CAE-1

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PART-B

(7) Given matrix,

$$A = \begin{bmatrix} 8 & 7 \\ 2 & 3 \end{bmatrix}$$

$$\det|A - \lambda I| = 0$$

$$\det\left|\begin{bmatrix} 8 & 7 \\ 2 & 3 \end{bmatrix} - \lambda\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix}\right| = 0$$

$$\det\left|\begin{bmatrix} 8 & 7 \\ 2 & 3 \end{bmatrix} - \begin{bmatrix} \lambda & 0 \\ 0 & \lambda \end{bmatrix}\right| = 0$$

$$\det\left|\begin{bmatrix} 8-\lambda & 7 \\ 2 & 3-\lambda \end{bmatrix}\right| = 0 \quad \text{— (1)}$$

$$(8-\lambda)(3-\lambda) - (2)(7) = 0$$

$$24 - 8\lambda - 3\lambda + \lambda^2 - 14 = 0$$

$$\lambda^2 - 11\lambda + 10 = 0$$

$$\lambda^2 - 11\lambda + 10 = 0$$

$$\lambda^2 - 10\lambda - \lambda + 10 = 0$$

$$\lambda(\lambda - 10) - 1(\lambda - 10) = 0$$

$$(\lambda - 1)(\lambda - 10) = 0$$

$$\lambda = 1, 10$$

The Eigen values are

$$\lambda = 1, 10$$

when $\lambda = 1$

from (1) sub $\lambda = 1$

$$\begin{bmatrix} 8-\lambda & 7 \\ 2 & 3-\lambda \end{bmatrix}$$

$$\begin{bmatrix} 7 & 7 \\ 2 & 2 \end{bmatrix}$$

$$\begin{bmatrix} 7 & 7 \\ 2 & 2 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$$7x + 7y = 0$$

$$2x + 2y = 0$$

$$7x + 7y = 0$$

$$7x = -7y$$

$$x = -y$$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} -1 \\ 1 \end{bmatrix}$$

when $\lambda = 10$

from (1) sub $\lambda = 10$

$$\begin{bmatrix} 8-\lambda & 7 \\ 2 & 3-\lambda \end{bmatrix}$$

$$\begin{bmatrix} -2 & 7 \\ 2 & -7 \end{bmatrix}$$

$$\begin{bmatrix} -2 & 7 \\ 2 & -7 \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}$$

$-2x + 7y = 0$

$2x - 7y = 0$

$-2x + 7y = 0$

$7y = 2x$

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} 7 \\ 2 \end{bmatrix}$$

The Eigen value and Eigen vectors are

$\lambda = 1, 10$

$$\begin{bmatrix} -1 \\ 1 \end{bmatrix}, \begin{bmatrix} 7 \\ 2 \end{bmatrix}$$

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(8) Normal distribution a bell-shaped, symmetrical distribution in which the mean, median and mode are all equal to z score (also known as standard deviation): the number of standard deviation that a given raw score falls above or below the mean standard deviation normal distribution.

The normal distribution is an important class of statistical Distribution that has a wide range of applications. The distribution applies in most Machine Learning Algorithms and the the concept of the Normal distribution is a must for any statistican, Machine Learning Engineer and Data Scientist.

Parameters of Normal Distribution

-> Mean
-> Standard Deviation

Properitis of Normal Distribution

-> Symmetricity
-> Measures of Central Tendencies are equal
-> Empirical Rule
-> Skewness and kurtosis
-> the area under the curve

The different types of normal distribution:

Mean:

The mean represents the average value of the dataset. It can be calculated as the sum of all the values in the dataset divided by the number of values. In general it is considered as orithematic mean.

It is observed that

Eg: 1 5 4 3 2

$1+5+4+3+2 = 15$

$N = 5$

$15/5 = 3$

Mean = 3

Median

The median is simple another name for the 50th percentile. Sort the data from the highest to lowest. Find the score in the middle. If N, the number of scores, is even the median is the average of the midde two elements.

Eg: 1 5 4 3 2

1 2 3 4 5

$(N+1)/2 = (5+1)/2 = 6/2 = 3$

Middle score = median = 3

Mode:

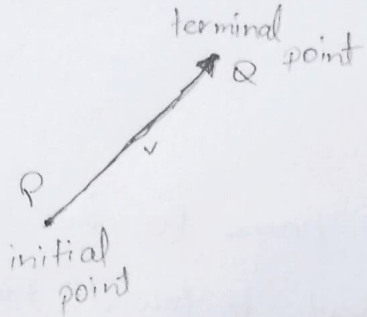
The mode is the score that occurs most frequently in a set of data.

Eg: 3 (1) 5 7 13 3 (2) 7 9 3 (3)

mode = 3

PART-A

① Vectors can be represented geometrically by arrows (directed line segments). The arrow head indicates of the vector, and the length of the arrow discribes the magnitude of the vector.



A vector with initial point P and terminal point Q can be represented by $\overrightarrow{PQ}$, v, or $\vec{v}$.

② In a defined system, a matrix is just a container for entries and it doesn't change if any change occurs in the system, where as a tensor is an entity in the system that interacts with other entities in a system and changes its value other values change.

(3) Values: 1 2 4 7

Mean:

1 + 2 + 4 + 7

= 14

14/4 = 3.5

Mean = 3.5

Median

(2+4) ÷ 2 = 6 ÷ 2 = 3

Median = 3

Mode:

Since no number is repeated.

mode: none

Range

Highest = 7

Lowest = 1

= Higest - lowest

= 7 - 1

= 6

Range = 6

(4) If two vectors are perpendicular, then their dot product will be equal to zero. the cross product of two vectors is defined to be vector that is perpendicular to both of them.

(5) Rank of a matrix is equal to the maximum number of linearly independent row vectors in a matrix A set of vector is linearly dependent if we can express at least one of the vectors as a linear combination of remaining vectors in a set.

To calculate Rank of the matrix, there are two methods.

1. Minor method
2. Echelon form

Eg: $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 1 & 4 \\ 3 & 0 & 5 \end{bmatrix}$

$R_2 \to R_2 - 2R_1$

$R_3 \to R_3 - 3R_1$

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 & -2 \\ 0 & -6 & -4 \end{bmatrix}$$

$R_3 \to R_3 - 2R_2$

$$\begin{bmatrix} 1 & 2 & 3 \\ 0 & -3 & -2 \\ 0 & 0 & 0 \end{bmatrix}$$

Number of non-zero rows = 2

Hence, the rank of matrix A = 2