Lec 03 Monday, January 9, 2023 1:19 PM

> Assignment 1 (due 01/23) is available on canvas and course website

Recap of lec 02

Population vs Sample

| location | M | 4 |
|----------|---|---|
| spread | σ | S |

probability density = f -> probability = f × h

- random sample : each sample has equal chance of getting picked

single variable (V2) Multivariable/variates

Normal distribution > Central limit effect "experimental error tends \$0 be symmetric"

$$P(Y) = \frac{1}{\sigma\sqrt{2\pi}} \exp\left(-\frac{(y-\mu)^2}{2\sigma^2}\right)$$

probahiuity densily
$$\int_{-\alpha}^{\alpha} p(y) \, dy = 1$$

Z (standarized variate of y) =
$$\frac{y - \mu}{\sigma}$$

 $\mathbb{E}[z] = 0$, $\sigma(z) = 1$

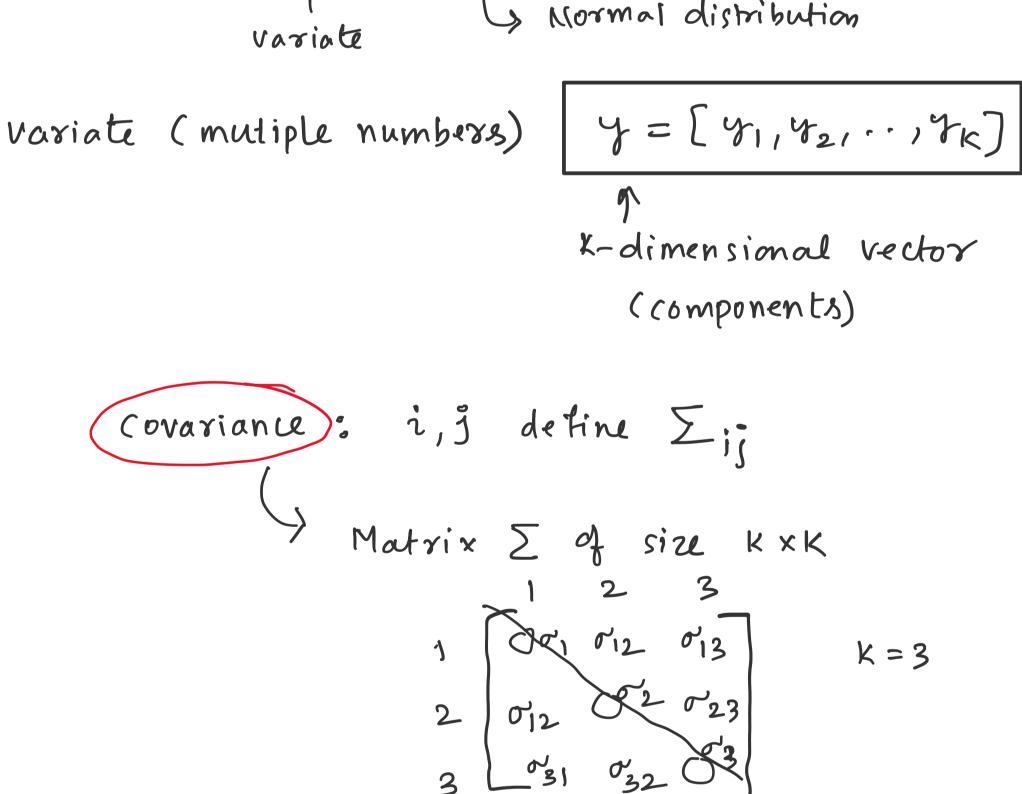
Z - discounts for magnitude effects

score for each variate based P(Z) (z-score, normalization score

$$P(z) = \frac{1}{\sqrt{2\pi}} \exp\left(-\frac{z^{\nu}}{2}\right) \rightarrow \mathcal{N}(\mu, \sigma)$$

