Question Paper

Exam Date & Time: 09-Oct-2020 (09:30 AM - 01:00 PM)

BMS COLLEGE OF ENGINEERING

Autonomous Institute Affiliated to VTU, Supplementary Semester End Main Examinations, October 2020

Machine Learning [16IS6DEMLG]

Marks: 100 **Duration: 210 mins.**

Information Science and Engineering, Sem:VI

Answer all the questions.

Instructions:
1. Answer FIVE full questions using the given internal choice
2. Missing data, if any, may be suitably assumed

1) a) Design a learning system for a handwriting recognition problem with the task of recognizing and classifying handwritten words within images. The performance measure is the percentage of words correctly classified. (10)

b) Write the candidate-elimination algorithm using version spaces. Illustrate the algorithm with an example. (10)

2) a) Consider the learning task represented by the training examples in the table given below. Here the target attribute is PlayTennis, which can have values yes or no for different days, which is predicted based on other attributes. Apply ID3 algorithm to construct a decision tree selecting the attribute at each node that best classifies the training examples. (12)

Day	Outlook	Humidity	Wind	PlayTennis
D1	Sunny	High	Weak	No
D2	Sunny	High	Strong	No
D3	Overcast	High	Weak	Yes
D4	Rain	High	Weak	Yes
D5	Rain	Normal	Weak	Yes
D6	Rain	Normal	Strong	No
D7	Overcast	Normal	Strong	Yes
D8	Sunny	High	Weak	No
D9	Sunny	Normal	Weak	Yes
D10	Rain	Normal	Weak	Yes
D11	Sunny	Normal	Strong	Yes
D12	Overcast	High	Strong	Yes
D13	Overcast	Normal	Weak	Yes
D14	Rain	High	Strong	No

b) Describe the steps involved in Rule post-pruning. Illustrate with an example. (8)

3) a) **Build an Artificial Neural Network (ANN) learning system for ALVINN to steer an autonomous vehicle driving at normal speeds on public highways.** (10)

b) Write and explain the Stochastic Gradient Descent version of the Backpropagation algorithm for feedforward networks containing two layers of sigmoid units. (10)

[OR]		What set of functions can be represented by feedforward networks? Explain.	(6)
4)			
	a)		
	b)	Design a two-input perceptron that implements the boolean function **A Λ ¬B**.	(6)
	c)	Write and explain the Gradient Descent algorithm for training a linear unit.	(8)
5)		Describe Maximum A Posteriori (MAP) hypothesis and solve the following problem using MAP hypothesis.	(10)
	a)	Consider a medical diagnosis problem in which there are two alternative hypotheses: 1. that the patient has a particular form of cancer (+) and 2. that the patient does not have cancer (-). A patient takes a lab test and the result comes back positive. The test returns a correct positive result in only 98% of the cases in which the disease is actually present, and a correct negative result in only 97% of the cases in which the disease is not present. Furthermore, 0.008 of the entire population have this cancer. Determine whether the patient has Cancer or not.	
	b)	Illustrate the concept of Normal or guassian distribution for model approximation in processes. Reason out why we prefer guassian distribution.	(10)
[OR]		Illustrate the working of Bayes Optimal Classifier with an example.	(8)
6)			
	a)		
	b)	Consider a learned hypothesis, h, for some boolean concept. When h is tested on a set of 100 examples, it classifies 83 correctly. What is the standard deviation and the 95% confidence interval for the true error rate for ErrorD(h)? (Given Zn for 95% is 1.96)	(6)
	c)	Write the Brute-Force Map Learning algorithm. In order specify a learning problem for the Brute-Force Map Learning algorithm: i) What values should we specify for P(h)? ii) What values should we specify for P(D|h)?	(6)
7)		**Describe the learning model used in Reinforcement Learning.**	(6)
	a)		
	b)	Nearest Neighbor approaches can be thought of as approximating the target function f(x) at a single query point $x=x_q$. Justify how locally weighted regression is a generalization of this approach.	(6)
	c)	Discuss the approximating function used in Radial Basis Function (RBF). Illustrate the algorithmic steps on how RBF can be implemented in a neural network.	(8)

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