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Question Paper Code: R4G05

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

Fourth Semester

Artificial Intelligence and Machine Learning

R21UAM405- PRINCIPLES OF MACHINE LEARNING

(Regulations-R2021)

Duration: Three hours

Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

1. What is Machine Learning? What are the important objectives of Machine learning? CO1- U
2. Distinguish between overfitting and underfitting. How it can affect model Generalization? CO1- U
3. Write about Regularized Regression. CO1- U
4. When will you use the Regression? Identify pros and cons of regression models. CO1- U
5. Calculate the output y of a three input neuron with bias. The input feature vector is $(x_1, x_2, x_3) = (0.8, 0.6, 0.4)$ and weight values are $[w_1, w_2, w_3, b] = [0.2, 0.1, -0.3, \text{and } 0.35]$. Use binary Sigmoid function as activation function CO2-App
6. What is Decision Tree? What types of problems are best suited for decision tree learning? How does the structure of decision tree help in classifying a data instance? CO1- U
7. Write down the major differences between K-means clustering and hierarchical clustering. CO1- U
8. Why we need to implement Unsupervised Machine Learning? CO1- U
9. What are the types of Reinforcement Learning? CO1- U
10. List out the Applications in Game playing. CO1- U

PART – B (5 x 16= 80 Marks)

11. (a) Illustrate with an Example Supervised, Unsupervised and Reinforcement Learning and Discuss any four Examples of machine learning Applications. CO1- U (16)

Or

- (b) Explain in detail CO1- U (16)
- i) training Vs Testing
 - ii) Error and Noise
 - iii) Bias and Variance

12. (a) Suppose there is a marketing Company A, who does various Advertisement every year and get sales on that. The below list shows the Advertisement made by the Company in the last 5 years and the Corresponding Sales: CO2-App (16)

Advertisement	Sales
\$90	\$1000
\$120	\$1300
\$150	\$1800
\$100	\$1200
\$130	\$1380
\$200	?

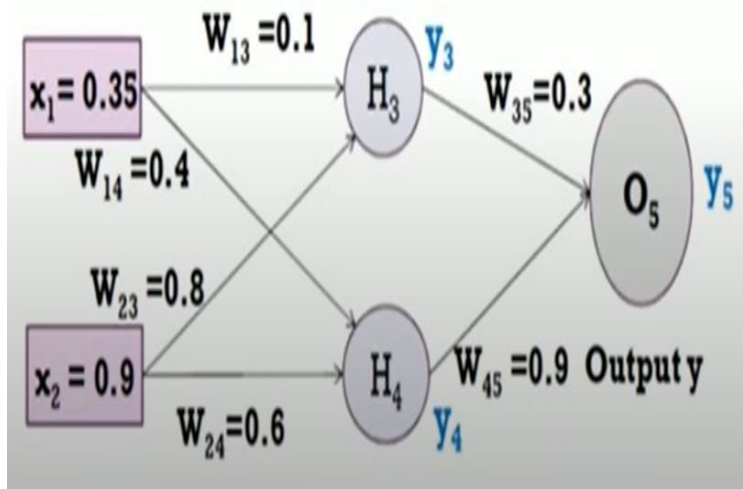
The Company wants to do the advertisement of \$200 in the year 2019 and wants to know the prediction about the sales for this year. Solve such type of prediction problems using Machine Learning Techniques.

Or

- (b) The following data set contains factors that determine whether tennis is played or not. Using Naive Bayes classifier, find the play prediction for the day <Sunny, Cool, High, Strong> CO2-App (16)

DAY	OUTLOOK	TEMP	HUMIDITY	WIND	PLAY
Day 1	Sunny	Hot	High	Weak	NO
Day 2	Sunny	Hot	High	Strong	NO
Day 3	Overcast	Hot	High	Weak	YES
Day 4	Rain	Mild	High	Weak	YES
Day 5	Rain	Cool	Normal	Weak	YES
Day 6	Rain	Cool	Normal	Strong	NO
Day 7	Overcast	Cool	Normal	Strong	YES
Day 8	Sunny	Mild	High	Weak	NO
Day 9	Sunny	Cool	Normal	Weak	YES
Day 10	Rain	Mild	Normal	Weak	YES
Day 11	Sunny	Mild	Normal	Strong	YES
Day 12	Overcast	Mild	High	Strong	YES
Day 13	Overcast	Hot	Normal	Weak	YES
Day 14	Rain	Mild	High	Strong	NO

13. (a) Assume that the Neurons have a Sigmoid Activation Function, CO2- App (16)
 Perform a Forward pass and a Backward pass on the Network.
 Assume that the actual output of Y is 0.5 and Learning rate is 1.
 Perform another Forward pass.



Or

- (b) Apply Classification and Regression Trees for the data set. The CO2- App (16)
 Target Attribute 'Job Offer' has 7 instances as Yes and 3 instances as No.

CGPA	Interactive	Practical Knowledge	Comm on Skills	Job Offer
≥ 9	Yes	Very Good	Good	Yes
≥ 8	No	Good	Moder ate	Yes
≥ 9	No	Average	Poor	No
< 8	No	Average	Good	No
≥ 8	Yes	Good	Moder ate	Yes
≥ 9	Yes	Good	Moder ate	Yes
< 8	Yes	Good	Poor	No
≥ 9	No	Very Good	Good	Yes
≥ 8	Yes	Good	Good	Yes
≥ 8	Yes	Average	Good	Yes

14. (a) Cluster the following data points into three clusters, where the point are A1(2,10), A2(2,5), A3(8,4), B1(5,8), B2(7,5), B3(6,4), C1(1,2), C2(4,9). CO2-App (16)

Or

- (b) Given the following data, use Principal Component Analysis to reduce the dimension from 2 to 1. CO2-App (16)

Feature	Example 1	Example 2	Example 3	Example 4
x	4	8	13	7
y	11	4	5	14

15. (a) Explain in detail about Reinforcement Learning and Direct Utility Estimation with Examples. CO1- U (16)

Or

- (b) Illustrate the following Reinforcement Learning of CO1- U (16)
- i) Applications in Game Playing
 - ii) Applications in Robot Control