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DSCI-633

ASSIGNMENT-1

Q7]

$x = (1,1,1,1)$ and $y = (3,3,3,3)$

To find

Cosine similarity

$$= \cos(x,y) = \frac{x \cdot y}{\|x\| \cdot \|y\|}$$

$$x \times y = 1\times3 + 1\times3 + 1\times3 + 1\times3$$
$$= 12$$
$$x \cdot y = 12$$

$$\|x\| = \sqrt{1^2 + 1^2 + 1^2 + 1^2} = 2$$
$$\|y\| = \sqrt{3^2 + 3^2 + 3^2 + 3^2} = 6$$

$$= \frac{12}{6 \times 2} = 1$$

$\cos(x,y) = 1$

Cosine similarity = 1

correleation coefficient

x	y	xy	x^2	y^2
1	3	3	1	9
1	3	3	1	9
1	3	3	1	9
1	3	3	1	9
4	12	12	4	36

$$r = \frac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{[n\Sigma x^2 - (\Sigma x)^2][n\Sigma y^2 - (\Sigma y)^2]}}$$

$$r = \frac{4 \times 12 - 4(12)}{\sqrt{[12(4)^2 - (4)^2][4(36) - (36)^2]}}$$

$$r = 0$$

correleation coefficient = 0

Euclidean distance

$x = 1\ 1\ 1\ 1$
$y = 3\ 3\ 3\ 3$

Euclidean distance
$= \sqrt{(1-3)^2 + (1-3)^2 + (1-3)^2 + (1-3)^2}$

$= 4$

Euclidean Distance = 4

B

$x = 0, 1, 0, 1, 0, 1$
$y = 1, 0, 1, 0, 1, 0$

Cosine similarity

$$\cos(x, y) = \frac{x \cdot y}{\|x\| \|y\|}$$

$x \cdot y = 0\times1 + 1\times0 + 0\times1 + 1\times0 + 0\times1 + 1\times0$
$= 0$

$\|x\| = \sqrt{0^2 + 1^2 + 0^2 + 1^2 + 0^2 + 1^2} = 1.73$
$\|y\| = \sqrt{1^2 + 0^2 + 1^2 + 0^2 + 1^2 + 0^2} = 1.73$

$$\frac{0}{1.73 \times 1.73} = 0$$

$\cos x \cdot y = 0$

Correlation

x	y	xy	x^2	y^2
0	1	0	0	1
1	0	0	1	0
0	1	0	0	1
1	0	0	1	0
0	1	0	0	1
1	0	0	1	0
3	3	0	3	3

$$r = \frac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{[n\Sigma x^2 - (x)^2][n\Sigma y^2 - (y)^2]}}$$

$$r = \frac{6(0) - (3)(3)}{\sqrt{[6(3) - (3)^2][6(3) - (3)^2]}}$$

$$\frac{0-9}{\sqrt{(18-9)(18-9)}}$$

$$= -1$$

$$\boxed{r = -1}$$

$$\boxed{\text{Correlation coefficient} = -1}$$

Jaccard Similarity

$$= \frac{f_{11}}{f_{01} + f_{10} + f_{11}}$$

$$= \frac{0}{3 + 5 + 0}$$

Jaccard Similarity = 0

Euclidean

$$= \sqrt{(0-1)^2 + (1-0)^2 + (0-1)^2 + (1-0)^2 + (0-1)^2 + (1-0)^2}$$

$$= 2.44$$

Euclidean Distance = 2.44

c) $x = 1, 1, 0, 1, 0, 1$

$y = 1, 1, 1, 0, 0, 1$

Cosine Similarity

$$\cos(x, y) = \frac{x \cdot y}{\|x\| \cdot \|y\|}$$

$x \cdot y = 1\times1 + 1\times1 + 0\times1 + 1\times0 + 0\times0 + 1\times1$

$= 3$

$\|x\| = \sqrt{1^2 + 1^2 + 0^2 + 1^2 + 0^2 + 1^2} = 2$

$\|y\| = \sqrt{1^2 + 1^2 + 1^2 + 0^2 + 0^2 + 1^2} = 2$

$$\frac{3}{4}$$

$$\boxed{\cos x \cdot y = 0.75}$$

correlation

x	y	xy	x^2	y^2
1	1	1	1	1
1	1	1	1	1
1	1	1	1	1
0	1	0	0	1
1	0	0	1	0
0	0	0	0	0
1	1	1	1	1
4	4	3	4	4

$$r = \frac{n\Sigma xy - \Sigma x \Sigma y}{\sqrt{[n\Sigma x^2 - (x)^2][n\Sigma y^2 - (y)^2]}}$$

$$= \frac{6(3) - (4)(4)}{\sqrt{[6 \times 4 - (4)^2][6(4) - (4)^2]}}$$

$$= \frac{18 - 16}{\sqrt{[24 - (16)][24 - (16)]}}$$

$$= \boxed{0.25}$$

Jaccard Coefficient

$$\frac{f_{11}}{f_{01} + f_{10} + f_{11}}$$

$$= \frac{3}{1 + 1 + 3}$$

$$= 0.6$$

λ_{max}

$= 1$