25.02.2024

PCA

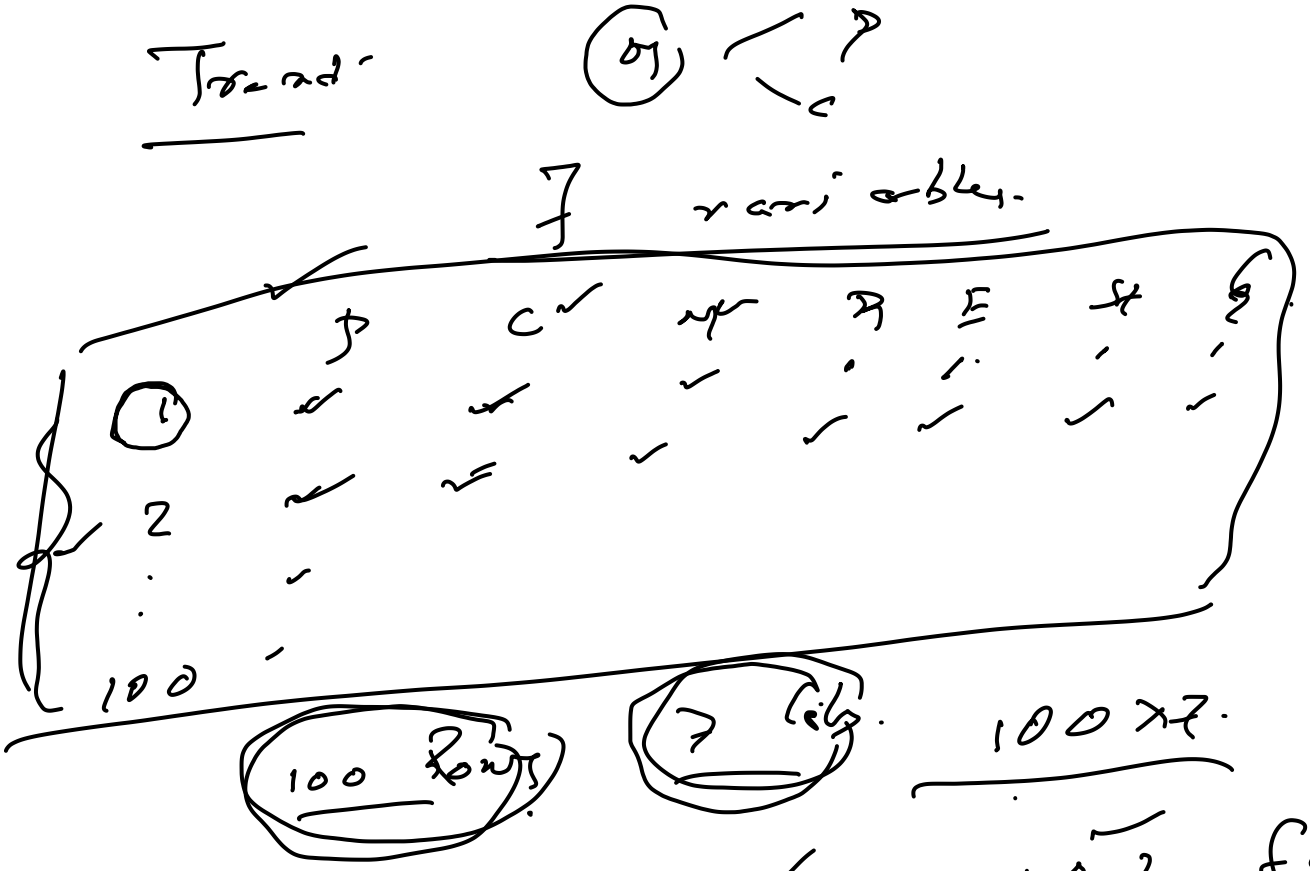
Multivariable

5
1. Dimension
2. Sorting & grouping
3. Dependence among the variables
4. Prediction → Time
→ Prob.
5. Hyp. Construction & Testing

PCM → Basic Sc.
EB → Language
HS → Social Sc.
→ 7 subjects

7
G1 → PCM
G2 → EB
G3 → HS

Trend.



Step (1). Find mean & S.d. for each variable.

Step (2) (Covariance). Find the Covariance matrix.

Step (3). Find the Correlation matrix (this is very simple to understand.

Covariance matrix :

$$\begin{pmatrix} x_1 & x_2 & x_3 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{pmatrix}$$

Diagonal matrix.

$v(x_1)$
$v(x_2)$
$v(x_3)$

$c_{12} = c_{21}$.
$c_{13} = c_{31}$
$c_{23} = c_{32}$

When there are 3 variables.

You have to Compute

$(3C_1) = 3$ → variables

Correlations = $\binom{3}{C_2} = 3$.

