Badji Mokhtar Annaba University **2020/2021**
Master 1 BDMA
Pattern recognition

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Exercice Series N°1

Exercice 1: Euclidean Distance

In pattern recognition, the Euclidean distance is calculated between two vectors X = x_i and Y=y_i with i = 1,...,N as follows

$$d(x,y) = \sqrt{(x_i - y_i)^2}$$

write a script in R for the Euclidean distance calculation of two vectors X and Y.

Exercice 2: Binary Similarity measures

Binary similarity measures are a set of similarity measures calculated between binary vectors. These similarities employ a 2*2 contingency matrix with OTU (Operational Taxonomic Units). In a binary vector, 1 denotes the presence of the attribute and 0 denotes its absence. The OTU based matrix is calculated as follow for the Vectors X_i Y_j

j \ i	1 (Presence)	0 (Absence)	Sum
1 (Presence)	$a = i \bullet j$	$b = \bar{i} \bullet j$	$a+b$
0 (Absence)	$c = i \bullet \bar{j}$	$d = \bar{i} \bullet \bar{j}$	$c+d$
Sum	$a+c$	$b+d$	$n=a+b+c+d$

Write a script in R to calculate the matrix and based on it the following two binary similarity measures

$$S_{JACCARD} = \frac{a}{a+b+c}$$

$$S_{ROGER\&TANIMOTO} = \frac{a+d}{a+2(b+c)+d}$$

Exercice 3: Cooccurrence matrix of a grey-level image

A grey-level image is an m*n matrix of integer values within the range of [0,255]. Cooccurrence matrix is a square matrix of 256*256 used to calculate several image features such as texture statistical features.

Each element x_{ij} of the cooccurrence matrix present the apparition frequency of i^{th} grey level in adjacence with the j^{th} one for a certain direction θ. The following example illustrates the calculation of matrix for a 4*4 image with θ = 0°.

$$\begin{matrix} 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 1 \\ 0 & 2 & 2 & 3 \\ 2 & 2 & 3 & 3 \end{matrix} \qquad P_{0°,1} = \begin{bmatrix} 6 & 2 & 1 & 0 \\ 2 & 2 & 0 & 0 \\ 1 & 0 & 4 & 2 \\ 0 & 0 & 2 & 2 \end{bmatrix}$$

Write a script in R to calculate the cooccurrence matrix