

การวัดค่าเฉลี่ย

การวัดค่าเฉลี่ย 2 วิธี คือ วิธีแรก = แปลงเป็นข้อมูล 1 วิธี คือ วิธีที่สอง

| จุดข้อมูล | X | Y | ① ค่าเฉลี่ย |
|-----------|---|---|--|
| A | 2 | 1 | $X = \frac{(2+4+5+7)}{4} = \frac{18}{4} = 4.5$ |
| B | 4 | 3 | $Y = \frac{(1+3+5+5)}{4} = \frac{14}{4} = 3.5$ |
| C | 5 | 5 | |
| D | 7 | 5 | |

การวัดค่าเฉลี่ย

| P(x,y) | X | Y | P | X | Y |
|--------|----------------|----------------|---|------|-----|
| A' | $2-4.5 = -2.5$ | $1-3.5 = -2.5$ | A | -2.5 | 2.5 |
| B' | $4-4.5 = -0.5$ | $3-3.5 = -0.5$ | B | -0.5 | 0.5 |
| C' | $5-4.5 = 0.5$ | $5-3.5 = 1.5$ | C | 0.5 | 1.5 |
| D' | $7-4.5 = 2.5$ | $5-3.5 = 1.5$ | D | 2.5 | 1.5 |

② การวัดค่า

$$\text{Cor} = (x_1, x_1) = \frac{(2-1.5)(2-1.5) + (4-1.5)(4-1.5) + (5-1.5)(5-1.5) + (7-1.5)(7-1.5)}{4-1}$$

$$= \frac{13}{3} = 4.33 \neq$$

$$\text{Cor} = (x_1, x_2) = \frac{(2-4.5)(1-3.5) + (4-4.5)(3-3.5) + (5-4.5)(5-4.5) + (7-4.5)(5-3.5)}{4-1}$$

$$= \frac{11}{3} = 3.66 \neq$$

$$\text{Cor} = (x_2, x_1) = \frac{(1-3.5)(2-4.5) + (3-3.5)(4-4.5) + (5-3.5)(5-4.5) + (5-3.5)(7-4.5)}{4-1}$$

$$= \frac{11}{3} \approx 3.66 \neq$$

$$\text{Cor}(x_1, x_2) = \frac{(1-3.5)(1-5.5) + (3-5.5)(3-5.5) + (5-3.5)(5-5.5) + (5-5.5)(5-3.5)}{4.0}$$

$$= \frac{11}{5} = 3.66 \quad \neq$$

③ սիստեմ (λ)

$$\det \begin{bmatrix} 4.33 & 3.66 \\ 3.66 & 3.66 \end{bmatrix} - \lambda \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} = 0 \quad \begin{cases} (4.33 - \lambda)(3.66 - \lambda) - 13.39 = 0 \\ = 4.33 \times 3.66 - 4.33\lambda - 3.66\lambda + \lambda^2 \\ 4.33 \times 3.66 = 15.8478 \\ \therefore \lambda - 7.99 + 15.8478 \end{cases}$$

$$\det \begin{bmatrix} 4.33 & 3.66 \\ 3.66 & 3.66 \end{bmatrix} - \begin{pmatrix} \lambda & 0 \\ 0 & \lambda \end{pmatrix} = 0$$

$$\det \begin{bmatrix} 4.33 - \lambda & 3.66 \\ 3.66 & 3.66 - \lambda \end{bmatrix} = 0 \quad \begin{cases} (3.66)(2.66) = 13.39 \\ (1.33 - \lambda)(3.66) \end{cases}$$

Գտնենք սիստեմի $\lambda = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

$$\lambda = \frac{7.99 \pm \sqrt{(-7.99)^2 - 4(1)(2.3578)}}{2(1)}$$

$$= \frac{7.99 \pm \sqrt{63.82 - 9.43}}{2}$$

$$= \frac{7.99 \pm \sqrt{54.39}}{2}$$

$$= \frac{7.99 \pm 7.37}{2}$$

$$\lambda^+ = \frac{7.99 + 7.37}{2} = \frac{15.36}{2} = 7.61$$

$$\lambda^- = \frac{7.99 - 7.37}{2} = \frac{0.62}{2} = 0.32$$

\therefore քաղցր սիստեմ ($\lambda = 7.61$)

