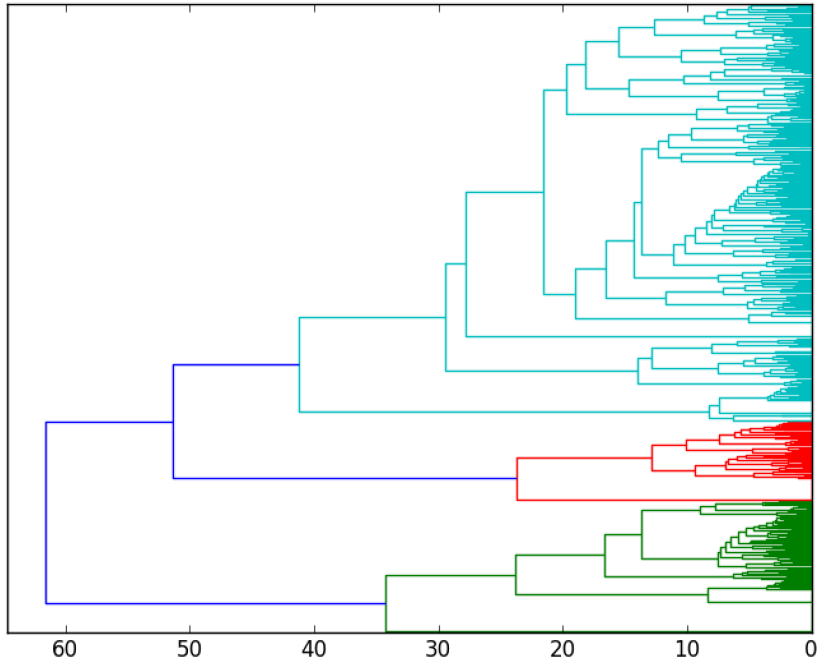


Пример: перекос в размерах кластеров

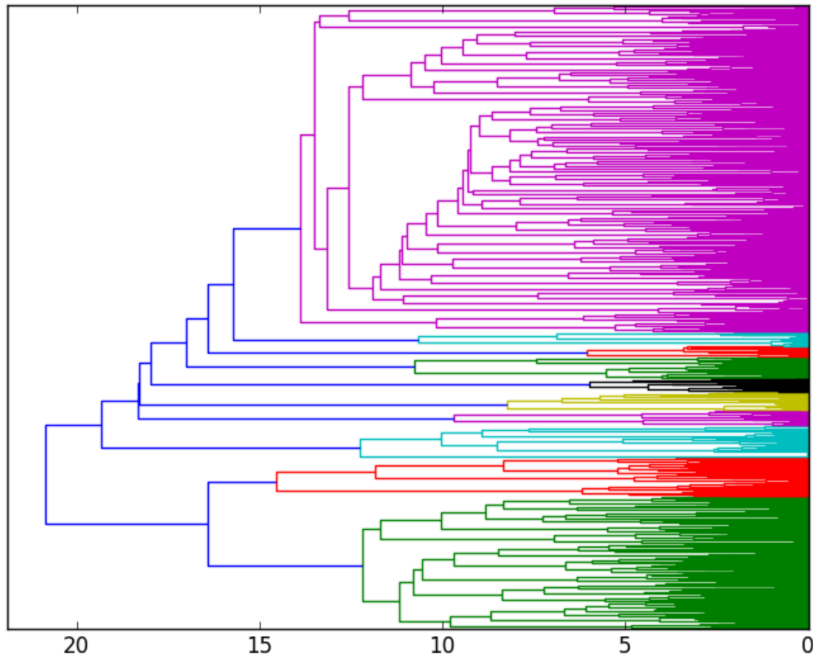
- Дендрограмма, построенная для другой выборки текстов:



