

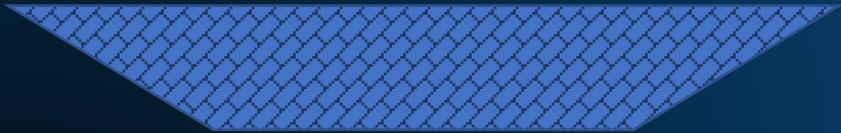
A hand is shown in the foreground, reaching out towards a complex, futuristic digital interface. The interface features a large circular gauge with multiple concentric rings, some of which are illuminated with green and blue light. Inside the gauge, there are several interlocking gears. The background is dark, with various digital elements like lines, dots, and data patterns floating around, creating a high-tech, cybernetic atmosphere.

# Feature Extraction

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# FEATURE EXTRACTION



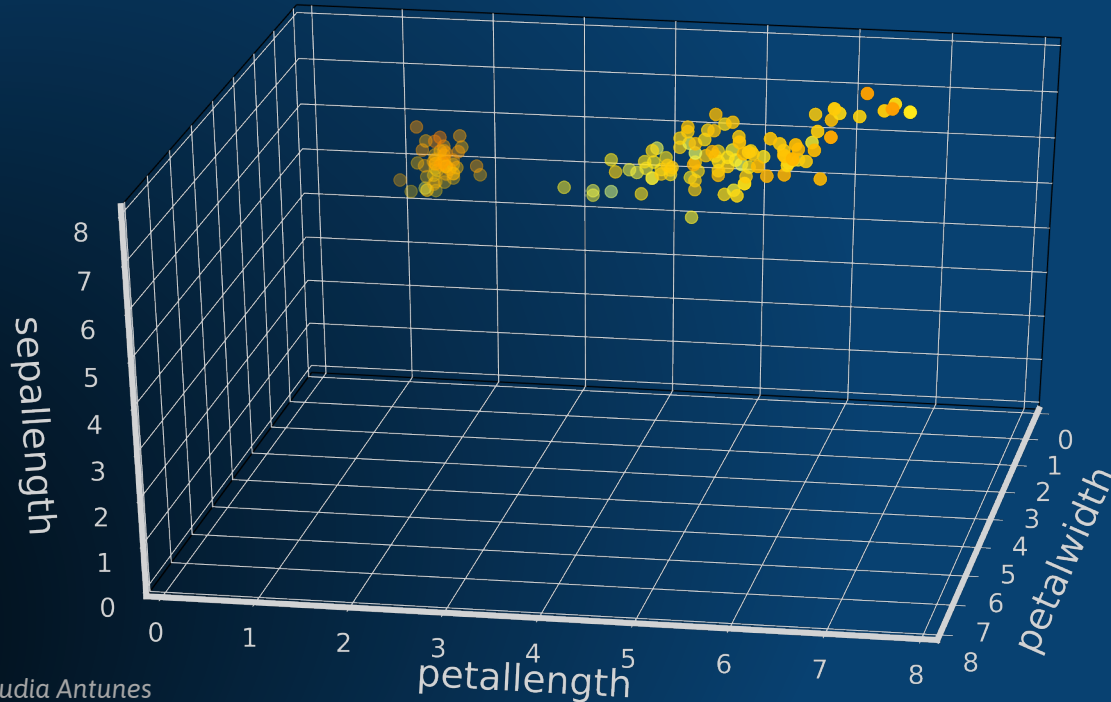
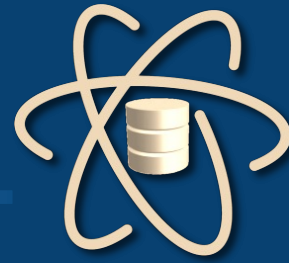
$$\mathcal{F} = \{v_1, v_2, \dots, v_d\}$$



