### December 2023
### B.Tech. (ENC) VII Semester
### MACHINE LEARNING (ECPEL-709)

Time : 3 Hours]　　　　　　　　　　　　　　[Max. Marks : 75

*Instructions :*

1. *It is compulsory to answer all the questions (1.5 marks each) of Part-A in short.*
2. *Answer any four questions from Part-B in detail.*
3. *Different sub-parts of a question are to be attempted adjacent to each other.*

### PART–A

1. (a) What do you understand by a well-posed learning problem? (1.5)

   (b) Define "Pairwise separation" in the context of neural networks. (1.5)

   (c) Explain the basic concept behind the "Gradient Descent" optimization algorithm. (1.5)

   (d) In the context of machine learning, what is the significance of the "Hypothesis Space"? (1.5)

   (e) What is the main idea behind "Parallelizing Genetic Algorithms" and why it is useful in optimization tasks? (1.5)

   (f) What is the primary goal of learning rule sets in machine learning? (1.5)

(g) Define "Prolog-EBG" in the context of analytical learning. (1.5)

(h) Name two commonly used performance measures for evaluating classifier performance. (1.5)

(i) When comparing two classification algorithms, what are the key considerations for selecting appropriate metrics to ensure a meaningful and valid comparison? (1.5)

(j) How does the choice of significance level in hypothesis testing impact the interpretation of results in machine learning experiments? (1.5)

## PART–B

2. Compare and contrast two types of supervised learning algorithms: Classification and Regression Trees (CART) and Support Vector Machines (SVM). Explain their core principles, strengths, and weaknesses, and provide examples of scenarios in which each algorithm is particularly well-suited. (15)

3. (a) Explain how the Bayes optimal classifier makes decisions based on probabilistic information. (5)

(b) You are given a dataset containing information about customer purchases in an e-commerce store. The dataset includes features such as product category, price, customer location, and whether the customer made a purchase or not. Your goal is to build a decision tree model to predict whether a customer will make a purchase based on the available features. (10)

4. (a) Explain the fundamental components and architecture of a multilayer perceptron (MLP), focusing on its hidden layers and the use of activation functions. Describe how the backpropagation algorithm is used to train an MLP. Provide step-by-step details of the backpropagation process, including the computation of gradients and weight updates. (10)

(b) Discuss the concept of dynamically modifying the network structure in recurrent neural networks (RNNs). (5)

5. (a) Discuss the role of genetic programming in hypothesis space search. (5)

(b) Explain the key models of evolution used in genetic algorithms, such as generational, steady-state, and elitist models. Compare and contrast these models in terms of their advantages and drawbacks in optimizing solutions. (10)

6. (a) Explain the importance of using prior knowledge to initialize hypotheses in machine learning, as demonstrated by the KBANN algorithm. Describe the main idea behind KBANN and its impact on the learning process. (10)

(b) Compare inductive and analytical approaches to learning. (5)

7. Discuss the various measures used for evaluating classifier performance in machine learning, including accuracy, precision, recall, F1-score, ROC curves, and AUC. Explain when and why each measure is appropriate for assessing different aspects of classifier performance. (15)

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