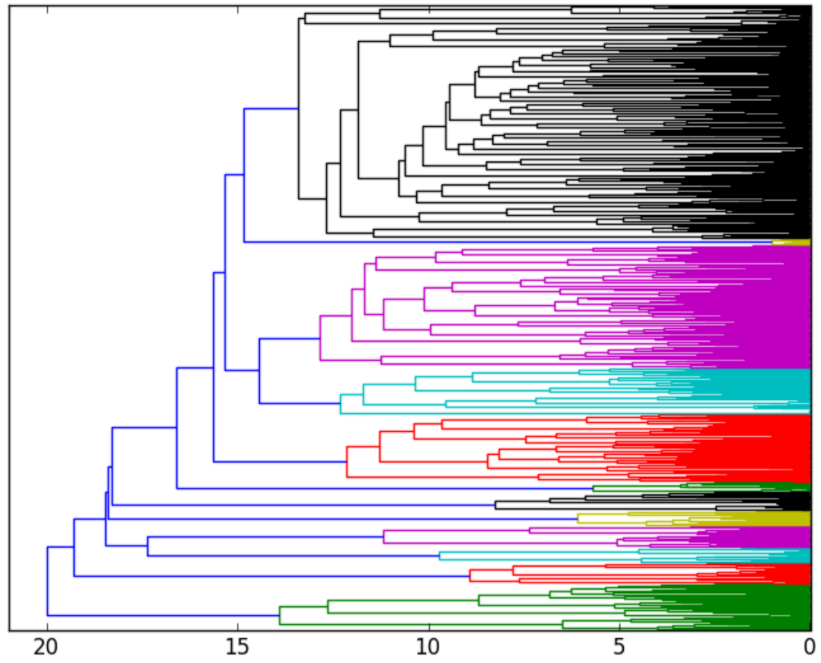
Пример: добавляем SVD



Исходные признаки

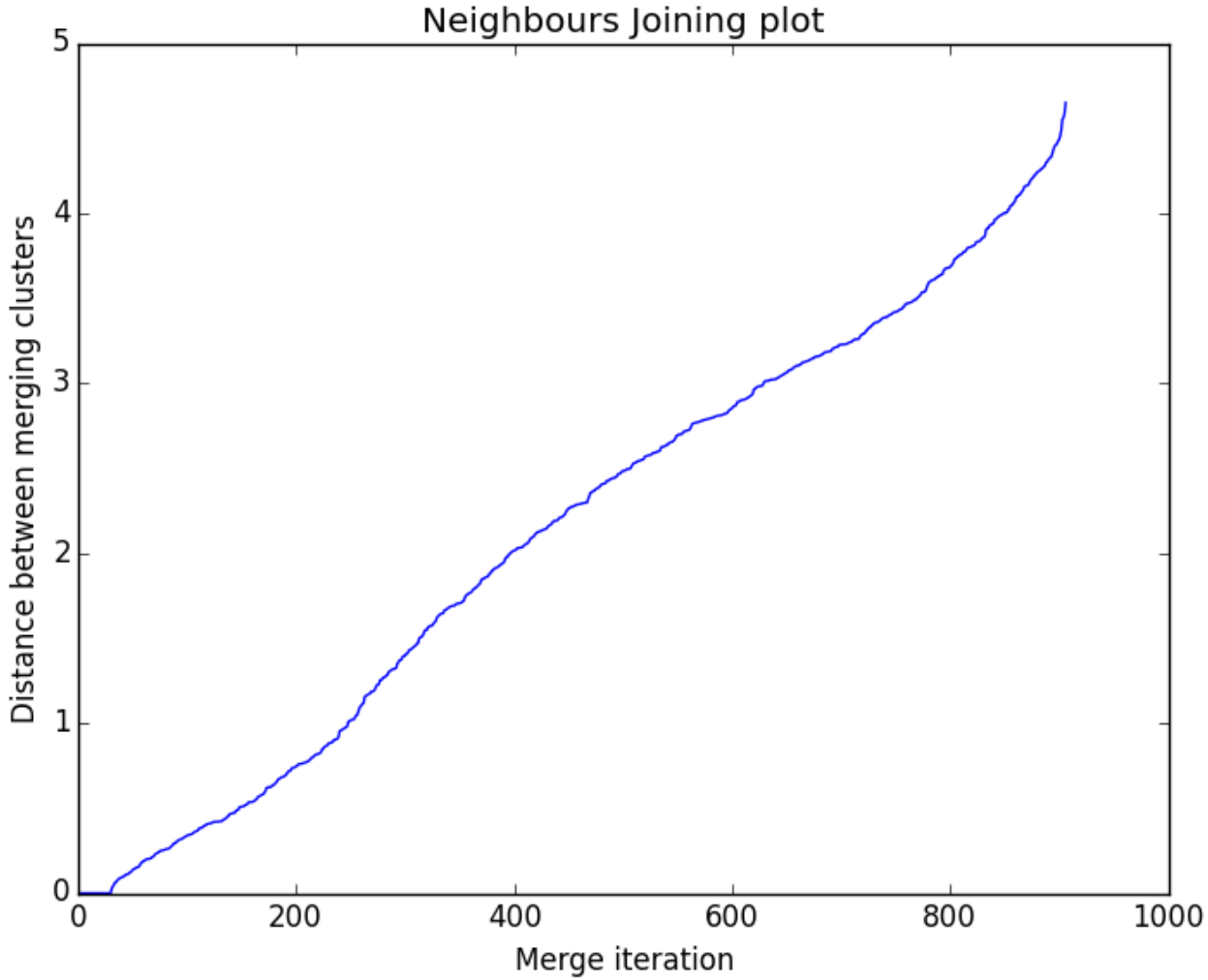


SVD



SVD (еще меньше компонент)

Пример: SVD и расстояние при слиянии



Резюме

1. Иерархическая кластеризация
2. Как устроена агломеративная кластеризация
3. Расстояние между кластерами
4. Формула Ланса-Уильямса
5. Дендрограммы
6. Примеры работы