ML Assignment 2

Qu 1 positive samples = 6
negative samples = 4

total samples = 10

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

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

$$H(S) = -\left(\frac{6}{10}\log\frac{6}{10}\right) - \left(\frac{4}{10}\log_2\frac{4}{10}\right)$$

$$\simeq -(0.6 - 0.736) - (0.4 - 1.322)$$

$$\Rightarrow 0.97 \text{ bits.}$$

Qus 2 K-NN classification (K=3)
nearest distance to neighbours

distance 1 = 2.1
distance 2 = 1.5
distance 4 = 1.8

majority voting = 2 votes (C_2)

hence, predicted class is classified as C_2 because of majority votes

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Q3 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.

Q4 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:-

$w_1x_1 + w_2x_2 + \text{bias}$

$\Rightarrow 0.3(0.5) + 0.1(1.5) + 0.1 \rightarrow 0.35$

Compute the error =

error = target - net output = $1 - 0.35$

$\Rightarrow 0.65$

Updated weights

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

$\Rightarrow 0.0162$

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

$\Rightarrow 0.3162$

$w_2 = 0.1 + 0.487 = 1.487$

$bias = 0.1 + (0.5) \cdot (0.65) = 0.1325$.