Department of Computer Engineering
University of Peradeniya

CO 544 Machine Learning and Data Mining

Tutorial 01

15^{th} of May 2020

Answer All questions below.

1. Show that the following perceptron model can be used to achieve an AND gate.
   (Activation function:Threshold function with output threshold value given as 0)

   $$x_1 + x_2 - 1.5 : (w_0 = -1.5, w_1 = 1, w_2 = 1)$$

   (a) Draw the schematic diagram of the perceptron model

   (b) Mark the outputs in a 2D plot and draw the model to visualize the separation of two classes.

   AND logic table:

A	B	Out
0	0	0
0	1	0
1	0	0
1	1	1

2. Three inputs with values given in the table below used as inputs to a neuron. The corresponding weights are $w_0 = 0.4, w_1 = 0.1, w_2 = 0.4, w_3 = 0.5$.

x_1	x_2	x_3
1	3	2
2	2	4
3	1	5
2	4	1
3	3	3

   If the activation function is the threshold function with output threshold value given as 3, calculate the outputs of this neuron corresponding to each row of the given table.

   Threshold function : $y = \begin{cases} 1 & v \geq 3 \\ 0 & v < 3 \end{cases}$; where v - output of the sigma function.

3. Consider the data set given below.

x_1	x_2	d
0	0	0
0	1	1
1	0	1
1	1	1

Consider a perceptron with the below activation function. If the threshold value v=0.5 and learning parameter value η =0.1, Show the updates of the weight parameter values till convergence using **Stochastic Gradient Decent(SGD)** method for optimisation.Consider the initial weight parameter values as: $w_1 = 0, w_2 = 0, w_0 = 0$

Note: Equation to update the weights when using SGD : $w_i(n+1) = w_i(n) + \eta * e(n) * x_i(n)$;

where, $e(n)$ is the prediction error for n^{th} instance; $e(n)$= Actual output ($d(n)$) - Predicted output ($y(n)$)