No. :

② Given the previous data of athlete (slide 13), split training and test set to respectively 60% : 40%

- Training : ID 1 - 6
- Test : ID 7 - 10

ID	Speed	Agility	Draft
1.	2,5	6	Yes
2.	3,75	8	No
3.	2,25	5,5	No
4.	3,25	8,25	Yes
5.	2,75	7,5	No
6.	9,5	5	No
7.	3,5	5,25	Yes
8.	3	3,25	No
9.	4	4	No
10.	4,25	3,75	Yes

Answer :

a) Euclidian Distance

Distance to ID	Draft	7 (3,5 ; 5,25)	8 (3 ; 3,25)	9 (4 ; 4)	10 (4,25 ; 3,75)
1	Yes	1,25	2,795	2,5	2,85
2	No	2,761	4,8088	4,0078	4,2793
3	No	1,274	2,371	2,309	2,657
4	Yes	3,0103	5,0062	4,3156	4,6097
5	No	2,3717	4,2573	3,7097	4,0588
6	No	1,0307	2,3098	1,1180	1,2797

No. :

Distance to ID 1 Test 7

$= \sqrt{(2,5-3,5)^2 + (6-5,25)^2}$

$= \sqrt{(-1)^2 + (0,75)^2}$

$= \sqrt{1 + 0,5625}$

$= \sqrt{1,5625}$

$= 1,25$

Distance to ID 2 Test 7

$= \sqrt{(3,75-3,5)^2 + (8-5,25)^2}$

$= \sqrt{(0,25)^2 + (2,75)^2}$

$= \sqrt{0,0625 + 7,5625}$

$= \sqrt{7,625}$

$= 2,761$

Distance to ID 1 Test 8

$= \sqrt{(2,5-3)^2 + (6-3,25)^2}$

$= \sqrt{(-0,5)^2 + (2,75)^2}$

$= \sqrt{0,25 + 7,5625}$

$= \sqrt{7,8125}$

$= 2,795$

Distance to ID 2 Test 8

$= \sqrt{(3,75-3)^2 + (8-3,25)^2}$

$= \sqrt{(0,75)^2 + (4,75)^2}$

$= \sqrt{0,5625 + 22,5625}$

$= \sqrt{23,125}$

$= 4,8088$

Distance to ID 1 Test 9

$= \sqrt{(2,5-4)^2 + (6-4)^2}$

$= \sqrt{(-1,5)^2 + (2)^2}$

$= \sqrt{(2,25) + 4}$

$= \sqrt{6,25}$

$= 2,5$

Distance to ID 2 Test 9

$= \sqrt{(3,75-4)^2 + (8-4)^2}$

$= \sqrt{(-0,25)^2 + (4)^2}$

$= \sqrt{0,0625 + 16}$

$= \sqrt{16,0625}$

$= 4,0078$

Distance to ID 1 Test 10

$= \sqrt{(2,5-4,25)^2 + (6-3,75)^2}$

$= \sqrt{(-1,75)^2 + (2,25)^2}$

$= \sqrt{3,0625 + 5,0625}$

$= \sqrt{8,125}$

$= 2,85$

Distance to ID 2 Test 10

$= \sqrt{(3,75-4,25)^2 + (8-3,75)^2}$

$= \sqrt{(-0,5)^2 + (4,25)^2}$

$= \sqrt{(0,25) + (18,0625)}$

$= \sqrt{18,3125}$

$= 4,2793$

No. :

Distance to ID 3 Test 7

$= \sqrt{(2,25 - 3,5)^2 + (5,5 - 5,25)^2}$

$= \sqrt{(-1,25)^2 + (0,25)^2}$

$= \sqrt{1,5625 + 0,0625}$

$= \sqrt{1,625}$

$= 1,274$

Distance to ID 4 Test 7

$= \sqrt{(3,25 - 3,5)^2 + (8,25 - 5,25)^2}$

$= \sqrt{(-0,25)^2 + (3)^2}$

$= \sqrt{0,0625 + 9}$

$= \sqrt{9,0625}$

$= 3,0103$

Distance to ID 3 Test 8

$= \sqrt{(2,25 - 3)^2 + (5,5 - 3,25)^2}$

$= \sqrt{(-0,75)^2 + (2,25)^2}$

$= \sqrt{0,5625 + 5,0625}$

$= \sqrt{5,625}$

$= 2,371$

Distance to ID 4 Test 8

$= \sqrt{(3,25 - 3)^2 + (8,25 - 3,25)^2}$

$= \sqrt{(0,25)^2 + (5)^2}$

$= \sqrt{0,0625 + 25}$

$= \sqrt{25,0625}$

$= 5,0062$

Distance to ID 3 Test 9

$= \sqrt{(2,25 - 4)^2 + (5,5 - 4)^2}$

$= \sqrt{(-1,75)^2 + (1,5)^2}$

$= \sqrt{3,0625 + 2,25}$

$= \sqrt{5,3125}$

$= 2,309$

Distance to ID 4 test 9

$= \sqrt{(3,25 - 4)^2 + (8,25 - 4)^2}$

$= \sqrt{(-0,75)^2 + (4,25)^2}$

$= \sqrt{0,5625 + 18,0625}$

$= \sqrt{18,625}$

$= 4,3156$

Distance to ID 3 Test 10

$= \sqrt{(2,25 - 4,25)^2 + (5,5 - 3,75)^2}$

$= \sqrt{(-2)^2 + (1,75)^2}$

$= \sqrt{4 + 3,0625}$

$= \sqrt{7,0625}$

$= 2,657$

Distance to ID 4 test 10

$= \sqrt{(3,25 - 4,25)^2 + (8,25 - 5,75)^2}$

$= \sqrt{(-1)^2 + (4,5)^2}$

$= \sqrt{1 + 20,25}$

$= \sqrt{21,25}$

$= 4,6097$

No. :

