Question Paper

Exam Date & Time: 08-May-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

VI SEM B. Tech (BME) DEGREE END SEMESTER EXAMINATIONS, MAY-2024
SUBJECT: MACHINE LEARNING (BME 4057)
(REVISED CREDIT SYSTEM)
May, 2024

ELECTIVE-MACHINE LEARNING [BME 4057]

Marks: 50 **Duration: 180 mins.**

END EXAM

Answer all the questions. Section Duration: 180 mins

Draw relevant graphs on a seperate graph sheet provided.

1A) Calculate the ***Mean squared error (MSE***) for the following set of values: (4)

(43,41), (44,45), (45,49), (46,47), (47,44)

1B) Consider a dataset containing information about the heights and weights of individuals, along with their gender. The dataset is as follows: (4)

Height (cm)	Weight (kg)	Gender
155	50	Female
160	55	Female
165	60	Female
170	65	Male
175	70	Male
180	75	Male

Using the ***k-nearest neighbors (KNN) algorithm*** with ***k=3***, predict the gender of a person with ***height 168 cm and weight 63 kg.***

1C) Illustrate the ***decision tree*** for the given parity function table with a neat diagram (2)

A	B	C	D	Class
T	T	T	T	T
T	T	T	F	F
T	T	F	T	F
T	T	F	F	T
T	F	T	T	F
T	F	T	F	T
T	F	F	T	T
T	F	F	F	F
F	T	T	T	F
F	T	T	F	T
F	T	F	T	T
F	T	F	F	F
F	F	T	T	T
F	F	T	F	F
F	F	F	T	F
F	F	F	F	T

2A) Employ ***K-means*** to categorize the given points into clusters, and produce a well-organized visual depiction of the resultant clusters. (4)

P1(1,3), P2(2,2), P3(5,8), P4(8,5), P5(3,9), P6(10,7), P7(3,3), P8(9,4), P9(3,7)

{*Take K value as 3 and assume that Initial cluster centres are P7(3,3), P9(3,7), P8(9,4) as C1, C2, C3*}

2B) Apply the ***DBSCAN algorithm*** with a **similarity threshold of 0.8** (using the similarity matrix) to the given data points and **MinPts>=2** (Minimum required points in a cluster) what are core, border, and noise (outliers) in the set of points given in the table. (4)

	P1	P2	P3	P4	P5
P1	1.00	0.10	0.41	0.55	0.35
P2	0.10	1.00	0.64	0.47	0.98
P3	0.41	0.64	1.00	0.44	0.85
P4	0.55	0.47	0.44	1.00	0.76
P5	0.35	0.98	0.85	0.76	1.00

2C) Consider the two-dimensional patterns (2)

(2, 1), (3, 5), (4, 3), (5, 6), (6, 7), (7, 8).

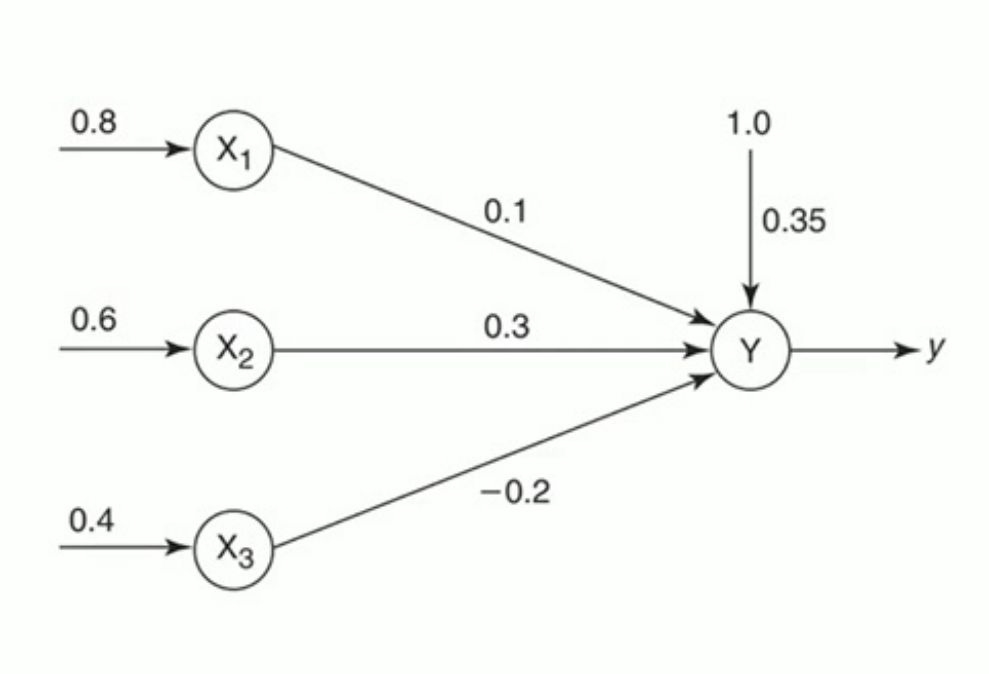
Compute the ***principal component*** using the ***PCA Algorithm***

3A) Solve using ***McCulloch-Pitts neuron*** method for the given Truth Table (4)

x_1	x_2	y
0	0	0
0	1	0
1	0	1
1	1	0

3B) Implement ***AND function*** using ***Perceptron Training Rule*** with neat diagram (4)

3C) Deduce the output of neuron Y using ***binary sigmoidal function*** (2)



4A) In a certain neighborhood, 90% of children fell ill due to the flu and 10% due to measles, with no other diseases reported. The probability of observing rashes for measles is 0.95 and for the flu is 0.08. If a child develops rashes, find the ***probability*** of the child having the flu. (4)

4B) The table below shows the confusion matrix illustrating the performance of a binary classification model: (4)

	Predicted Negative	**Predicted Positive**
Actual Negative	85	15
Actual Positive	10	90

Calculate the following performance metrics for the model:

1. ***Accuracy***
2. ***Precision***

3. ***Recall (Sensitivity)***

4. ***Specificity***

4C)	Explain with the help of a diagram the ***architecture of a single-layer feed-forward neuron network***	(2)
5A)	Explain any four differences between ***Principal Component Analysis (PCA)*** and ***Independent Component Analysis (ICA)***.	(4)
5B)	Explain the differences between ***Perceptron*** and ***MP (McCulloch-Pitts) neural models*** with the help of a neat diagram	(4)
5C)	List any two indicators with respective formulas to evaluate Linear Regression	(2)

-----End-----