Two hours

QUESTION PAPER MUST NOT BE REMOVED FROM THE EXAM ROOM

UNIVERSITY OF MANCHESTER
SCHOOL OF COMPUTER SCIENCE

Machine Learning and Data Mining

Date: Wednesday 18th January 2012
Time: 09:45 - 11:45

Section A should be answered in an Answer book.

For full marks your answers should be concise as well as accurate.
Marks will be awarded for reasoning and method as well as being correct.

Section B is multiple choice and should be answered directly on the exam paper.
Only answers written in the boxes on the exam paper will be marked.

This is a CLOSED book examination

The use of electronic calculators is permitted provided they are not programmable and do not store text.
Section A

Answer all questions.

1. When assessing a machine learning procedure, the train/test error rate (the opposite of accuracy) is obviously very important. Other than these, state two (2) additional factors that might be used to assess a learning procedure. (2 marks)

2. State the equation for the entropy of a feature, and calculate it for a binary feature with \( p(X = 1) = 0.6 \). (2 marks)

3. Explain the difference between filters and wrappers for feature selection. (2 marks)

4. What is the main difference between the decision boundary induced by a Perceptron, and the decision boundary induced by a linear SVM? (2 marks)

5. Give one advantage and one disadvantage of using the K-NN rule. (2 marks)

6. Imagine you regularly travel between Manchester and London for work. Assuming you work a 7-day week, you usually spend 4 days in Manchester, and 3 days in London. You wake up one morning, and cannot remember where you are. You notice that it is raining. You know that in general, in the UK, it rains about 3 days per week. You know that in London in particular, it rains about 2 days per week. You know that 80% of the time, it rains in Manchester. Using Bayes Theorem, calculate the probability that you have woken up in Manchester. Remember, the probability of rain in general is not the same as the probability of you seeing the rain. (5 marks)

7. Given the training data in the table below, what probability will a Naive Bayes classifier predict for \( p(y = 1|x) \), given input \( x = \{1,1,1\}^T \)? (5 marks)

<table>
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<tr>
<th>( x_1 )</th>
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Section B is restricted and cannot be published