

# VVP Engineering College, Rajkot

## GUJCOST Sponsored Two Day Workshop on MACHINE LEARNING

Date: 17<sup>th</sup> - 18<sup>th</sup> Sept, 2020

### Problem Set - 1:

#### Vector Formulas:

$$\text{Mean: } m = \mu = \frac{1}{N} \sum_{i=1}^N X(i)$$

$$\text{Sample Variance: } \sigma^2 = \frac{1}{N-1} \sum_{i=1}^N (X(i) - m)^2$$

$$\text{Euclidean Distance: } ED(A, B) = \sqrt{\sum_{i=1}^N (A(i) - B(i))^2}$$

$$\text{Cross Correlation: } r(A, B) = \frac{\sum_{i=1}^N [(A(i) - \mu_A)(B(i) - \mu_B)]}{\sqrt{\sum_{i=1}^N (A(i) - \mu_A)^2} \sqrt{\sum_{i=1}^N (B(i) - \mu_B)^2}}$$

#### Given the following vectors:

$$A = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10]$$

$$B = [4, 8, 12, 16, 20, 24, 28, 32, 36, 40]$$

$$C = [10, 9, 8, 7, 6, 5, 4, 3, 2, 1]$$

Sr.	Description	Answer
1	Ex. 1: Find the arithmetic mean of vector A, B and C	$\mu_A = \mu_C = 5.5, \mu_B = 22.0$
2	Ex. 2: Find the variance of the vector A, B and C	$\sigma_A^2 = \sigma_C^2 = 9.17, \sigma_B^2 = 146.67$
3	Ex. 3: Find the Euclidean distance between vector A and B	$ED(A, B) = 58.86$
4	Ex. 4: Find the correlation between vectors A & B and A & C	$r(A, B) = 1, r(A, C) = -1$

## Problem Set - 2:

### Formulas:

$$\text{Within Class Scatter: } S_W = \sum_{i=1}^C \sum_{x \in w_i} (x - m_i)(x - m_i)^T$$

$$\text{Between Class Scatter: } S_B = \sum_{i=1}^C n_i (m_i - m)(m_i - m)^T$$

$$\text{Total Scatter: } S_T = \sum_{i=1}^M (x_i - m)(x_i - m)^T$$

### Consider following three vectors representing features of three classes:

$$A = [1, 2, 4, 7, 4, 4, 7, 3, 6, 5]$$

$$B = [3, 1, 4, 6, 7, 3, 5, 4, 2, 5]$$

$$C = [9, 8, 1, 1, 2, 8, 2, 9, 1, 2]$$

### Problems:

**Ex 1:** Find within class scatter for the vectors A, B and C

**Ex 2:** Find between class scatter for the vectors A, B and C

**Ex 3:** Find total scatter for the vectors A, B and C

Sr.	Description	Answer
1	<b>Ex 1:</b> Find within class scatter for the vectors A, B and C	$SW_A = 36.1,$ $SW_B = 21.6,$ $SW_C = 120.1$
2	<b>Ex 2:</b> Find between class scatter for the vectors A, B and C	$S_B = 0.07$
3	<b>Ex 3:</b> Find total scatter for the vectors A, B and C	$S_T = 177.8$