$$f_1(\mathcal{F}), f_2(\mathcal{F}), \dots, f_\delta(\mathcal{F})$$

with  $\delta \leq d$

# PRINCIPAL COMPONENT ANALYSIS



# PCA ALGORITHM



1. Center the dataset

$$X = X - 1 \times \mu^T$$

2. Compute covariance matrix

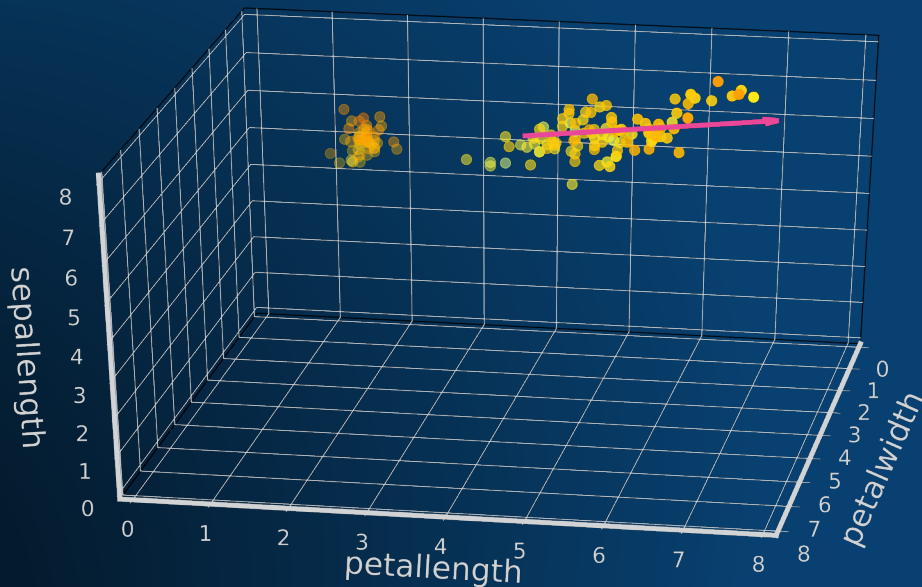
$$\Sigma = \begin{pmatrix} \text{var}(v_1) & \cdots & \text{cov}(v_1, v_d) \\ \vdots & \ddots & \vdots \\ \text{cov}(v_1, v_d) & \cdots & \text{var}(v_d) \end{pmatrix}$$

3. Compute eigen values and vectors

$$\lambda_1, \vec{v}_1, \lambda_2, \vec{v}_2, \dots, \lambda_d, \vec{v}_d$$

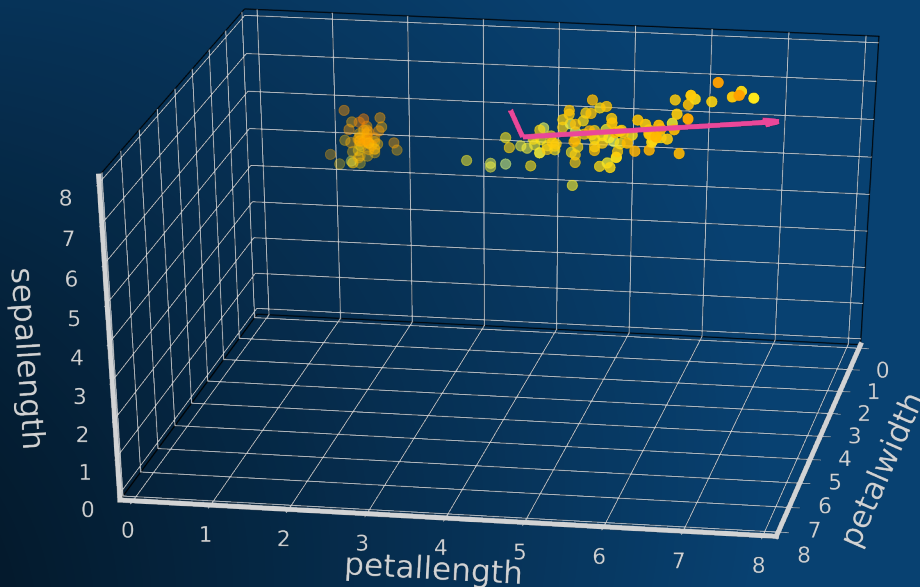
$$\lambda_1 > \lambda_2 > \dots \lambda_n$$

# PCA INTERPRETATION



$$PC1 = 0.36 \times \text{sepal length} - 0.08 \times \text{sepal width} + 0.86 \times \text{petal length} + 0.36 \times \text{petal width}$$

