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Question Paper Code : 90926

B.E./B.Tech. DEGREE EXAMINATIONS, APRIL/MAY 2025.

Fourth Semester

Computer Science and Engineering

CS 3491 – ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

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

(Regulations 2021)

Time : Three hours

Maximum : 100 marks

Answer ALL questions.

PART A — ($10 \times 2 = 20$ marks)

1. What is the role of AI in predictive maintenance within industrial settings?
2. How do heuristics contribute to the effectiveness of adversarial search algorithms?
3. What role do Bayesian networks play in managing uncertainty?
4. What challenges are associated with Bayesian inference, particularly in high-dimensional spaces?
5. What is a linear regression model, and what is its primary purpose in statistical analysis?
6. What is the role of gradient descent in machine learning?
7. How does the weighted average method function in ensemble predictions?
8. How can voting be applied to improve classification tasks in machine learning?
9. What are activation functions, and why are they essential in neural networks?
10. What is hyper parameter tuning, and why is it important in training neural networks?

PART B — (5 × 13 = 65 marks)

11. (a) How do heuristic functions improve search efficiency, and what are the key characteristics of a good heuristic? Provide examples of heuristics used in specific search problems.

Or

- (b) (i) Discuss the challenges associated with search algorithms in AI. (6)
(ii) Write in detail about constraint satisfaction problem. (7)

12. (a) Compare and contrast exact and approximate inference techniques in Bayesian networks.

Or

- (b) Describe the Naive Bayes model. Discuss its assumptions, the process of training the model, and its applications in classification tasks.

13. (a) Describe the maximum margin classifier and the concept of Support Vector Machines (SVM).

Or

- (b) Explain the concepts of prior distribution, likelihood and posterior distribution in this context.

14. (a) Discuss the advantages and disadvantages of stacking compared to other ensemble methods.

Or

- (b) What is Instance-Based Learning (IBL), and how does it differ from other learning paradigms? Focus on the K-Nearest Neighbors (KNN) algorithm, explaining how it works, its strengths and weaknesses and its typical use cases.

15. (a) Elaborate on the back propagation algorithm used in training neural networks. Explain how it calculates gradients and updates weights and illustrate the steps involved with an example.

Or

- (b) Discuss the concept of gradient descent optimization and its variants, including Stochastic Gradient Descent (SGD). Compare their effectiveness in training neural networks, highlighting their advantages and drawbacks.

PART C — (1 × 15 = 15 marks)

16. (a) Explain the K-means clustering algorithm. Describe the steps involved in the algorithm, including initialization, assignment and update phases. Discuss its advantages, limitations and common applications.

Or

- (b) Describe the transition from shallow networks to deep networks in neural network architecture. Discuss the benefits and challenges of deeper architectures, focusing on aspects like model capacity, training complexity and computational requirements.
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