

Quiz2: Student Name: _____ Student # _____

1. True/False: A perceptron is guaranteed to learn any set of training data given a suitable learning rate.

2. True/False: Clustering is supervised learning while KNN is unsupervised learning.

3. Consider a supervised learning problem with only 2 examples where each is a point in 5 dimensional space.

The first example is $(1, 5, 2, 7, 9)$ and has a label of 1.

The second example is $(-3, 8, 2, 4, 6)$ and has a label of 0.

Give a perceptron that would correctly label these two points. Give a perceptron means give the list of weights that define that perceptron. Weights should give >0 for point one and less than 0 for 2.

E.G. $1, 0, 0, 0, 0$ or $3, 0, 0, 0, 0$

4. Consider a learning problem where each example has n attributes x_1, \dots, x_n with each x_i taking on the value of either 0 or 1. Give a Perceptron that returns 1 if more of the x_i 's have value 0 than value 1 and otherwise returns 0.

Weights all -1s Threshold < -2.5 or something similar.

5. Five 2-dimensional Data points are classified as: Negative: $(1, 0), (2, 1), (2, 2)$ Positive: $(0, 0), (1, 0)$

1. What class does 3NN predict for the new point: $(1, 1.01)$ Explain why.

3 NN are $(1, 0), (2, 1), (2, 2) \rightarrow$ Negative

2. What class does 5NN predict for the new point: $(1, 1.01)$ Explain why.

5 NN are all points \rightarrow Majority Class: Negative

6. Consider a perceptron with sign activation function. The perceptron is represented by the weights $\langle 0.4, -0.3, 0.1 \rangle$ and has the bias $(\theta) = 0$.

If the input vector $X = \langle 0.2, 0.6, 0.5 \rangle$ then what is the output of the perceptron?

$.4 * .2 - .3 * .6 + .1 * .5 = -0.05 \rightarrow$ Negative: Zero

If the input vector $X = \langle 0.6, 0.2, 0.5 \rangle$ then what is the output of the perceptron?

$.4 * .6 - .3 * .2 + .1 * .5 = -0.23 \rightarrow$ Positive: One