ML Problem Solving

Vector norms and normalization

Consider the following vectors $v_i = \{a, b, c, d\} \in R^2$:

a) $[1, 2]$

b) $[3, 4]$

c) $[1, -2]$

d) $[-3, -4]$

1. Draw the vectors a, b, c, d. You can use a single (cartesian coordinate system) 2-d space for that.

2. Calculate the L2-norm (a.k.a. vector magnitude) of v_i.

a)

b)

c)

d)

3. Calculate the L1-norm of the v_i.

a)

b)

c)

d)

4. Calculate the cosine similarity given by $cos\_simm(a, b) = \frac{a \cdot b}{||a||\,||b||}$

a) $cos\_simm(a, b) =$

b) $cos\_simm(c, d) =$

5. Consider now the set of vectors $v_j \in R^2, ||v_j||_2 = 1$. Choose at least 10 vectors that are as far apart as possible. Draw them in the same graph. What is the shape of the region defined by all vectors $v'_j \in R^2, ||v'_j|| \leq ||v_j||$?

6. Consider now the set of vectors $v_k \in R^2, ||v_k||_1 = 1$. Choose at least 10 vectors that are as far apart as possible. Draw them in the same graph. What is the shape of the region defined by all vectors $v'_k \in R^2, ||v'_k|| \leq ||v_k||$??

7. Calculate the normalized forms of vectors v_i (such that $||v_i|| = 1$).

a)

b)

c)

d)