Intro to Big Data Science — Spring 2023-2024

Name: _____ ID No.: _____ D

Quiz1: Concepts in Data Science and Preprocessing

To receive credit, this worksheet MUST be handed in at the end of the class.

1. What are the key features of "BIG" data? (4 big "V")

   Volume, Variety, Value, Velocity

D 2. You are running a company, and you want to develop learning algorithms to address each of two problems.

   - Problem 1: You have a large inventory of identical items. You want to predict how many of these items will sell over the next 3 months.
   - Problem 2: You'd like software to examine individual customer accounts, and for each account decide if it has been hacked/compromised.

   Should you treat these as classification or as regression problems?

   (A) Treat both as classification problems.

   (B) Treat both as regression problems.

   (C) Treat problem 1 as a classification problem, problem 2 as a regression problem.

   (D) Treat problem 1 as a regression problem, problem 2 as a classification problem.

BC 3. Of the following examples, which would you address using an unsupervised learning algorithm? (Select all that apply)

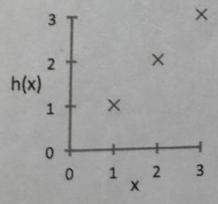
   ~~(A)~~ Given email labeled as spam/not spam, learn a spam filter.

   (B) Given a set of news articles found on the web, group them into set of articles about the same story.

   (C) Given a database of customer data, automatically discover market segments and group customers into different market segments.

   ~~(D)~~ Given a dataset of patients diagnosed as either having diabetes or not, learn to classify new patients as having diabetes or not.

4. Suppose we have a training set with $m = 3$ samples, plotted below. Our hypothesis representation is $h_\theta(x) = \theta_1 x$, with parameter θ_1. The loss function is $J(\theta_1) = \frac{1}{2m}\sum_{i=1}^{m}(h_\theta(x^{(i)}) - y^{(i)})^2$. What is $J(0)$?



When $\theta_1 = 0$, $h_\theta(x) = 0 \cdot x = 0$

~~J(0)~~

$$J(0) = \frac{1}{2m}\sum_{i=1}^{m}(0 - y^{(i)})^2$$

$$= \frac{1}{6}\sum_{i=1}^{3}(y^{(i)})^2$$

$$= \frac{1}{6}(1^2 + 2^2 + 3^2)$$

$$= \frac{7}{3}$$

ADEF 5. Which of the following statistics could be applied to missing value completion? (Select all that apply)

(A) Mean
(B) Variance.
(C) Standard deviation
(D) Median
(E) Mode
(F) Zero

p

6. True or false:

1) Dummy variable is used to deal with the missing values in continuous variable. False
2) Both Manhattan distance and Jaccard distance satisfy the three properties: positive definiteness, symmetry, and triangle inequality. True

7. For a two-class problem, compare the 1-nearest-neighbor method vs. Bayes classifier (classify the point to the most probable class, i.e., the class with greater probability), which method has a larger classification error? And why?

1-nearest-~~neighbor~~ neighbor has a larger error.

Error of $1NN = \sum_c p_c(x)(1-p_c(z)) \to \sum_c p_c(x)(1-p_c(x)) = 1 - \sum_c (p_c(x))^2$

Error of Bayes $= \sum_c p_c(x)(1-p_{c^*}(x)) = 1 - p_{c^*}(x)$, $c^* = \arg\max_c p_c(x)$

$\sum_c (p_c(x))^2 \leq p_{c^*}(x)$

$\Rightarrow$ Error of $1NN \geq$ Error of Bayes