

Quiz 2

● Graded

Student

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Total Points

14 / 14 pts

Question 1

Overfitting

2 / 2 pts

✓ + 2 pts Correct

Question 2

Cross Validation

2 / 2 pts

✓ + 2 pts Correct

Question 3

Decision Tree

7 / 7 pts

3.1 Entropy

2 / 2 pts

✓ + 2 pts Correct

3.2 Conditional entropy

2 / 2 pts

✓ + 2 pts Correct

3.3 ID3 Algorithm

3 / 3 pts

✓ + 3 pts Correct

Question 4

K-nearest neighbors

3 / 3 pts

4.1 Concept

2 / 2 pts

✓ + 2 pts Correct

4.2 KNN practice

1 / 1 pt

✓ + 1 pt Correct

Q1 Overfitting

2 Points

Which of the following actions is the least likely to address overfitting problems

- ☐ Remove irrelevant features.
- ☒ Increasing the complexity of the model to better capture the nuances in the noisy data.
- ☐ Reduce the complexity of the model.
- ☐ Split the training data into the training and validation set and select the model via cross-validation.

Q2 Cross Validation

2 Points

You perform 2-fold cross-validation to tune the MaxDepth hyperparameter of a decision tree classifier. The MaxDepth hyperparameter can take one of 3 possible values: $\{1, 2, 3\}$. These are the accuracies you obtain for each MaxDepth on each fold:

Fold	MaxDepth		
	1	2	3
1	0.9	0.8	0.5
2	0.5	0.8	0.6

What is the MaxDepth hyperparameter chosen by this procedure?

- ☐ 1
- ☒ 2
- ☐ 3

Q3 Decision Tree

7 Points

Consider the data points below. The Weather, Wind, and Temperature are features and we want to use a decision tree to decide whether it is ok to play outside.

Weather	Wind	Temperature	Play?
Sunny	Weak	Hot	+
Sunny	Strong	Hot	-
Rain	Weak	Cold	-
Rain	Weak	Hot	+
Cloudy	Strong	Cold	-
Cloudy	Weak	Cold	+
Rain	Strong	Cold	-

Q3.1 Entropy

2 Points

What is the entropy of the label over these seven examples ("Play?" is the label)

- ☐ $\log \frac{3}{7} + \log \frac{4}{7}$
- ☐ $-\log \frac{3}{7} - \log \frac{4}{7}$
- ☐ $-\frac{4}{7} \log \frac{3}{7} - \frac{3}{7} \log \frac{4}{7}$
- ☒ $-\frac{3}{7} \log \frac{3}{7} - \frac{4}{7} \log \frac{4}{7}$

Q3.2 Conditional entropy

2 Points

What is the conditional entropy of the label ("Play?" is the label) given the feature "Wind" is Strong?

☒ 0

☐ $-\frac{3}{7}(\frac{3}{7}\log(\frac{3}{7}) + \frac{4}{7}\log(\frac{4}{7}))$

☐ $-\frac{4}{7}(\frac{3}{7}\log(\frac{3}{7}) + \frac{4}{7}\log(\frac{4}{7}))$

☐ $-\frac{4}{7}\log(\frac{1}{2})$

Q3.3 ID3 Algorithm

3 Points

What would you pick as the first node using the ID3 decision tree learning algorithm?

☐ Weather

☒ Wind

☐ Temperature

Q4 K-nearest neighbors

3 Points

Q4.1 Concept

2 Points

Which of the following statements about KNN is *not* true?

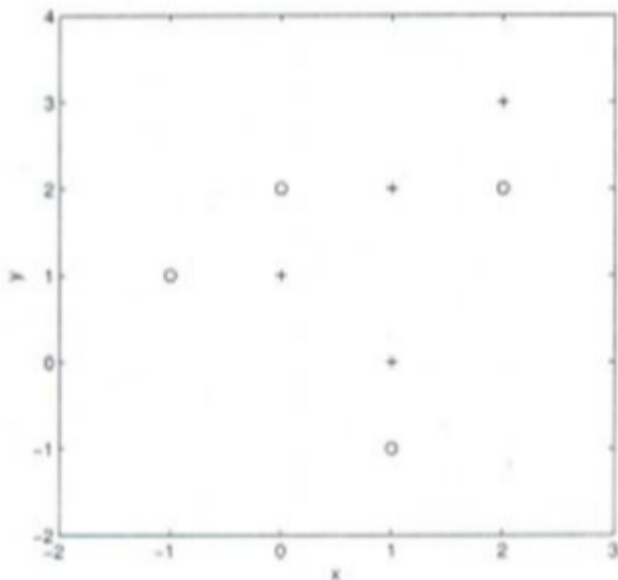
- ☐ For the large values of k , the classifier is less likely to overfit than underfit.
- ☒ Both the training and testing time complexity are constant.
- ☐ The larger value of K results in a smoother decision boundary.
- ☐ The hyperparameter k is typically set to an odd number.

Q4.2 KNN practice

1 Point

Consider the following data where x and y are two input features. Suppose you want to predict the label of a new data point $x = -1, y = 0.5$ using Manhattan distance in 1-Nearest Neighbour (1-NN). What would be the predicted label for this data point? (Note: In the plot, \circ represents label "-"; $+$ represents label "+")

x	y	label
-1	1	-
0	1	+
0	2	-
1	-1	-
1	0	+
1	2	+
2	2	-
2	3	+



- ☐ Using 1-NN, the label will be +
- ☒ Using 1-NN, the label will be -