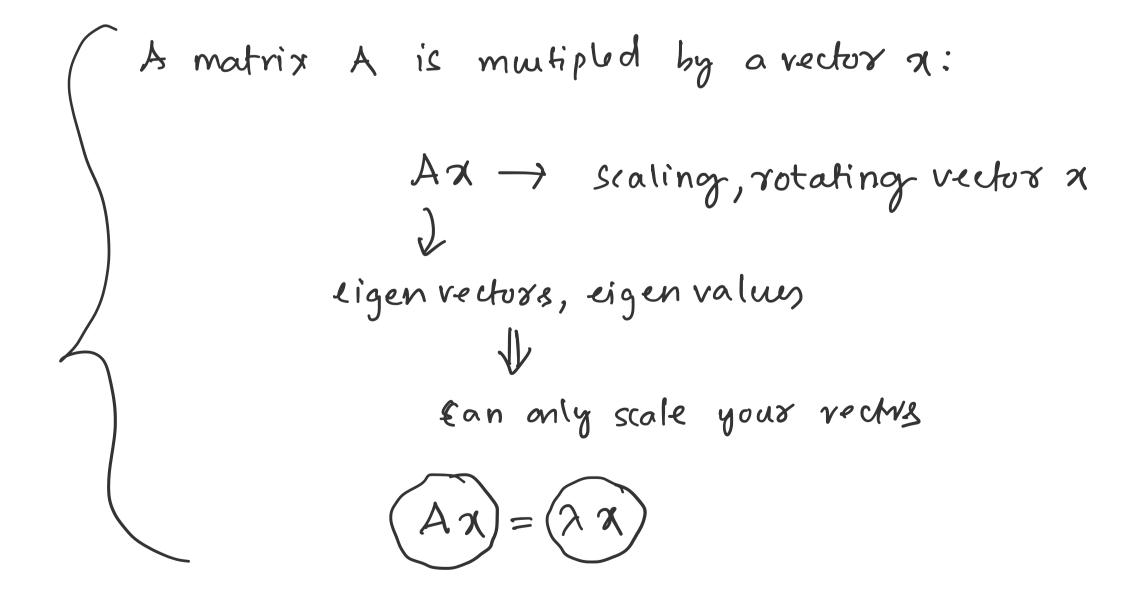
$$\int_{\sqrt{2\pi}}^{\sqrt{2\pi}} \int_{\sqrt{2\pi}}^{\sqrt{2\pi}} \frac{1}{2} \exp\left(-\frac{z^{\nu}}{2}\right) \rightarrow \mathcal{N}(\mu, \sigma)$$

$$\int_{\sqrt{2\pi}}^{\sqrt{2\pi}} \int_{\sqrt{2\pi}}^{\sqrt{2\pi}} \frac{1}{2} \exp\left(-\frac{z^{\nu}}{2}\right) \rightarrow \mathcal{N}(\mu, \sigma)$$



location of $\mathcal{Y}_{\mathcal{K}}$: $\mathbb{E}[\mathcal{Y}] = [\mathbb{E}[\mathcal{Y}_1], \dots, \mathbb{E}[\mathcal{Y}_n]_{1\times \mathcal{K}} = \mathcal{M}$ $\sum_{i} = \mathbb{E}\left[(y_i - \mu)(y_j - \mu)\right]$

eigen values of Zij are all positive; then I is called a positive definite matrix



mutivariate normal distribution

$$P(Y) = \frac{1}{\sqrt{|z||K|}} \exp\left(-\frac{1}{2}(y-\mu)^{T} \sum_{i=1}^{-1} (y-\mu)\right)$$

For a 2D case: yz, y2 $\neg \mu = [0.5, -0.5] = (E[y_1], E[y_2])$ $\sum = \begin{bmatrix} 2.0 & 0.0 \\ 0.0 \end{bmatrix} \frac{1.0}{2 \times 2}$ $y_{1} \sim \mathcal{N}(0.5, 2.0)$