Artificial Intelligence and Machine Learning (6CS012)

Time: 3 hrs **F.M: 100**

P.M: 40

All questions are compulsory

SET - 02

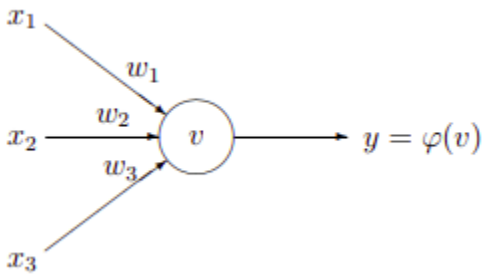
Multiple Choice Questions (1 * 10 = 10 Marks)

1. What are AI neural networks?
    a. Model how the human brain works
    b. Enables the machine to think and learn as humans do.
    c. Both of them
    d. None of them
2. Which of the following hyperparameter(s), when increased may cause the random forest to overfit the data?
    a. Number of Trees
    b. Depth of tree
    c. Learning Rate
    d. All of the above
3. Let's say, you are using activation function X in the hidden layers of the neural network. At a particular neuron for any given input, you will get the output as "-0.0001". Which of the following activation function could X represent?
    a. ReLu
    b. Tanh
    c. Sigmoid
    d. None of the above
4. Which of the following is leave-one-out-cross-validation accuracy for 3-NN(3- nearest neighbor)?
    a. 0.2
    b. 0.4
    c. 0.8
    d. 1

5. Which is false about the linear model?
    a. Errors in linearity assumptions
    b. Can't solve overfitting problems
    c. You can use it to calculate outcomes or binary outcomes
    d. Always autocorrelation
6. Why would you use batch normalization?
    a. To standardize the data before sending it to another layer
    b. To normalize the weights before sending it to another layer
    c. To evaluate the bias before sending it to another layer
    d. None of the above
7. The network that involves backward links from output to the input and hidden layers is called _____
    a. Self-organizing maps
    b. Perceptrons
    c. Recurrent neural network
    d. Multi-Layered Perceptron
8. What is the name of the function in the following statement "A perceptron adds up all the weighted inputs it receives, and if it exceeds a certain value, it outputs a 1, otherwise it just outputs a 0"?
    a. Step Function
    b. Heaviside Function
    c. Logistic Function
    d. Perceptron Function
9. Which produces hypotheses that are easy to read for humans?
    a. ILP
    b. Artificial Intelligence
    c. Propositional Logic
    d. First-order Logic
10. An algorithm A is admissible if _____
    a. It is not guaranteed to return an optimal solution when one exists
    b. It is guaranteed to return an optimal solution when one exists
    c. It returns more solutions, but not an optimal one
    d. It guarantees to return more optimal solutions

Short Questions (4*15 = 60 Marks)

1. Show that the angle between the tangents to the parabola $y^2 = 4x$ and $x^2 = 4y$ at their points of intersections other than the origin is $tan^{-1} = (\frac{3}{4})$.
2. Suppose that a credit card company decided to deploy a new system for assessing credit worthiness of its customers. The new system is using a feed-forward neural network with a supervised learning algorithm. Suggest in a form of an essay what should the bank have before the system can be used? Discuss problems associated with this requirement.
3. Below is the diagram of a single artificial neuron (unit):



The node has three inputs x = (x_1, x_2, x_3) that receive only binary signals (either 0 or 1). How many different input patterns this node can receive? What if the node had four inputs? Five? Can you give the formula that computes the number of binary input patterns for a given number of inputs?

4. In any 15-minute interval, there is a 20% probability that you will see at least one shooting star. What is the probability that you see at least one shooting star in a period of an hour?
5. Find the maximum area of a rectangular plot of land which can be enclosed by a rope of length 60 meters.
6. What cross-validation technique would you use on a time series data set?
7. Calculate using product moment formula, the coefficient of correlation between the prices and sales.

Price	20	21	28	26	20	18
Sales	60	54	66	68	53	57

8. Draw the graph of the following equations
   a. $y = \frac{1}{x}$
   b. $x^2 + y^2 = 9$
   c. y = |-2x|
   d. x = -3|siny|

9. Consider a train data set that has 1 million rows and 1000 columns is given to you. The set of data is based on a classification problem. If your manager has asked you to decrease the dimension of data so that it is possible to minimize model computing time. What would you do?

   Note: Your Computer has limitations on memory.

10. What are Tensors? How do you think Google is training data for self-driving cars?
11. You were asked to test a model of regression based on R^2, adjusted R^2, and tolerance. In which criteria you will evaluate a regression model.
12. Prove

    a. $\text{Cos}\Theta = \dfrac{\vec{a} \circ \vec{b}}{ab}$

    b. Why do we use cosine as the expression of vector dot product?
13. Why do not we initialize the weights of a neural network to zero?
14. "A system that acts like a human being is an intelligent system", justify the statement with reference to Turing Test. Also, make a comment on that.
15. You have come to realize that your model has a low bias and high variance. To tackle it, which algorithm do you use? Why?

Very Long Questions (10*3 = 30 Marks)

1. What do you mean by Occam's Razor? Define entropy, information-gain & confusion-matrix. How is splitting decided for Decision Trees? Discuss the pros & cons of the algorithm.
2. Compute the Tylor series of function: ln (1 + x). Write pseudocode to determine the value of $log_3 100$.
3. Find the eigenvectors, eigenvalues, eigenspace associated with eigenvalues, and eigen direction.

$$A = \begin{bmatrix} 8 & -6 & 2 \\ -6 & 7 & -4 \\ 2 & -4 & 3 \end{bmatrix}$$

Good Luck!

ALBERT EINSTEIN ONCE SAID, "If you want to live life, tie it to a goal, not to people or things"