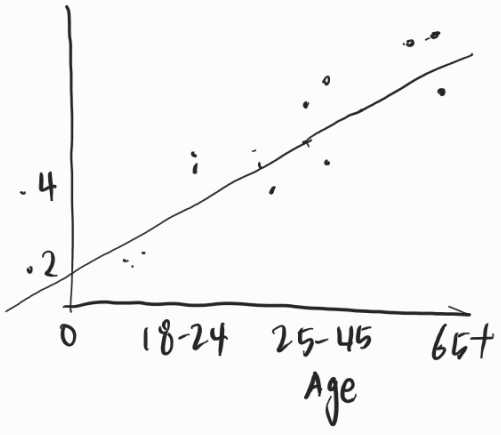
Project : 10%

3-5 group people

① Dataset Real 100+ LLS

② Analyze Results



is LLS group model?

③ 2-4 page paper

1) Intro
2) Explain Everything

Project

- Robotics similar

- graphics showcase

- Paper review

Find a linear algebra paper

Due: Weds Dec 14 11:59PM

$U = m \times m = [u_1 \dots u_r \mid u_{r+1} \dots u_m]$

$C(A)$ $N(A^T)$

V is $n \times n = [v_1 \dots v_r \mid v_{r+1} \dots v_n]$

$C(A^T)$ $N(A)$

Σ is $m \times n$

A is $m \times n$ is rank r.

$$A = U \Sigma V^T$$

$$A = \sigma_1 \underbrace{u_1 v_1^T}_{\text{outer product}} + \dots + \sigma_r u_r v_r^T$$

A is a sum of singular matrices

$X \Lambda X^T$

$$\Lambda = \begin{bmatrix} 3 & \\ & 1 \end{bmatrix}$$

$$\Lambda = \begin{bmatrix} 1 & \\ & 3 \end{bmatrix}$$

$$\begin{bmatrix} X_2 & X_1 \end{bmatrix}$$

$$\Sigma = \begin{bmatrix} \sigma_1 & & \\ & \ddots & \\ & & \sigma_r \end{bmatrix}$$

orient $\geq$ s.t.

$\sigma_i \geq \sigma_{i+1}$

$\sigma_1 \geq \sigma_2 \geq \dots \geq \sigma_r$

V / $A^T A$

σ_i^2

$$\Sigma^2 = \begin{bmatrix} \sqrt{\sigma_1}^2 & \\ & \sqrt{\sigma_2}^2 \end{bmatrix}$$

$A v_i = \sigma_i u_i$

$A v_1 = \sigma_1 v_1$

$A v_2 = \sigma_2 v_2$

vector = vector

$$\frac{Av_i}{\sigma_i} = u_i$$

$Av_2 = \sigma_2 u_2$

$$\frac{U}{AA^T}$$

$$A = \begin{bmatrix} 3 & 0 \\ 4 & 5 \end{bmatrix}$$

① V:

$$A^TA = \begin{bmatrix} 25 & 20 \\ 20 & 25 \end{bmatrix}$$

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

$$(25-\lambda)(25-\lambda) - 400$$

$$\lambda_1 = 45, \quad \lambda_2 = 5$$

$$\Sigma = \begin{bmatrix} \sqrt{45} & 0 \\ 0 & \sqrt{5} \end{bmatrix}$$

$$V = \begin{bmatrix} 1/\sqrt{2} & -1/\sqrt{2} \\ 1/\sqrt{2} & 1/\sqrt{2} \end{bmatrix}$$

$$v_1 = \begin{bmatrix} 1/\sqrt{2} \\ 1/\sqrt{2} \end{bmatrix} \qquad v_2 = \begin{bmatrix} -1/\sqrt{2} \\ 1/\sqrt{2} \end{bmatrix}$$

② U

$$u_1 = \frac{Av_1}{\sigma_1}$$

might need to normalize

$$= \frac{\begin{bmatrix} 3 & 0 \\ 4 & 5 \end{bmatrix} \begin{bmatrix} 1/\sqrt{2} \\ 1/\sqrt{2} \end{bmatrix}}{\sqrt{45}} = \begin{bmatrix} .3162 \\ .9487 \end{bmatrix}$$

$$u_2 = \frac{Av_2}{\sigma_2}$$

$$= \frac{\begin{bmatrix} 3 & 0 \\ 4 & 5 \end{bmatrix} \begin{bmatrix} -1/\sqrt{2} \\ 1/\sqrt{2} \end{bmatrix}}{\sqrt{5}} = \begin{bmatrix} -.9487 \\ .3162 \end{bmatrix}$$

$$A = U \Sigma V^T = \sigma_1 u_1 v_1^T + \sigma_2 u_2 v_2^T$$

$$= \sqrt{45} \begin{bmatrix} .3162 \\ .9487 \end{bmatrix} \begin{bmatrix} 1/\sqrt{2} & 1/\sqrt{2} \end{bmatrix}$$

σ_1 u_1 v_1^T

$$+ \sqrt{5} \begin{bmatrix} -.9487 \\ .3162 \end{bmatrix} \begin{bmatrix} -1/\sqrt{2} & 1/\sqrt{2} \end{bmatrix}$$

σ_2 u_2 v_2^T

Normalize