CS 6301 MACHINE LEARNING

Tutorial 1

26.9.22

Max. Marks: 20

Part – A (8*2 = 16)

1. Justify the need for bias input in neural networks?
2. What is the activation function used in single layer perceptron? Can it be used as an activation function of a multilayer perceptron? Justify
3. Give one similarity and three differences between MLP and RBF network.
4. Define four metrics that can be used to evaluate the performance of a classifier.
5. What is early stopping?
6. Consider a single layer perceptron with the initial weight vector (0.3, 0.2,-0.1). What is the output for the input vector (1, 1) with a bias input of -1 and a threshold of 0?
7. Prove that a single layer perceptron cannot be used for solving XOR problem.
8. Give the equations for the following:
   a. Pseudo inverse computation method for weight updation
   b. Learning rule for single layer perceptron
   c. Activation of hidden layer in RBF network
   d. Response of output neuron in RBF network

Part – B (1*4=4)

9. Consider a 3-2-1 multilayer perceptron with the nodes serially numbered from 1 to 6 and the initial weights as shown below:

w14	w15	w24	w25	w34	w35	w46	w56	b4	b5	b6
0.2	-0.3	0.4	0.1	-0.5	0.2	-0.3	-0.2	-0.4	0.2	0.1

Consider the initial training sample as X = (1,0,1) whose class label is 1. Illustrate one iteration of MLP training. $\eta = 0.9$

Anna University: CEG Campus

Department of Computer Science and Engineering

Semester V

CS 6301 MACHINE LEARNING

Mid-Semester Examination

Date: 07.11.2022

Max. Duration: 1 ½ hours

Max. Marks: 50

Part – A (5 x 2 = 10 marks)

1. Justify the need for bias input in neural network.
2. Define any one performance evaluation metric for classification and one for regression.
3. Define early stopping.
4. What is the principle behind SVM? Give an advantage of using the SVM.
5. How is overfitting handled in decision trees?

Part – B (4 x 8 = 32 marks)

Answer any FOUR questions

6. i) Explain the steps in designing a learning system
   ii) Apply candidate elimination algorithm on the following dataset to learn the concept of "Japanese Economy Car":

Origin	Manufacturer	Color	Decade	Type	Example Type
Japan	Honda	Blue	1980	Economy	Positive
Japan	Toyota	Green	1970	Sports	Negative
Japan	Toyota	Blue	1990	Economy	Positive
USA	Chrysler	Red	1980	Economy	Negative
Japan	Honda	White	1980	Economy	Positive
Japan	Toyota	Green	1980	Economy	Positive
Japan	Honda	Red	1990	Economy	Negative

7. i) Design a single layer perceptron to model AND logic function. Show one iteration of the design process.
   ii) Substantiate the drawback of single layer perceptron
8. i) Derive the error equation for the error at the output layer that has a single hidden layer and uses the activation function $g(h)=\frac{1}{1+\exp(-\beta h)}$.
   ii) Brief on the design considerations when developing a MLP for a practical application.
9. i) Compare and contrast RBF network and multilayer perceptron. Give one similarity and three differences.
   ii) Write the algorithm for training an RBF network.

10. i) Consider the following dataset:

Outlook	Temperature Numeric	Temperature Nominal	Humidity Numeric	Humidity Nominal	Windy	Play
overcast	83	hot	86	high	FALSE	yes
overcast	64	cool	65	normal	TRUE	yes
overcast	72	mild	90	high	TRUE	yes
overcast	81	hot	75	normal	FALSE	yes
rainy	70	mild	96	high	FALSE	yes
rainy	68	cool	80	normal	FALSE	yes
rainy	65	cool	70	normal	TRUE	no
rainy	75	mild	80	normal	FALSE	yes
rainy	71	mild	91	high	TRUE	no
sunny	85	hot	85	high	FALSE	no
sunny	80	hot	90	high	TRUE	no
sunny	72	mild	95	high	FALSE	no
sunny	69	cool	70	normal	FALSE	yes
sunny	75	mild	70	normal	TRUE	yes

"Players will play if weather is sunny. Is this statement correct? Justify using Naïve Bayes.

ii) Identify an example of Gaussian mixture model and explain the algorithm.

Part – C (1 x 8 = 8 marks)

11. i) Construct a decision tree by applying C4.5 algorithm on the following dataset:

Color	Type	Doors	Tires	Class
Red	SUV	2	Whitewall	+
Blue	Minivan	4	Whitewall	-
Green	Car	4	Whitewall	-
Red	Minivan	4	Blackwall	-
Green	Car	2	Blackwall	+
Green	SUV	4	Blackwall	-
Blue	SUV	2	Blackwall	-
Blue	Car	2	Whitewall	+
Red	SUV	2	Blackwall	-
Blue	Car	4	Blackwall	-
Green	SUV	4	Whitewall	+
Red	Car	2	Blackwall	+
Green	SUV	2	Blackwall	-
Green	Minivan	4	Whitewall	-

ii) Write the Random Forest Training algorithm. Compare and contrast with boosting.