Distance to ID 5 Test 7

$= \sqrt{(2,75 - 3,5)^2 + (7,5 - 5,25)^2}$

$= \sqrt{(-0,75)^2 + (2,25)^2}$

$= \sqrt{0,5625 + 5,0625}$

$= \sqrt{5,625}$

$= 2,3717$

Distance to ID 6 Test 7

$= \sqrt{(9,5 - 5,5)^2 + (5 - 5,25)^2}$

$= \sqrt{(1)^2 + (-0,25)^2}$

$= \sqrt{1 + 0,0625}$

$= \sqrt{1,0625}$

$= 1,0307$

Distance to ID 5 Test 8

$= \sqrt{(2,75 - 3)^2 + (7,5 - 3,25)^2}$

$= \sqrt{(-0,25)^2 + (9,25)^2}$

$= \sqrt{0,0625 + 18,0625}$

$= \sqrt{18,125}$

$= 4,2573$

Distance to ID 6 Test 8

$= \sqrt{(9,5 - 3)^2 + (5 - 3,25)^2}$

$= \sqrt{(1,5)^2 + (1,75)^2}$

$= \sqrt{2,25 + 3,0625}$

$= \sqrt{5,3125}$

$= 2,3048$

Distance to ID 5 Test 9

$= \sqrt{(2,75 - 4)^2 + (7,5 - 4)^2}$

$= \sqrt{(-1,25)^2 + (3,5)^2}$

$= \sqrt{1,5625 + 12,25}$

$= \sqrt{13,7625}$

$= 3,7097$

Distance to ID 6 Test 9

$= \sqrt{(9,5 - 4)^2 + (5 - 4)^2}$

$= \sqrt{(0,5)^2 + (1)^2}$

$= \sqrt{0,25 + 1}$

$= \sqrt{1,25}$

$= 1,1180$

Distance to ID 5 Test 10

$= \sqrt{(2,75 - 9,25)^2 + (7,5 - 3,75)^2}$

$= \sqrt{(-1,5)^2 + (3,75)^2}$

$= \sqrt{2,25 + 14,0625}$

$= \sqrt{16,3125}$

$= 9,0388$

Distance to ID 6 Test 10

$= \sqrt{(9,5 - 9,25)^2 + (5 - 3,75)^2}$

$= \sqrt{(0,25)^2 + (1,25)^2}$

$= \sqrt{0,0625 + 1,5625}$

$= \sqrt{1,625}$

$= 1,2747$

Predict kkN with K = 3 for test data using

ID	Target	Prediction
7	Yes	No
8	No	No
9	No	No
10	Yes	No

b) Cosine Similarity

Distance to ID	Data	7 (3,5 ; 5,25)	8 (3 ; 3,25)	9 (4 ; 4)	10 (4,25 ; 3,75)
1	Yes	0,9815	0,9346	0,9246	0,8991
2	No	0,9888	0,9532	0,9403	0,9173
3	No	0,9801	0,9369	0,922	0,8962
4	Yes	0,9774	0,9322	0,917	0,8904
5	No	0,9721	0,9234	0,9073	0,8793
6	No	0,9895	0,9999	0,9986	0,9934

Cosine Similarity ID1 Test 7

$$\text{Cosine Similarity} = \frac{3,5 \times 2,5 + 5,25 \times 6}{\sqrt{(2,5)^2 + (6)^2} \times \sqrt{(3,5)^2 + (5,25)^2}}$$

$$= \frac{8,75 + 31,5}{\sqrt{6,25 + 36} \times \sqrt{12,25 + 27,5625}}$$

$$= \frac{40,25}{\sqrt{92,25} \times \sqrt{39,8125}}$$

$$= \frac{40,25}{6,5 \times 6,309}$$

$$= \frac{40,25}{91,0085} = 0,9815$$

No

Date

Cosine Similarity ID 1 Test 8

$$\text{Cosine Similarity} = \frac{(3 \times 2,5) + (3,25 \times 6)}{\sqrt{(2,5)^2 + (6)^2} \times \sqrt{(3)^2 + (3,25)^2}}$$

$$= \frac{7,5 + 19,5}{\sqrt{6,25 + 36} \times \sqrt{9 + 10,5625}}$$

$$= \frac{27}{\sqrt{42,5} \times \sqrt{19,5625}}$$

$$= \frac{27}{6,519 \times 4,422}$$

$$= \frac{27}{28,827} = 0,9366$$

Predict KKN with $k=3$ for test data using

ID	Target	Prediction
7	Yes	No
8	No	No
9	No	No
10	Yes	No

③ Compare the prediction of a) and b) to the real label. Are the predictions correct / not?

* Euclidean distance
  - Correct 50%
  - Error 50%

* Cosine Similarity
  - Correct 50%
  - Error 50%