

YIFAN YU
CSE 60647
DATA SCIENCE HM 1 WATKIN

1. $N=1,000,000$

SAMPLE $n=9$ $\mu=10$ $v=18$

SAMPLE+1 $n+1=10$ μ' ? v' ? $x_{n+1}=20$

$$\mu = 10 = \frac{1}{n} \sum_{i=1}^n x_i$$

$$\sum_{i=1}^n x_i = \mu \cdot n = 9 \times 10 = 90$$

$$\mu' = \frac{1}{n+1} \sum_{i=1}^{n+1} x_i$$

$$\sum_{i=1}^{n+1} x_i = \sum_{i=1}^n x_i + x_{n+1}$$

$$= 90 + 20 = 110$$

$$110 = (n+1) \mu'$$

$$110 = 10 \mu'$$

$$\mu' = 11$$

$$v = 18 = \frac{1}{n-1} \sum_{i=1}^n (x_i - \mu)^2$$

$$v' = \frac{1}{n+1-1} \sum_{i=1}^{n+1} (x_i - \mu')^2$$

$$n \cdot v' - (n-1)v = \sum_{i=1}^{n+1} (x_i - \mu')^2 - \sum_{i=1}^n (x_i - \mu)^2$$

$$= (x_{n+1} - \mu')^2 + \sum_{i=1}^n ((x_i - \mu')^2 - (x_i - \mu)^2)$$

$$= (x_{n+1} - \mu')^2 + \sum_{i=1}^n (2x_i - \mu - \mu')(\mu' - \mu)$$

$$\mu' = x_{n+1}$$

$$= (x_{n+1} - \mu') (x_{n+1} - \mu' - \mu + \mu')$$

$$= (x_{n+1} - \mu') (x_{n+1} - \mu)$$

$$9 \times v' - 8 \times 18 = (20 - 11)(20 - 9)$$

$$= 99$$

$$v' = 27$$

2. (2,5) (3,8) (5,10) (4,11) (6,14)

$$r = \frac{n(\sum xy) - (\sum x)(\sum y)}{\sqrt{[n\sum x^2 - (\sum x)^2][n\sum y^2 - (\sum y)^2]}}$$

$$\sum xy = 10 + 24 + 50 + 44 + 84 = 212$$

$$\sum x = 20 \quad \sum y = 48$$

$$\sum x^2 = 90 \quad \sum y^2 = 816 \quad n=5$$

$$r = \frac{5 \times 212 - 20 \times 48}{\sqrt{(90 \times 5 - 20^2)(816 \times 5 - 48^2)}}$$

$$= \frac{1060 - 960}{\sqrt{50 \times 226}} \quad \text{Sol}$$

$$= \frac{100}{\sqrt{11300}}$$

$$= \frac{100}{106.301} = 0.9407$$

RISING TOGETHER.

$$Y = wX + b$$

$$= w_1 X_1 + \dots + w_K X_K + b$$

$$Y = w_1 X_1 + \dots + w_K X_K + w_{K+1} \bar{X} + b$$

$$\bar{X} = \frac{X_1 + \dots + X_K}{K} \quad K\bar{X} = X_1 + \dots + X_K$$

$$Y = (w_1 - 1)X_1 + \dots + (w_K - 1)X_K + \frac{w_{K+1}}{K} \bar{X} + b$$

$$R = 1 - \frac{\sum_{i=1}^{K+1} (y_i - \bar{y})^2}{\sum_{i=1}^{K+1} (y_i - \bar{y})^2}$$

$$Y_{K+1} - \bar{y} = 0 \quad Y_{K+1} = \bar{y}$$

R STAY THE SAME