



**PRESIDENCY UNIVERSITY  
BENGALURU**

**SCHOOL OF ENGINEERING  
MID TERM EXAMINATION - APR 2023**

**Semester :** Semester IV - 2021

**Date :** 13-APR-2023

**Course Code :** ECE3020

**Time :** 2:00PM -  
3:30PM

**Course Name :** Sem IV - ECE3020 - Computational Intelligence and Machine Learning

**Max Marks :** 50

**Program :** ECE

**Weightage :** 25%

**Instructions:**

- (i) Read all questions carefully and answer accordingly.
- (ii) Question paper consists of 3 parts.
- (iii) Scientific and non-programmable calculator are permitted.
- (iv) Do not write any information on the question paper other than Roll Number.

**PART A**

**ANSWER ALL THE QUESTIONS**

**(5 X 2 = 10M)**

1. Oftentimes, the terms machine learning and artificial intelligence (AI) are used interchangeably; however, they are not the same. AI is basically the umbrella concept, and machine learning is a subset of artificial intelligence. Choose the correct option regarding machine learning (ML) and artificial intelligence (AI)
  - A) ML is a set of techniques that turns a dataset into a software
  - B) AI is a software that can emulate the human mind
  - C) ML is an alternate way of programming intelligent machines
  - D) All of the above

(CO1) [Knowledge]
2. In machine learning, multiclass or multinomial classification is the problem of classifying instances into one of three or more classes (classifying instances into one of two classes is called binary classification). Which of the following method is used for multiclass classification?
  - A) One vs Rest
  - B) One
  - C) All vs One
  - D) One vs Another

(CO1) [Knowledge]
3. Regression is a predictive modeling technique investigating relationship between dependent and independent variables. In linear model of regression, the term  $\phi(x)$  W.R.T input variable X is
  - A) Sum function
  - B) Product function
  - C) Basis function
  - D) Basic function

(CO1) [Knowledge]
4. Curve fitting is the major task in regression concept. \_\_\_\_\_ is the scenario when the model fails to decipher or misses data point to fit on a curve and to find the underlying trend in the input data.
  - A) Over fitting
  - B) Under fitting
  - C) Both A and B
  - D) None of the above

(CO1) [Knowledge]
5. Dimensionality reduction refers to techniques for reducing the number of input variables in training data. Dimensionality Reduction Algorithms are one of the possible ways to reduce the computation time required to build a model
  - A) False.
  - B) True
  - C) Maybe.
  - D) Cannot be determined.

(CO1) [Knowledge]

**PART B**

**ANSWER ALL THE QUESTIONS**

**(2 X 10 = 20M)**

6. There are few possibilities to come out from the over-fitting problem. Among them increasing dataset size, using Bayes functions and adding regularization term to an error function are the most efficient methods.

How regularized least squares are useful to control the error while we are training a system.

**Hint:** Regularization allows complex models to be trained on data sets of limited size without severe over-fitting, essentially by limiting the effective model complexity. However, the problem of determining the optimal model complexity is then shifted from one of finding the appropriate number of basis functions to one of determining a suitable value of the regularization coefficient  $\lambda$ .

(CO1) [Comprehension]

7. Consider a data set of inputs  $X=\{X_1, X_2, X_3, \dots, X_N\}$  The target variable 't' is given by a deterministic function  $Y(X, W)$  with additive Gaussian noise ( $\epsilon$ -zero mean Gaussian random variable with precision  $\beta$ ).

A) How Maximum likelihood and least squares are related (2M)

B) Give the mathematical modeling behind maximum likelihood with respect to weights ( $w$ ) and precision ( $\beta$ ). (8M)

(CO2) [Comprehension]

**PART C**

**ANSWER ALL THE QUESTIONS**

**(2 X 10 = 20M)**

8. Consider a data set  $X=\{X_1, X_2, X_3, \dots, X_N\}$  and the target vector  $t= \{1 \ 0 \ 1 \ 1\}^T$ . the weight vector  $W=$

$$\begin{bmatrix} 1 & 0 & 1 \\ 1 & 0 & -1 \\ 0 & 1 & 0 \\ 1 & 1 & 1 \end{bmatrix}$$

$\{W_1, W_2, W_3, W_4\}$ . Consider a Linear model for regression with design matrix then Calculate the Maximum likelihood weight vector (WML)

(CO1) [Application]

9. Principal Component Analysis (PCA) is a statistical procedure that uses an orthogonal transformation that converts a set of correlated variables to a set of uncorrelated variables. PCA is the most widely used tool in exploratory data analysis and in machine learning for predictive models. Moreover, PCA is an unsupervised statistical technique used to examine the interrelations among a set of variables.

A) Many times, analyzing the higher dimension data will be typical than lower dimension, what algorithm/method that you will choose to overcome this problem. (2M)

B) If you identify such an algorithm (mentioned in above), apply the same to below given data and generate the reduced dimension data. (8M)

Hint: Use covariance matrix  $S = \begin{bmatrix} 14 & -11 \\ -11 & 23 \end{bmatrix}$

Feature				
X	4	8	13	7
Y	11	4	5	14

(CO2) [Application]