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Question Paper Code : 50904

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2024.

Fourth/Sixth Semester

Computer Science and Engineering

CS 3491 – ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

(Common to : Biomedical Engineering/Computer Science and Design/Computer Science and Engineering (Cyber Security)/Computer and Communication Engineering/Electronics and Communication Engineering/ Electronics and Telecommunication Engineering/Medical Electronics/Information Technology)

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. What are the various applications of AI?
2. How will you measure the performance of AI application?
3. Mention the needs of probabilistic reasoning in AI.
4. Given that $P(A)=0.3$, $P(A|B)=0.4$ and $P(B)=0.5$, Compute $P(B|A)$.
5. How can overfitting be avoided?
6. Assume a disease so rare that it is seen in only one person out of every million. Also assume that we have a test that is effective in that if a person has the disease, there is a 99 percent chance that the test result will be positive; however, the test is not perfect, and there is a one in a thousand chance that the test result will be positive on a healthy person. Assume that a new patient arrives and the test result is positive. What is the probability that the patient has the disease?
7. Write the three types of ensemble learning.
8. How expectation maximization is used in Gaussian mixture models?
9. What is stochastic gradient descent and why is it used in the training of neural networks?
10. Why is ReLU better than Softmax? Give the equation for both.

PART B — (5 × 13 = 65 marks)

11. (a) Differentiate Blind Search and Heuristic Search.

Or

(b) Explain characteristics of intelligent agents.

12. (a) Consider the following set of propositions:

- Patient has spots
- Patient has measles
- Patient has high fever
- Patient has Rocky mountain spotted fever.
- Patient has previously been inoculated against measles.
- Patient was recently bitten by a tick
- Patient has an allergy.

(i) Create a network that defines the casual connections among these nodes. (5)

(ii) Make it a Bayesian network by constructing the necessary conditional probability matrix. (8)

Or

(b) Construct a Bayesian Network and define the necessary CPTs for the given scenario. We have a bag of three biased coins a, b and c with probabilities of coming up heads of 20%, 60% and 80% respectively. One coin is drawn randomly from the bag (with equal likelihood of drawing each of the three coins) and then the coin is flipped three times to generate the outcomes X1, X2 and X3.

(i) Draw a Bayesian network corresponding to this setup and define the relevant CPTs. (7)

(ii) Calculate which coin is most likely to have been drawn if the flips come up HHT. (6)

13. (a) State when and why you would use random forests vs SVM?

Or

(b) Explain the principle of the gradient descent algorithm. Accompany your explanation with a diagram.

14. (a) Explain various learning techniques involved in unsupervised learning.

Or

(b) List the applications of clustering and identify advantages and disadvantages of clustering algorithms.

15. (a) Draw the architecture of a single layer perceptron (SLP) and explain its operation. Mention its advantages and disadvantages.

Or

- (b) How do you tune hyperparameters for better neural network performance? Explain in detail.

PART C — (1 × 15 = 15 marks)

16. (a) Discuss constraint satisfaction problems with an algorithm for solving crypt arithmetic. Trace the algorithm for the following:

$$\begin{array}{r} \text{CROSS} \\ + \text{ROADS} \\ \hline \text{DANGER} \end{array}$$

Or

- (b) Construct the decision tree for the below dataset

| Day | Outlook | Temperature | Humidity | Wind | Play Golf |
|-----|----------|-------------|----------|--------|-----------|
| D1 | Sunny | Hot | High | Weak | No |
| D2 | Sunny | Hot | High | Strong | No |
| D3 | Overcast | Hot | High | Weak | Yes |
| D4 | Rain | Mild | High | Weak | Yes |
| D5 | Rain | Cool | Normal | Weak | Yes |
| D6 | Rain | Cool | Normal | Strong | No |
| D7 | Overcast | Cool | Normal | Strong | Yes |
| D8 | Sunny | Mild | High | Weak | No |
| D9 | Sunny | Cool | Normal | Weak | Yes |
| D10 | Rain | Mild | Normal | Weak | Yes |
| D11 | Sunny | Mild | Normal | Strong | Yes |
| D12 | Overcast | Mild | High | Strong | Yes |
| D13 | Overcast | Hot | Normal | Weak | Yes |
| D14 | Rain | Mild | High | Strong | No |