To Compute

$$\begin{matrix} x_1 \\ x_3 \\ x_3 \end{matrix} \begin{pmatrix} v(x_1) & C_{12} & C_{13} \\ C_{21} & v(x_2) & C_{23} \\ C_{31} & C_{32} & v(x_3) \end{pmatrix}_{3\times 3}$$

$$\left.\begin{aligned} v(x_1) &= 1 \\ v(x_2) &= 5 \\ v(x_3) &= 2 \end{aligned}\right\} \quad \left\{\begin{aligned} C_{12} &= C_{21} = -2 \\ C_{13} &= C_{31} = 0 \\ C_{23} &= C_{32} = 0 \end{aligned}\right.$$

$$\begin{pmatrix} 1 & -2 & 0 \\ -2 & 5 & 0 \\ 0 & 0 & 2 \end{pmatrix}_{3\times 3}$$

$x_1 \quad x_2 \quad x_3 \quad x_3$

No of variables $= (4C_1) = 4$.

No of Correlations $= (4C_2) = 6$

$$\begin{pmatrix} v(x_1) & C_{12} & C_{13} & C_{14} \\ C_{21} & v(x_2) & C_{23} & C_{24} \\ C_{31} & C_{32} & v(x_3) & C_{34} \\ C_{41} & C_{42} & C_{43} & v(x_4) \end{pmatrix}_{4\times 4}$$

$r(x_1) = 1 \quad r(x_2) = 5 \quad r(x_3) = 3 \quad r(x_4) = 6$

$C_{12} = 2 \quad C_{13} = 0 \quad C_{14} = -2$

$C_{23} = 5 \quad C_{24} = -1 \quad C_{34} = 3$

$4 + 6 = (10)$

$$\begin{pmatrix} 5 & 2 & 0 & -2 \\ 2 & 5 & 5 & -1 \\ 0 & 5 & 3 & 3 \\ -2 & -1 & 3 & 6 \end{pmatrix} \quad 4 \times 4$$

7×7 Correlation

$1 \quad r_{12} \quad r_{13} \quad r_{14} \quad r_{15} \quad r_{16} \quad r_{17}$

variables.

$$C(7,2) = \frac{7 \times 6}{2} = (21)$$

P C M.

G1. no. of Combination

$= (3C_2) = 3$

P E.

$G_2 = (2C_2) = 1$

W C

$G_3 = (2C_2) = 1$

$3 + 1 + 1 = 5$ ans

7

G_1 G_2 G_3

3 Dimension Relation

Banking Element Food

P C M

G1. How many members in the groups?

In G1. no of members = 3.

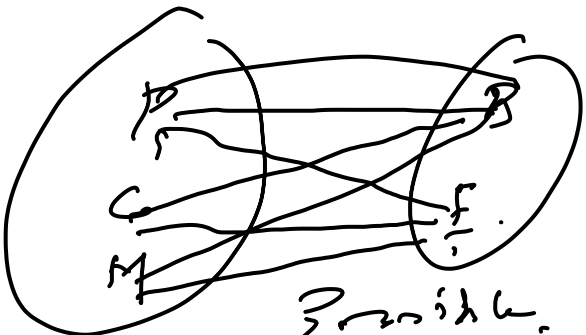
In G_2 no of members = 2

In G_3 " " " = 2.

Association many occur between

G_1 & G_2. G_1 & G_3 G_2 & G_3.

G_1 & G_3



6

no of a possible association

= 6

G_2 & G_3

4

$6+6+4$
$= 16$

$[{}^7C_2]$

$21 = 5 + 16$

Total x y z.

Combination among x, y & z

xy. xz. yz.

x_1 x_2 x_3.

x_1 = DV

x_2 & x_3 = IV.

Three types of models

1. Independent.
2. Hypothetical.
3. Confirmatory.

} If r_{12} = (27)

x_1 x_2 x_3.

Completely ind.

They are

$r_{12} = 0$. $r_{13} = 0$ $r_{23} = 0$

$$I = \begin{array}{c} \\ x_1 \\ x_2 \\ x_3 \end{array} \begin{array}{c} \begin{array}{ccc} x_1 & x_2 & x_3 \end{array} \\ \begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix} \end{array}$$

Identity or unit matrix.

$$\begin{vmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{vmatrix} = 1. \quad |I| = 1.$$

$$\begin{array}{c} \\ x_1 \\ x_2 \\ x_3 \end{array} \begin{pmatrix} 1 & 0.99 & 0.98 \\ 0.99 & 1 & 0.90 \\ 0.97 & 0.90 & 1 \end{pmatrix}_{3\times 3}$$

$r_{12} = 0.99$ $\quad r_{13} = 0.97$)

$r_{23} = .90$

$|A| \to 0.$ ∠

If $\quad p - \text{value} > 0.05$

$\Rightarrow$ No linear association between two variables.

$p - \text{value} \leq 0.05$

9 variables $\equiv$ Inv. ||

1 Dv.

To get a model.

To improve R^2.

(9) (7)

Step wise Regression

(2) $R^2 = 0.743$

(9) $R^2 = 0.791$ → Maximum

(1) $R^2 = 0.49$ → Minimum

(2) $R^2 = 0.633$