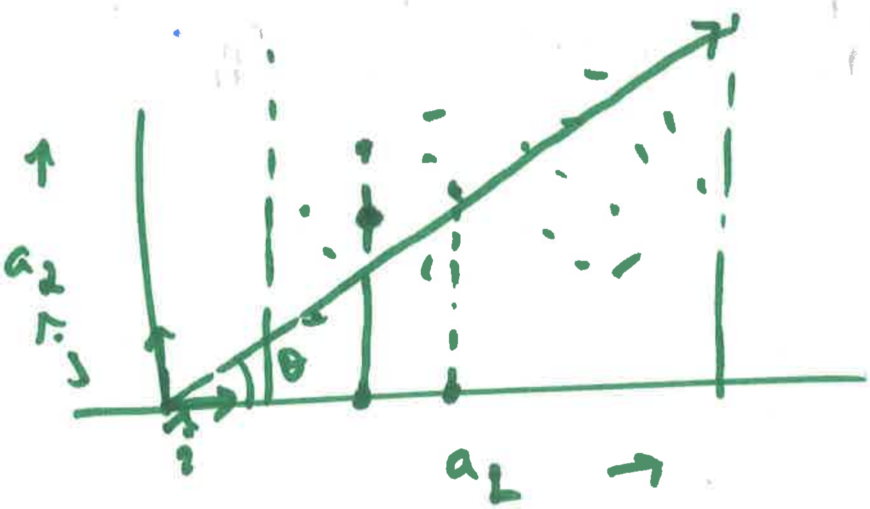
CSE 572

①

9/11/17

→ Attributes (Dimensions)

$D =$ ↓ Data points $\left[ \quad \right]$




$\vec{v} = \cos\theta\,\hat{i} + \sin\theta\,\hat{j}$

$[\vec{v}^T D^T]$ → projection of data D on the line $\vec{v}$

$$Cov = \begin{bmatrix} \sigma_{xx} & \sigma_{xy} \\ \sigma_{yx} & \sigma_{yy} \end{bmatrix}$$

$x = a_1 \quad y = a_2$

$\sigma_{xx} = E[(x - E(x))]^2$

$\sigma_{xy} = \sigma_{yx}$

$\sigma_{xy} = E[(x - E(x))(y - E(y))]$

**Rayleigh Quotient**

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eating action / No

X → random variable

→ parameters → $\theta$

→ accelerometer

gyroscope

orientation - - -

$$P(X|\theta)$$

$p \leftarrow \theta$

$$L(\theta|x)$$

$$p(x|\theta) = p^{a}(1-p)^{n-1}$$

$$P(x) = 0.5$$

$$\left[0.5 = p(1-p)^{n-1}\right]$$

$$L(\theta|x)$$

likelihood function

<u>estimator</u> → give x

$$\hat{\theta} = r(\vec{x}) \qquad \vec{x} = \begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_m \end{bmatrix}$$

bias variance

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$\hat{\theta} = r(\vec{x})$

$$\text{bias} = E(\theta - E(\hat{\theta}))$$

estimation

actual set of parameters.

<u>variance</u> $= E\left(\left[\hat{\theta} - E(\hat{\theta})\right]^2\right)$

Unbiased estimator $\Rightarrow$ bias $= 0$

$\theta = E(\hat{\theta})$

$\hat{\theta} \approx \theta$

$l(\theta \mid x)$

$l(\hat{\theta} \mid x) \rightarrow$ maximum.

$\log(l(\hat{\theta} \mid x)) \rightarrow$ log likelihood function.

$$\frac{d \log(l(\hat{\theta} \mid x))}{d\theta} = \frac{d\, l(\hat{\theta} \mid x)/d\theta}{l(\hat{\theta} \mid x)}$$

$$\frac{d}{d\theta} \log(l(\hat{\theta} | x)) = \frac{\frac{d\, l(\hat{\theta} | x)}{d\theta}}{l(\hat{\theta} | x)}$$

$$= \frac{l'(\hat{\theta} | x)}{l(\hat{\theta} | x)} = I(\hat{\theta})$$

Fisher information.

$$\hat{\theta} = \underline{\underline{r}}(\vec{x})$$

Cramer Rao lower bound (CRLB)

$$\cancel{\mathrm{Var}(\hat{\theta}) \geq \frac{I'(\hat{\theta})}{I(\theta)}}$$

~~not share~~

$$\mathrm{Var}(\hat{\theta}) \geq \frac{L(\theta | x)}{n\, L'(\theta | x)}$$

<u>unbiased</u>

$$= \frac{1}{n\, I(\hat{\theta})}$$

$$\hat{\theta} = A\vec{x} + B$$

$$A = (x^T x)^{-1} x$$

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$$Var(\hat{\theta}) \geq \frac{E(\hat{\theta})}{n\, I(\hat{\theta})}$$