CS3244 Exam 1: Part 1

28 Sep 2020

Please do not turn to the next page until you are told to do so by your proctor.

- This exam part is worth **25** marks out of a **75** mark total for all three parts.
- This exam part is estimated to take you about **25** minutes to complete.
- This exam part has a total of **13** questions.
- This exam part contains only multiple choice questions (MCQs) and multiple response questions (MRQ). Please key these into the assessment system.
- You can visit `http://www.comp.nus.edu.sg/~cs3244/2010/e1.part1.html` to reach the entry form for this survey if you lose your browser window.
- Do remember that you will need to key in and submit your answers to the according assessment system as designated by your proctor or by exam central.

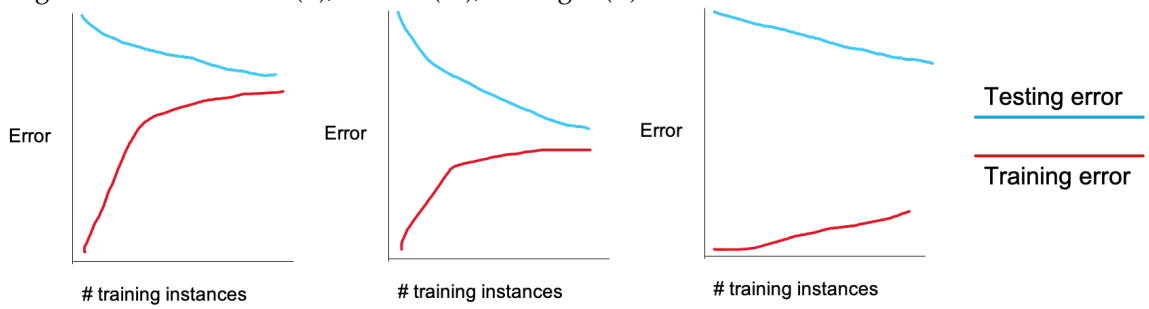
1. (MRQ with 4 options; 2 marks) Tribes of ML. Mark which tribes' algorithms use some form of randomization as taught in lecture.

   (a) Analogizer.
   (b) Connectionist.
   (c) Symbolist.
   (d) Bayesian.

2. (MRQ with 4 options; 3 marks) Which of the following statements is true regarding KNN?

   (a) KNN can be applied on regression tasks.
   (b) Using smaller k value leads to a smoother classification boundary.
   (c) As the k value increases, the classification accuracy will be higher.
   (d) The time complexity for training KNN is $O(1)$ and $O(n)$ for testing, where n is the number of test examples.

3. (MRQ with 5 options; 2 marks) Mark all correct associations with the diagrams below, where the diagrams are labeled left (L), middle (M), and right (R).



   (a) L — high bias
   (b) R — high variance
   (c) L — high variance
   (d) M — ideal
   (e) R — high bias

[Questions 4–7] (MCQ; 1 mark each) Mark (a) for true and (b) for false for each of the following statements.

4. Supervised learning requires labeled data while unsupervised learning does not.

5. KNN and K-means are both examples of unsupervised learning algorithms.

6. The goal of supervised learning is to learn a target function that approximates the hypothesis function.

7. SVM can penalise instances that are correctly classified.

8. (MCQ; 2 marks) For which of the following tasks should you **not** use machine learning?

   (a) Create an agent that can fly a plane in a flight simulator.
   (b) Sort a list of random numbers.
   (c) Determine whether a student's transcript fulfills graduation requirements.
   (d) Predict the next number in a game of roulette after observing many rounds.
   (e) Predict the winner of a soccer tournament based on player statistics.
   (f) Predict the score of a student's machine learning exam given forum participation.

9. (MCQ; 2 marks) KNN may overfit datasets of high dimensionality. Which option would you choose to handle this problem?

   (a) Non-linear mapping to fewer dimensions (dimensionality reduction).
   (b) Using a smaller K.
   (c) Both non-linear mapping to fewer dimensions and using a smaller K.
   (d) Neither of them.

10. (MCQ; 2 marks) Suppose a perceptron with two input features does not have a bias weight. Mark the implication of this design choice.

    (a) It will require, on average, 1.5 times as many training examples compared to if it had a bias weight.
    (b) It will function as a sigmoid unit.
    (c) Its decision boundary will pass through the origin.
    (d) It will require, on average, 0.67 times as many training examples compared to if it had a bias weight.

11. (MCQ; 2 marks) In which of the following tasks should you **not** use unsupervised machine learning techniques?

    (a) Identify irregular packet traffic on a network.
    (b) Group customer data.
    (c) Predict lottery results.
    (d) Help a farmer sort produce based on camera footage.
    (e) We can use it for all of the above.

12. (MRQ with 5 options; 3 marks) SVM Knowledge. Mark the correct statement(s).

    (a) The hard SVM, like the perceptron, requires the dataset to be linearly separable.
    (b) SVMs achieve can find non-linear classification boundaries using a kernel function to map a $\mathcal{Z}$ space.
    (c) The margin is defined as the distance between the closest positive and closest negative point(s) in a training dataset to the optimal separative hyperplane.
    (d) The SVM penalises misclassifications more when they are further away from the margin boundary of their correct class.
    (e) The margin is defined to have unit (1) distance for convenience. Other values would also work.

13. (MRQ with 5 options; 3 marks) By running the Candidate-Elimination algorithm on a task, a version space is produced with a specific S boundary sets and a general boundary set G.
    Given a new input instance x, which of the following statements are correct?

    (a) If x satisfies none of the members of G, then x satisfies none of the hypotheses in the version space.
    (b) If x satisfies every member of S, then x satisfies every hypothesis in the version space.
    (c) If x satisfies every member of G, then x satisfies every hypothesis in the version space.
    (d) If x satisfies none of the members of S, then x satisfies none of the hypotheses in the version space.
    (e) If x satisfies both S and G, there is only one hypothesis remaining in the version space.

This marks the end of this part of the exam.
These is no additional material beyond this point.