
Machine Learning

Time: 3 hrs.                           Max. Marks: 80

Note: Answer FIVE full questions, choosing ONE full question from each module.

Module-1

1. a. Specify the learning task for ‘A checkers learning problem’.  
   (03 Marks)

   b. Discuss the following with respect to the above,
      (i) Choosing the training experience.
      (ii) Choosing the target function and
      (iii) Choosing a function approximation algorithm.  
   (09 Marks)

   c. Comment on the issues in machine learning.  
   (04 Marks)

   OR

   2. a. Write candidate elimination algorithm. Apply the algorithm to obtain the final version space 
   for the training example.  
   (10 Marks)

   b. Discuss about an unbiased Learner.  
   (06 Marks)

Module-2

3. a. What is a decision tree & discuss the use of decision tree for classification purpose with an 
   example.  
   (08 Marks)

   b. Write and explain decision tree for the following transactions:  
   (08 Marks)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Sky</th>
<th>Air temp</th>
<th>Humidity</th>
<th>Wind</th>
<th>Water</th>
<th>Forecast</th>
<th>Enjoy sport</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sunny</td>
<td>Warm</td>
<td>Normal</td>
<td>Strong</td>
<td>Warm</td>
<td>Same</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>Sunny</td>
<td>Warm</td>
<td>High</td>
<td>Strong</td>
<td>Warm</td>
<td>Same</td>
<td>Yes</td>
</tr>
<tr>
<td>3</td>
<td>Rainy</td>
<td>Cold</td>
<td>High</td>
<td>Strong</td>
<td>Warm</td>
<td>Change</td>
<td>No</td>
</tr>
<tr>
<td>4</td>
<td>Sunny</td>
<td>Warm</td>
<td>High</td>
<td>Strong</td>
<td>Cool</td>
<td>Change</td>
<td>Yes</td>
</tr>
</tbody>
</table>

4. a. For the transactions shown in the table compute the following:
   (i) Entropy of the collection of transaction records of the table with respect to 
   classification.  
   (ii) What are the information gain of a₁ and a₂ relative to the transactions of the table?  
   (08 Marks)

<table>
<thead>
<tr>
<th>Instance</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>a₁</td>
<td>T</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>a₂</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>T</td>
<td>T</td>
<td>F</td>
<td>T</td>
</tr>
</tbody>
</table>

   b. Discuss the decision learning algorithm.  
   (04 Marks)

   c. List the issues of decision tree learning.  
   (04 Marks)
Module-3
5  a. Draw the perceptron network with the notation. Derive an equation of gradient descent rule to minimize the error. (08 Marks)
b. Explain the importance of the terms: (i) Hidden layer (ii) Generalization (iii) Overfitting (iv) Stopping criterion (08 Marks)

OR
6  a. Discuss the application of Neural network which is used for learning to steer an autonomous vehicle. (06 Marks)
b. Write an algorithm for back propagation algorithm which uses stochastic gradient descent method. Comment on the effect of adding momentum to the network. (10 Marks)

Module-4
7  a. What is Bayes theorem and maximum posterior hypothesis? (04 Marks)
b. Derive an equation for MAP hypothesis using Bayes theorem. (04 Marks)
c. Consider a football game between two rival teams: Team 0 and Team 1. Suppose Team 0 wins 95% of the time and Team 1 wins the remaining matches. Among the games won by team 0, only 30% of them come from playing on teams 1’s football field. On the other hand, 75% of the victories for team 1 are obtained while playing at home. If team 1 is to host the next match between the two teams, which team will most likely emerge as the winner? (08 Marks)

OR
8  a. Describe Brute-force MAP learning algorithm. (04 Marks)
b. Discuss the Naïve Bayes classifier. (04 Marks)
c. The following table gives data set about stolen vehicles. Using Naïve bayes classifier classify the new data (Red, SUV, Domestic) (08 Marks)

<table>
<thead>
<tr>
<th>Color</th>
<th>Type</th>
<th>Origin</th>
<th>Stolen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red</td>
<td>Sports</td>
<td>Domestic</td>
<td>Yes</td>
</tr>
<tr>
<td>Red</td>
<td>Sports</td>
<td>Domestic</td>
<td>No</td>
</tr>
<tr>
<td>Red</td>
<td>Sports</td>
<td>Domestic</td>
<td>Yes</td>
</tr>
<tr>
<td>Yellow</td>
<td>Sports</td>
<td>Domestic</td>
<td>No</td>
</tr>
<tr>
<td>Yellow</td>
<td>Sports</td>
<td>Imported</td>
<td>Yes</td>
</tr>
<tr>
<td>Yellow</td>
<td>SUV</td>
<td>Imported</td>
<td>No</td>
</tr>
<tr>
<td>Yellow</td>
<td>SUV</td>
<td>Domestic</td>
<td>Yes</td>
</tr>
<tr>
<td>Red</td>
<td>SUV</td>
<td>Imported</td>
<td>No</td>
</tr>
<tr>
<td>Red</td>
<td>Sports</td>
<td>Imported</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Module-5
9  a. Write short notes on the following: (i) Estimating Hypothesis accuracy. (08 Marks)
    (ii) Binomial distribution.
b. Discuss the method of comparing two algorithms. Justify with paired to tests method. (08 Marks)

OR
10 a. Discuss the K-nearest neighbor language. (04 Marks)
b. Discuss locally weighted Regression. (04 Marks)
c. Discuss the learning tasks and Q learning in the context of reinforcement learning. (08 Marks)

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