ստեմի ($C - \lambda I$) $V_1 = 0$

$$\begin{bmatrix} 4.33 & 3.66 \\ 3.66 & 3.66 \end{bmatrix} - \lambda \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 0$$

$$\begin{bmatrix} 4.33 & 3.66 \\ 3.66 & 3.66 \end{bmatrix} - \lambda \begin{pmatrix} 7.57 & 0 \\ 0 & 7.57 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 0$$

$$\begin{bmatrix} 4.33 - 7.57 & 3.66 \\ 3.66 & 3.66 - 7.57 \end{bmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 0$$

$$\begin{bmatrix} -3.24 & 3.66 \\ 3.66 & -4.01 \end{bmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 0$$

$$\begin{pmatrix} -3.24x + 3.66y \\ 3.66y - 4.01x \end{pmatrix} = 0$$

$$-3.24x - 3.66 = 0 \quad 3.66 + 4.01 = 0$$

$$= \frac{3.66}{3.66} = 0.31x \quad Y = \frac{3.66}{4.01} = 0.31x$$

$$\therefore Y = 0.31x$$

9) $Y = 0.31$ แล้ว $x = 1$ $z = 0$ $V = [1, 0, 0]$

10) $line = \sqrt{x^2 + y^2}$ $||v|| = \sqrt{1^2 + 0.31^2} = \sqrt{1.123} = 1.052$

11) V 2 มิติ $\hat{V} = V / ||V||$

$X_{unit} = \frac{1}{1.052} \approx 0.949$

$Y_{unit} = \frac{0.31}{1.052} = 0.673$ $PC1 = [0.949, 0.673]$

12) P_1 บนระนาบ $PC1 = [0.949, 0.673] \times$ ค่า x และ y

$A = (-1.5)(0.949) + (-2.5)(0.673) = -3.53$

$B = (-0.5)(0.949) + (-0.5)(0.673) = -0.91$

$C = (0.1)(0.949) + (1.5)(0.673) = 1.33$

$D = (2.5)(0.949) + (1.5)(0.673) = 2.36$

13) พหุนาม 2D (x, y) เป็น 2D

14) พหุนาม 2 มิติ 4 ตัว

| id | x | y |
|----|---|---|
| E | 1 | 5 |
| F | 2 | 3 |
| G | 4 | 2 |
| H | 5 | 1 |

15) ค่าเฉลี่ย $X = \frac{1+2+4+5}{4} = \frac{12}{4} = 3$
 $Y = \frac{(5+3+2+1)}{4} = \frac{11}{4} = 2.75$

16) พหุนาม

| id | x | y |
|----|------------|------------------|
| E | $1-3 = -2$ | $5-2.75 = 2.25$ |
| F | $2-3 = -1$ | $3-2.75 = 0.25$ |
| G | $4-3 = 1$ | $2-2.75 = -0.75$ |
| H | $5-3 = 2$ | $1-2.75 = -1.75$ |

② $\hat{\sigma}_{1404}$

$$\begin{aligned} \text{Cov}(x_1, x_1) &= \frac{(2-3)(2-3) + (5-3)(2-3) + (4-3)(4-3) + (5-3)(5-3)}{4-1} = \frac{10}{3} = 3.33 \\ \text{Cov}(x_1, x_2) &= \frac{(2-3)(5-2.35) + (2-3)(5-2.35) + (4-3)(2-2.35) + (5-3)(2-2.35)}{4-1} = \frac{-9}{3} = -3 \\ \text{Cov}(x_2, x_1) &= \frac{(5-2.35)(2-3) + (5-2.35)(2-3) + (2-2.35)(1-3) + (2-2.35)(5-3)}{4-1} = \frac{-9}{3} = -3 \\ \text{Cov}(x_2, x_2) &= \frac{(5-2.35)(5-2.35) + (5-2.35)(5-2.35) + (2-2.35)(2-2.35) + (2-2.35)(2-2.35)}{4-1} = \frac{6.75}{3} = 2.25 \end{aligned}$$

