

MLT assignment 2

Ques 1

positive samples = 6
negative samples = 4

total samples = 10

$$H(S) = -p + \log_2(b+) - p - \log_2(p-)$$

$$p+ = \frac{6}{10}, \quad p- = \frac{4}{10}$$

$$\begin{aligned} H(S) &= -\left(\frac{6}{10} \log_2 \frac{6}{10}\right) - \left(\frac{4}{10} \log_2 \frac{4}{10}\right) \\ &\approx -(0.6 - 0.736) - (0.4 - 1.322) \\ &\Rightarrow 0.97 \text{ bits} \end{aligned}$$

Ques 2

K-NN classification ($K=3$)
nearest distances to neighbours

$$\text{distance 1} = 2.1$$

$$\text{distance 2} = 1.5$$

$$\text{distance 3} = 1.8$$

majority voting = 2 votes (C_2)

hence, predicted class is C_2 because of majority votes

Ques 3 Perceptron learning Algorithm:-

x_1	x_2	y	initial weights	updated weights
0	0	-1	[0, 0]	no change
0	1	-1	[0, 0]	[0, -1]
1	0	-1	[0, -1]	[-1, -1]
1	1	1	[-1, -1]	[0, 0]

hence convergence is achieved after all samples are correctly classified.

Ques 4 Gradient descent (delta Rule)

initial weights = $w_1 = 0.3$

$w_2 = 0.1$

bias = 0.1

learning rate: $\eta = 0.05$

input: $x_1 = 0.5$

$x_2 = 1.5$

target output = 1

compute the net output,

$$w_1 x_1 + w_2 x_2 + \text{bias} \\ \Rightarrow 0.3(0.5) + 0.1(1.5) + 0.1 \rightarrow 0.35$$

compute the error

$$\text{error} = \text{target} - \text{net output} = 1 - 0.35 \\ \Rightarrow 0.65$$

updated weights

$$\Delta w_1 = \eta \cdot \text{error} \cdot x_1 \rightarrow 0.05 \times 0.65 \times 0.5 \\ \Rightarrow 0.0162$$

$$\Delta w_2 = \eta \cdot \text{error} \cdot x_2 \rightarrow 0.05 \times 0.65 \times 1.5$$

$$2) 0.3162$$

$$W_2 = 0.4 + 0.487 = 1.487$$

$$W_{\text{max}} = 0.1 + (0.15) \cdot (0.65) = 0.1325$$

0.7	0.7	1	0	0
0.7	0.7	1	1	0
0.7	0.7	1	0	1
0.7	0.7	1	1	1

The above table is a representation of the state space of the system. The states are represented by the rows and the actions by the columns. The values in the cells represent the cost of the action in that state.

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