

# Tut 10: Hierarchical Clustering

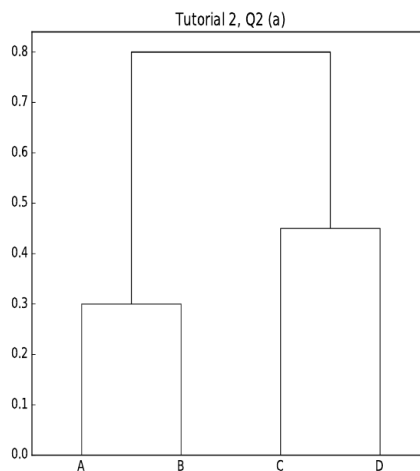
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## Hierarchical Clustering

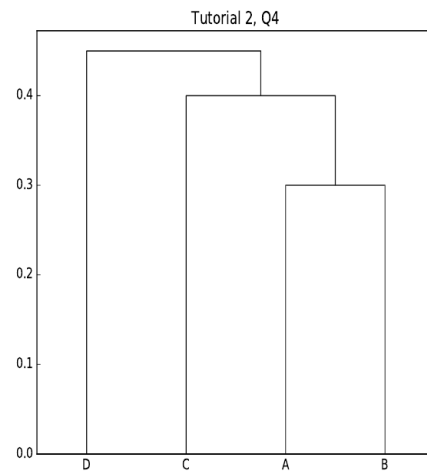
1. Suppose that we have four observations, for which we compute a distance matrix:

$$\begin{bmatrix} 0 & 0.3 & 0.4 & 0.7 \\ 0.3 & 0 & 0.5 & 0.8 \\ 0.4 & 0.5 & 0 & 0.45 \\ 0.7 & 0.8 & 0.45 & 0 \end{bmatrix}$$

- (a) Sketch the dendrogram that results from hierarchically clustering these four observations using **complete linkage**. Plot the height at which each fusion occurs, as well as the observations corresponding to each leaf in the dendrogram. Suppose that we cut the dendrogram such that two clusters result. What are the observations in each cluster?



(b) Repeat (a) using single linkage clustering.



2. (May 2020 Final Q3(a)) Given the unlabelled data in Table 3.1.

Table 3.1: Unlabelled data.

	V1	V2	V3
1	7.5205	4.6564	-0.1947
2	-1.1824	-1.1174	1.8383
3	-0.3576	-0.4739	-1.1603
4	-1.422	-0.5891	-0.8287
5	3.2287	0.7141	0.6208
6	3.2926	3.1609	2.7553
7	8.2304	3.8832	-1.7378
8	4.2079	0.4964	4.361
9	3.8443	5.7565	1.0293
10	1.493	3.525	-2.9904

Use the  $k$ -means algorithm with  $k = 2$  (unsupervised learning) to find the final cluster centres if the **first** and **sixth** rows are chosen as the **initial cluster centres**. (4 marks)