$$= 2.32$$

$$\begin{bmatrix} 3.33 & -3 \\ -3 & 2.32 \end{bmatrix} \lambda$$

③ $\hat{\sigma}_{1404} \lambda$ $(3.33 - \lambda)(2.32 - \lambda) - 9 = 0$, $= 3.33 \times 2.32 - 3.33 - 2.32 + \lambda^2$
 $= 3.70 \times 2.32 = 1.226$

$$\det \left[\begin{pmatrix} 3.33 & -3 \\ -3 & 2.32 \end{pmatrix} - \lambda \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \right] = 0 \quad \therefore \lambda^2 - (3.33 + 2.32)\lambda + 1.226$$

$$\det \left[\begin{pmatrix} 3.33 & -3 \\ -3 & 2.32 \end{pmatrix} - \begin{pmatrix} \lambda & 0 \\ 0 & \lambda \end{pmatrix} \right] = 0 \quad = 11 - 6.25 + 2.326$$

$$\det \left[\begin{pmatrix} 3.33 - \lambda & -3 \\ -3 & 2.32 - \lambda \end{pmatrix} \right] = 0 \quad \begin{matrix} (-3)(-3) - 9 \\ (-3.33)(2.32 - \lambda) \end{matrix} \quad \begin{matrix} = \lambda^2 - 6.25 + 2.326 - 3 = 0 \\ = \lambda^2 - 6.25 + 0.3276 = 0 \end{matrix}$$

$\hat{\sigma}_{1404} \lambda = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
 $\lambda = \frac{6.25 \pm \sqrt{(5.25)^2 - 4(1)(0.3276)}}{2}$
 $= \frac{6.25 \pm \sqrt{27.5625 - 1.3104}}{2}$
 $= \frac{6.25 \pm 5.014}{2}$

$$\lambda = \frac{6.25 + 5.014}{2} = \frac{11.264}{2} \approx 6.13$$

$$\lambda = \frac{6.25 - 5.014}{2} = \frac{1.236}{2} \approx 0.12$$

$\therefore \hat{\sigma}_{1404} \lambda = 6.13$

$$\left[\begin{pmatrix} 3.33 & -3 \\ -3 & 2.32 \end{pmatrix} - \lambda \begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix} \right] \begin{pmatrix} x \\ y \end{pmatrix} = 0 \quad \begin{matrix} -2.8 = 11(3.07) = 0 \\ (-3x) - 3.27y = 0 \end{matrix}$$

$$\left[\begin{pmatrix} 3.33 & -3 \\ -3 & 2.32 \end{pmatrix} - \begin{pmatrix} 6.13 & 0 \\ 0 & 6.13 \end{pmatrix} \right] \begin{pmatrix} x \\ y \end{pmatrix} = 0 \quad \begin{matrix} Y = \frac{2.8x}{3} \\ Y = 0.33x \end{matrix}$$

$$\left[\begin{pmatrix} 3.33 - 6.13 & -3 \\ -3 & 2.32 - 6.13 \end{pmatrix} \right] \begin{pmatrix} x \\ y \end{pmatrix} = 0 \quad \begin{matrix} Y = 0.33x \\ Y = 0.33x \end{matrix}$$

$$\begin{pmatrix} -2.8 & -3 \\ -3 & -3.81 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix} = 0$$

$$\begin{pmatrix} -2.8 & -3 \\ -3 & -3.81 \end{pmatrix} = 0 \quad Y = 0.33x$$