422 Exam 1

This is a preview of the published version of the quiz

Started: Jan 20 at 5:37pm

Quiz Instructions

This is your first midterm exam. You will have two hours to complete this exam once you have started. You are welcome to use your notes, textbook and lecture videos. You must work individually. You will want to have access to a calculator.

Question 1 — 5 pts

What is the difference between a model and an algorithm? Explain in 2 sentences or less.

Edit View Insert Format Tools Table

12pt Paragraph B I U A T²

p 0 words </>

Question 2

20 pts

#	x_1	x_2	x_3	y
1	0	0	0	1
2	0	1	0	0
3	1	0	0	0
4	1	0	1	1
5	1	1	0	1

Given the following training data, build the best depth-1 decision tree using the greedy information gain algorithm. Show your work.

Edit View Insert Format Tools Table

12pt Paragraph B I U A T²

p 0 words </>

Question 3

5 pts

What is the best accuracy you can achieve with a decision tree of any depth on the following data? How do you know?

#	x_1	x_2	y
1	0	0	1
2	0	0	0
3	0	1	0
4	1	0	0
5	1	0	1
6	1	1	0

Edit View Insert Format Tools Table

12pt Paragraph B I U A T²

p 0 words </>

Question 4 5 pts

True/False: K-Means always gives the same cluster centers given the same data and same K. Explain in one sentence.

Edit View Insert Format Tools Table

12pt Paragraph

p 0 words

Question 5 5 pts

True/False: K-NN with K=N (N=# of training samples) will always give the same result no matter what the test data is. Explain in one sentence.

Edit View Insert Format Tools Table

12pt Paragraph

p 0 words

Question 6

5 pts

True/False: The perceptron algorithm will always converge. Explain in one sentence.

Edit View Insert Format Tools Table

12pt Paragraph

p 0 words

Question 7

20 pts

I want to train a linear classifier with the logistic loss and squared norm regularizer:

$$L(w,b) = \frac{1}{\log(2)}\log\left(1+e^{-y(w\cdot x+b)}\right) + \frac{\lambda}{2}\|w\|^2$$

What are the update equations for w and b using gradient descent on this loss?

Assume the $\log$s are natural logarithms ($\log_e = \ln$). Remember that the derivative of the natural log is as follows

$$\frac{d}{dx}\ln(x) = \frac{1}{x}$$

Edit View Insert Format Tools Table

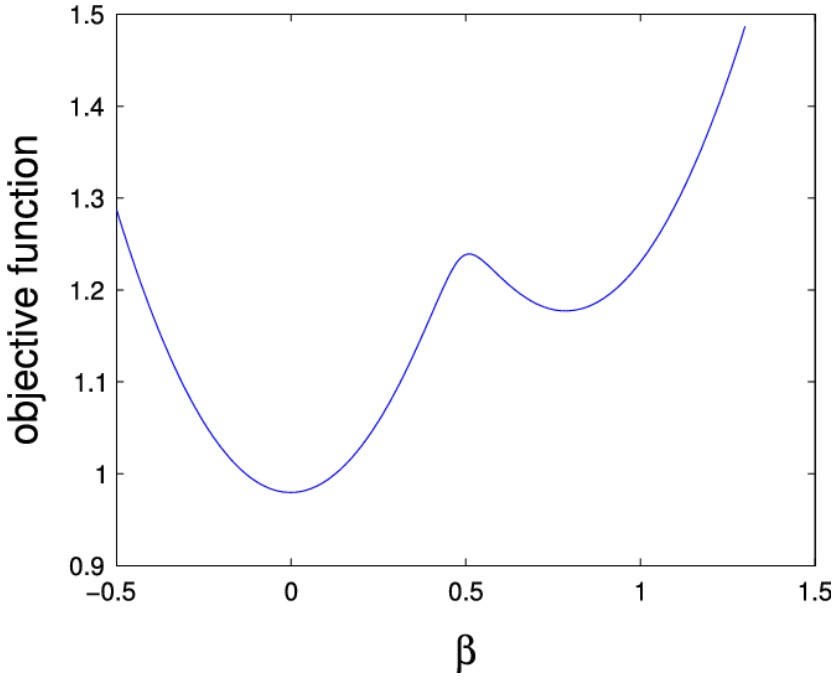
12pt Paragraph B I U A T²

p 0 words </>

Question 8

5 pts

If I run gradient descent on the following function, where will I end up? Explain. Think of β as your parameter, and the objective function as your loss.



Edit View Insert Format Tools Table

12pt Paragraph

p 0 words

Question 9

5 pts

True/False: Running K-Means with K=1 is an example of overfitting. Explain in 3 sentences or less.

Edit View Insert Format Tools Table

12pt Paragraph

p 0 words

Question 10

5 pts

True/False: A hyperparameter is something that is determined from the data. Explain in one sentence.

Edit View Insert Format Tools Table

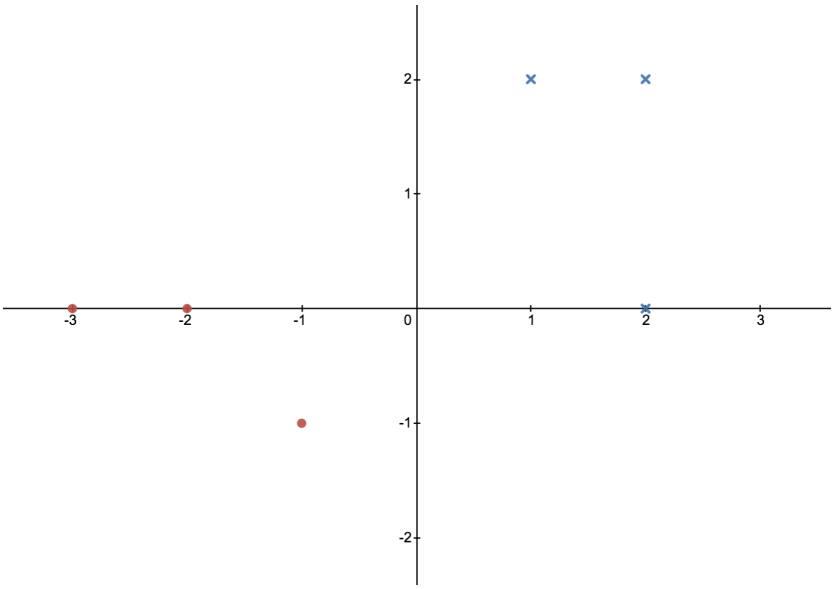
12pt Paragraph

p 0 words

Question 11

20 pts

Given the following data, run the perceptron algorithm and give the resulting weights and bias. Assume red circles are the negative class and blue crosses are the positive class. There are three of each. The data is also given in a table below. Use the ordering from the table to train your perceptron.



#	x_1	x_2	y
1	-3	0	-1
2	-2	0	-1
3	-1	-1	-1

4	1	2	1
5	2	2	1
6	2	0	1

Edit View Insert Format Tools Table

12pt Paragraph

p 0 words

Not saved Submit Quiz