Habib University
Artificial Intelligence
Fall 2020
Assignment 2 Part(B)

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1 Question 1

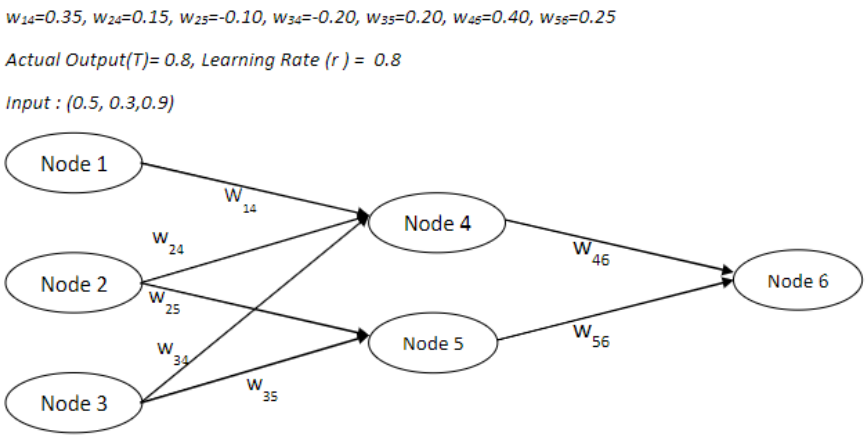

Figure 1: Artificial Neural Network (ANN)

Input of Node 4	0.0400	Error at Node 6	0.0525	Updated W14	0.3521
Output of Node 4	0.5100	Error at Node 4	0.0053	Updated W24	0.1513
Input of Node 5	0.1500	Error at Node 5	0.0033	Updated W34	-0.1962
Output of Node 5	0.5374	Updated W46	0.4214	Updated W25	-0.0992
Input of Node 6	0.3384	Updated W56	0.2726	Updated W35	0.2024
Ouput of Node 6	0.5838				

Input of Node 4 :

$$0.5 \times 0.35 + 0.3 \times 0.15 + 0.90 \times -0.20 = 0.04$$

Output of Node 4 :

$$\frac{1}{1+e^{-0.04}} = 0.509999$$

Input of Node 5 :

$$0.3 \times -0.10 + 0.9 \times 0.2 = 0.15$$

Output of Node 5 :

$$\frac{1}{1+e^{-0.15}} = 0.537430$$

Input of Node 6 :

$$0.509999 \times 0.40 + 0.537430 \times 0.25 = 0.338357$$

Output of Node 6 :

$$\frac{1}{1+e^{-0.338357}} = 0.583791$$

Error at Node 6 :

$(T-O_6)\times O_6\times(1-O_6) = (0.8-0.583791)\times 0.583791\times(1-0.583791) = 0.0525343$

Error at Node 4 :

$Error(6)\times W_{46}\times O_4\times(1-O_4) = 0.0525343\times 0.40\times 0.509999\times(1-0.509999) = 0.00525123$

Error at Node 5 :

$Error(6)\times W_{56}\times O_5\times(1-O_5) = 0.0525343\times 0.25\times(1-0.537430)\times 0.537430 = 0.00326553$

Updated W46

$$W_{46} + r \times Error(6) \times O_4 = 0.40 + 0.8 \times 0.0525343 \times 0.509999 = 0.421434$$

Updated W56

$$W_{56} + r \times Error(6) \times O_5 = 0.25 + 0.8 \times 0.0525343 \times 0.537430 = 0.272587$$

Updated W14

$$W_{14} + r \times Error(4) \times O_1 = 0.35 + 0.8 \times 0.00525123 \times 0.5 = 0.352100$$

Updated W24

$$W_{24} + r \times Error(4) \times O_2 = 0.15 + 0.8 \times 0.00525123 \times 0.3 = 0.151260$$

