

Department of Computer Engineering
University of Peradeniya
CO 544 Machine Learning and Data Mining
Tutorial 01

15th of May 2020

Answer All questions below.

1. Show that the following perceptron model can be used to achieve an AND gate.

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

- (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 $\eta =0.1$, 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; $e(n) = \text{Actual output } (d(n)) - \text{Predicted output } (y(n))$