Nirma University

Institute of Technology

Semester End Examination (IR) / Supplementary Examination, May - 2022

B. Tech. in Computer Science and Engineering, Semester-V

2CS501 Machine Learning

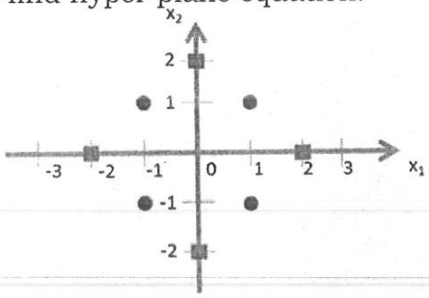
Roll / Exam No. | Supervisor's initial with date

Time: 2:00 Hours | Max. Marks: 50

Instructions:
1. Attempt all questions.
2. Figures to right indicate full marks.
3. Draw neat sketches wherever necessary.
4. Make suitable assumptions wherever necessary.

Q.1 **Answer the following questions:** **[10]**

(a) Consider the two groups of data points (circles and squares) as shown in Figure below. Use SVM kernel function, using the transformation function Φ, to find hyper plane equation. [05]



$$\phi\begin{pmatrix}x_1\\x_2\end{pmatrix}=\begin{cases}\begin{pmatrix}6-x_1+(x_1-x_2)^2\\6-x_2+(x_1-x_2)^2\end{pmatrix} & \text{if } \sqrt{x_1^2+x_2^2}\geq 2\\ \begin{pmatrix}x_1\\x_2\end{pmatrix} & \text{otherwise}\end{cases}$$

Transform the points circle and square and plot it in the new feature space.

(b) Define the terms [05]

i) Indicators of overfitting and underfitting

ii) Regularization and its applications

Q.2 **Answer the following questions:** **[15]**

(a) Which ML algorithm will you use in following situation explain with proper justification? [05]

(i) Predicting will it rain or not based on wind speed, temperature, humidity in air.

(ii) Predicting price of the house based on size, age of the house, distance from the main city.

(b) Given data as in table below. Assuming that the $h(O = (X$ (no intercept) , also the cost function is given as [05]

$J(O = 1/2m\Sigma\cong(y - h(O)^{\dagger}2$. Plot J(θ) against θ for θ= {0,1,2,3,4).

X	Y
1	2
2	5
4	7
3	7
5	10

OR

(b) Define the term decision boundary, explain the same using appropriate example and demonstration.

(c) (i) Take an appropriate example for reinforcement learning and define the components based on MDP. [05]
(ii) How is reinforcement learning paradigm different than supervised and unsupervised learning?

OR

(c) Find the root node using information gain for the dataset as below [05]

Animal	Warm-blooded	Feathers	Fur	Swims	Lays Eggs
Ostrich	Yes	Yes	No	No	Yes
Crocodile	No	No	No	Yes	Yes
Raven	Yes	Yes	No	No	Yes
Albatross	Yes	Yes	No	No	Yes
Dolphin	Yes	No	No	Yes	No
Koala	Yes	No	Yes	No	No

Q.3 **Answer the following questions:** **[15]**

(a) What are different loss functions? How to choose a loss function given a problem? Explain the same with appropriate example. [05]

OR

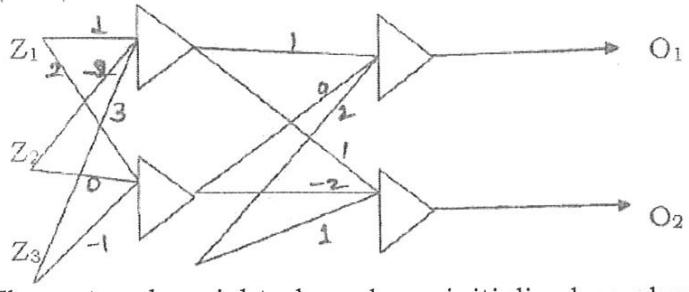
(a) Write differences between [05]
a. Self-organizing Maps and Artificial Neural networks
b. Gradient descent and Normal equation for regression

(b) The network shown in figure below , when properly trained should respond with [10]

$$\begin{bmatrix} O_1 \\ O_2 \end{bmatrix} = \begin{bmatrix} 0.95 \\ 0.05 \end{bmatrix}$$

To the argument input pattern

$$\begin{bmatrix} Z_1 \\ Z_2 \\ Z_3 \end{bmatrix} = \begin{bmatrix} 1 \\ 3 \\ -1 \end{bmatrix}$$



The network weights have been initialized as shown in the figure. Analyze a single feed forward and back propagation step for the initialized network by doing the following:
(a) Find weight matrices.
(b) Calculate output at each neuron.

(c) Calculate error signals at each neurons

For the computation assume $f(\text{net})=[1+\exp(-\text{net})]^{-1}$ and $\eta=1$

Q.4 **Answer the following questions:** **[10]**

(a) Assume training tuples: (85, 85, No), (71, 80, No), (75, 50, Yes), (60, 80, Yes), (72, 3, Yes). The last value in each tuple is the class to which the tuple belongs. Using distance/similarity-weighted 3-NN, predict the class of the tuple (72, 75). Assume cosine similarity as the similarity/distance measure. [05]

(b) Use Naïve Bayes Algorith for predicting the class for X = {outlook: sunny, temperature: mild, humidity: normal, windy: false} [05]

Outlook	Temperature	Humidity	Windy	Play?
sunny	hot	high	FALSE	no
sunny	hot	high	TRUE	no
overcast	hot	high	FALSE	yes
rainy	mild	high	FALSE	yes
rainy	cool	normal	FALSE	yes
rainy	cool	normal	TRUE	no
overcast	cool	normal	TRUE	yes
sunny	mild	high	FALSE	no
sunny	cool	normal	FALSE	yes
rainy	mild	normal	FALSE	yes
sunny	mild	normal	TRUE	yes
overcast	mild	high	TRUE	yes
overcast	hot	normal	FALSE	yes
rainy	mild	high	TRUE	no

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