DA 2020 LEC e 24

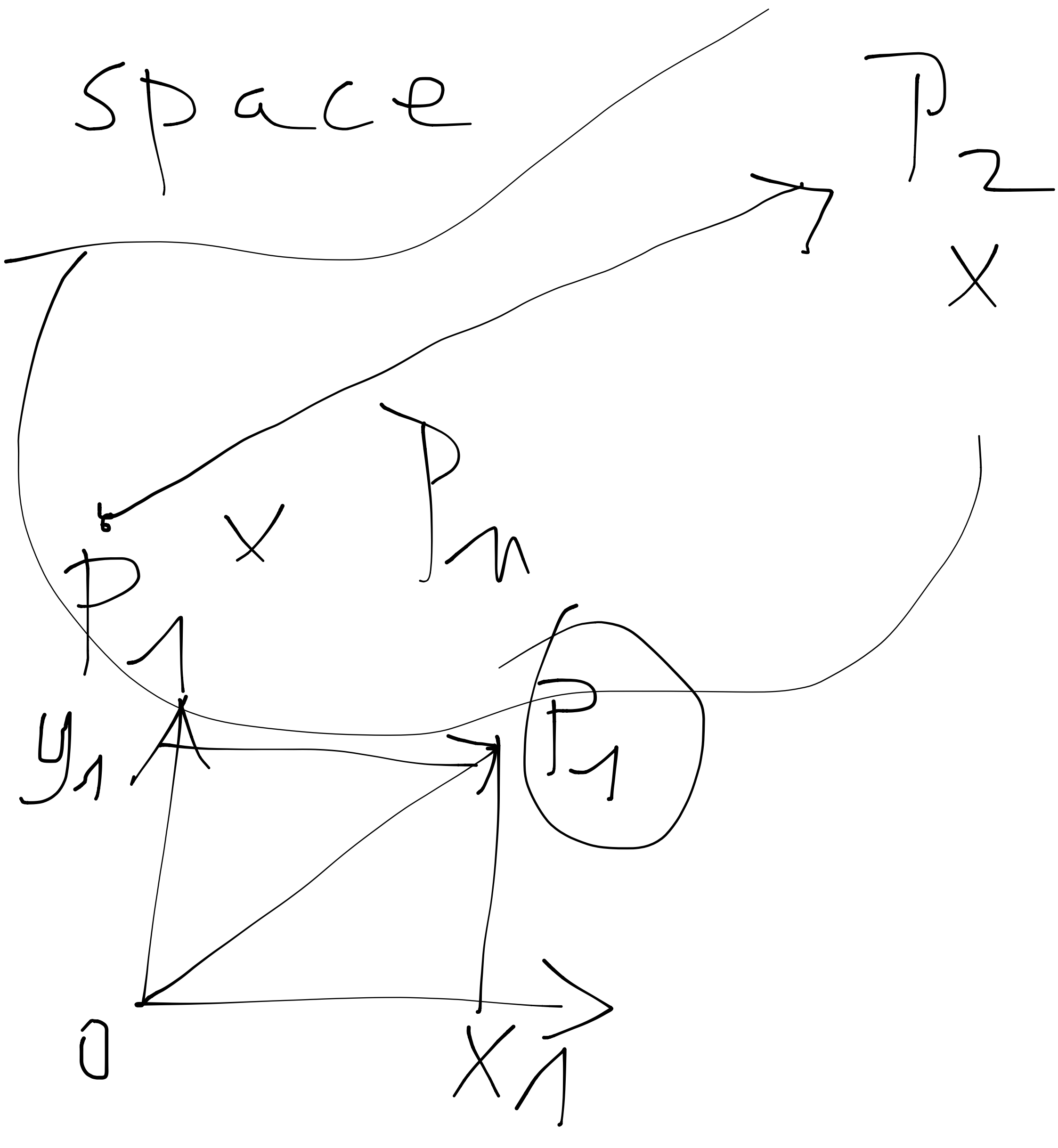
REGRESSION

CORRELATION]

LINEARITY

WORKING WITH LINEAR SPACES

objects that can be added & multiplyed by a number vectors ≈ locations in space



$$\vec{X} \equiv (X_1, X_2, \ldots, X_n)$$

$\vec{v}$ $\underline{v}$ row vector

column vector

$$\underline{X} = \begin{pmatrix} X_1 \\ X_2 \\ \vdots \\ X_n \end{pmatrix} \quad \underline{X}_1 \circ \underline{X}_2$$

$$\underline{X}^T = (X_1, X_2, \ldots, X_n)$$

$$(\underline{X}_1 \circ X_2) \equiv \sum_{i=1}^{n} x_i^{(1)} x_j^{(2)}$$

$$(\underline{X}_1^T \cdot \underline{X}_2) \equiv$$

$$(X_1^{(1)}, X_2^{(1)}, \ldots, X_n^{(1)}) \times \begin{pmatrix} X_1^{(2)} \\ X_2^{(2)} \\ \vdots \\ X_n^{(2)} \end{pmatrix}$$

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row by column product

LINEAR COMBINATION
of vectors

$$\underline{V} = a_1 \underline{V}_1 + a_2 \underline{V}_2 + \dots + a_n \underline{V}_n$$

$$\underline{V} = a_1' \underline{\hat{V}}_1' + a_2' \underline{\hat{V}}_2' + \dots + a_n' \underline{\hat{V}}_n'$$

new basis
base

$(a_1, a_2, \ldots, a_n) \longrightarrow$

$(a_1', a_2', \ldots, a_n')$

Linear transform

of

$$T(\underbrace{a_1 \underline{v}_1 + a_2 \underline{v}_2}) =$$

$$a_1 T(\underline{v}_1) + a_2 T(\underline{v}_2)$$

$$\underline{v} = (v_1, v_2, \dots, v_n)$$

$$T(\underline{v}) = \underline{v}'$$

Matrix

$n \times n$

$$\underline{x}' = \underline{\underline{T}}(\underline{x})\ x$$

$$x'_i = \sum_{k=1}^{n} T_{ik}\, x_k \qquad (*)$$

$i = 1, 2, \ldots, n$

$k = 1, 2, \ldots, n$

$$\begin{array}{cc} & \begin{array}{ccccc} & & k\text{th} & & \end{array} \\ T = & \begin{bmatrix} T_{11} & T_{12} & & & T_{1n} \\ T_{21} & T_{22} & & & T_{2n} \\ \vdots & & & & \\ & & & T_{ik} & \\ T_{n1} & T_{n2} & & \cdots & T_{nn} \end{bmatrix} \\ \end{array}$$

ith row

$$\min S = \sum_{i=1}^{n} d_i =$$

$$S(a,b) \text{ dak)} = \sum_{i} (y_i - a - b x_i)^2$$

$$\frac{\partial S}{\partial a} = 0 = \sum_{1} \frac{\partial}{\partial a} (\qquad)^2$$

$$\frac{\partial S}{\partial b} = 0 = \sum_{1} \frac{\partial}{\partial b} (\qquad)^2$$

$$\frac{\partial S}{\partial a} = 0 = \sum_i 2\left(y_i - a - b x_i\right)\cdot(-1)$$

$$\frac{\partial S}{\partial b} = 0 = \sum_i 2\left(y_i - a - b x_i\right)(-x_i)$$