Updated W34

$$W_{34} + r \times Error(4) \times O_3 = -0.20 + 0.8 \times 0.00525123 \times 0.9 = -0.196219$$

Updated W25

$$W_{25} + r \times Error(5) \times O_3 = -0.10 + 0.8 \times 0.00326553 \times 0.3 = -0.0992163$$

Updated W35

$$W_{35} + r \times Error(5) \times O_5 = 0.20 + 0.8 \times 0.00326553 \times 0.9 = 0.202351$$

2D - Agglomerative Hierarichal Clustering

Hierarichal Clustering starts by treating each observation as a seperate cluster. Then, it repeatedly executes the following two steps: (1) identify the two clusters that are together, and (2) merge the two most similar clusters. This iterative process is continued until all the clusters are merged together.

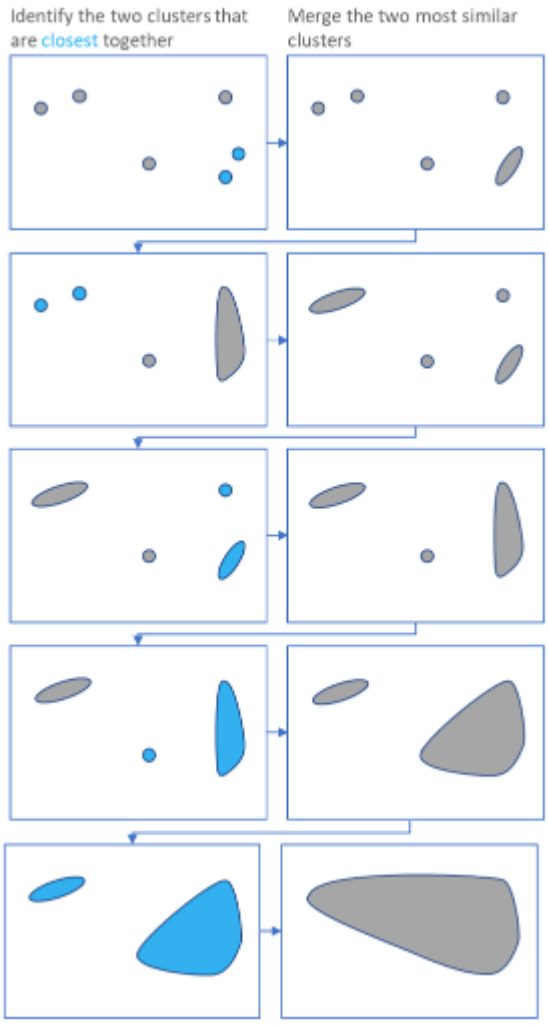

Figure 2: Hierarichal Clustering

The main output of Hierarichal Clustering is a **dendrogram**, which shows the

hierarchical relationship between clusters:

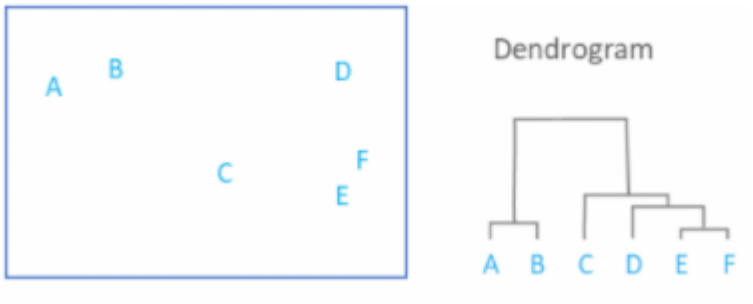

Figure 3: Dendrogram

In the above example, the distance between two clusters has been computed based on the length of the straight line drawn from one cluster to another. However, many other distance metrics have also been developed. In the above example, the distance is computed between the center of the clusters.
Reference :`https://www.displayr.com/what-is-hierarchical-clustering/#:~:text=Hierarchical%20clustering%2C%20also%20known%20as,broadly%20similar%20to%20each%20other.`