# PCA INTERPRETATION

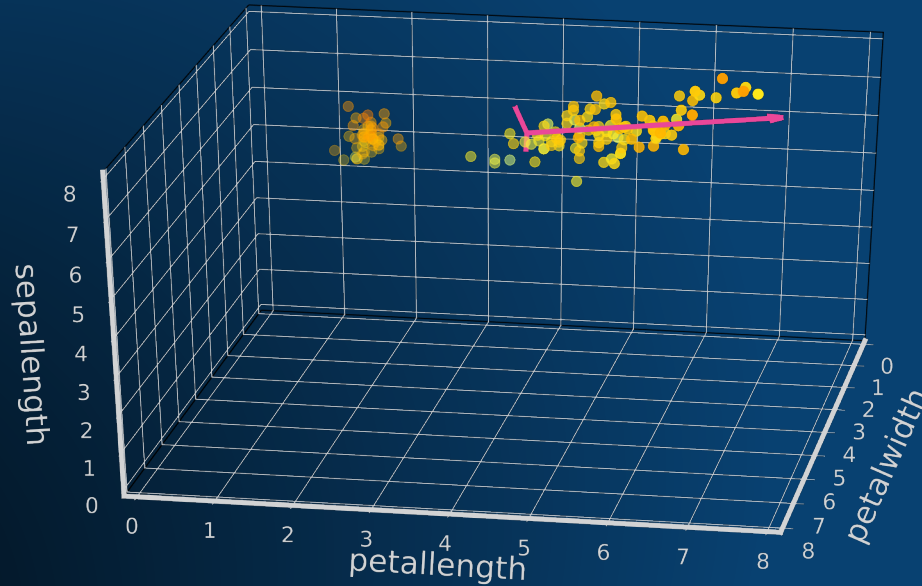
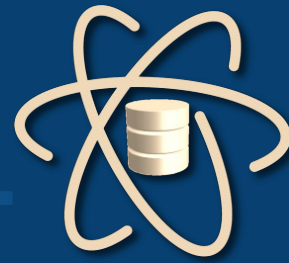


$$PC1 = 0.36 \times \text{sepal length} - 0.08 \times \text{sepal width} + 0.86 \times \text{petal length} + 0.36 \times \text{petal width}$$

$$PC2 = 0.66 \times \text{sepal length} + 0.73 \times \text{sepal width} - 0.18 \times \text{petal length} - 0.07 \times \text{petal width}$$



# PCA INTERPRETATION

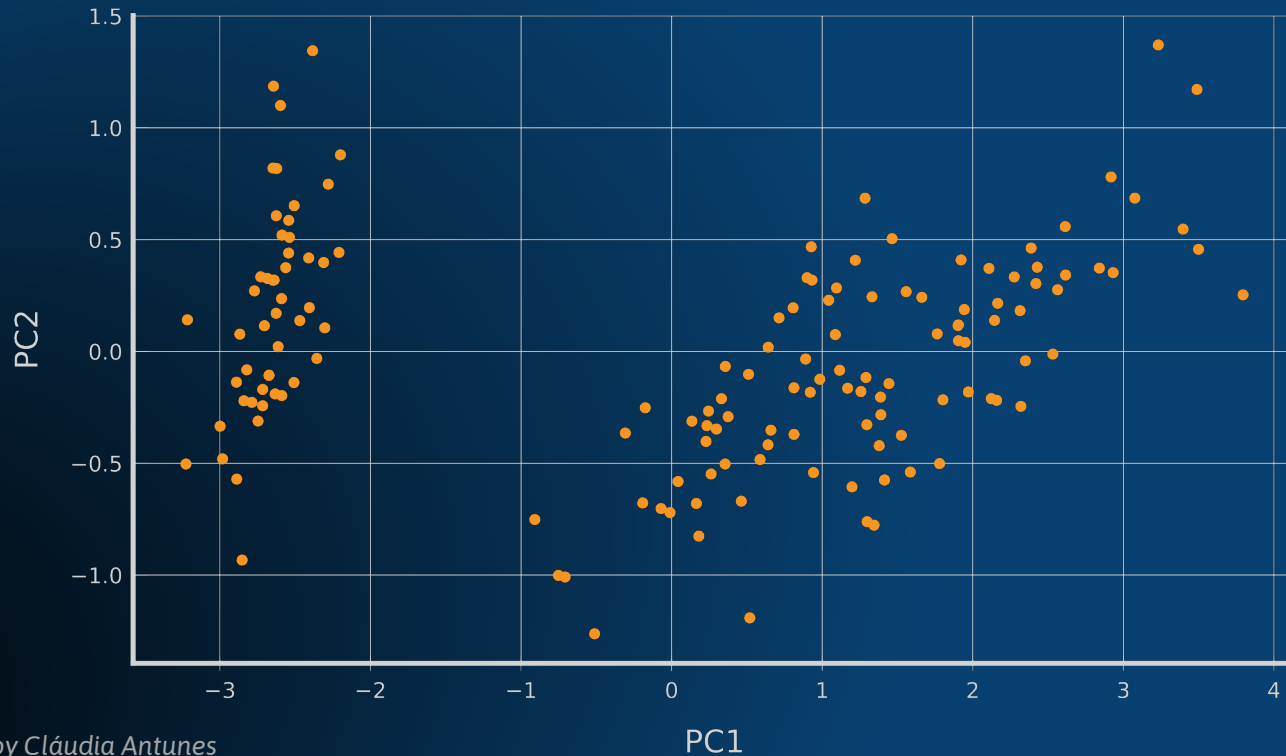


$$PC1 = 0.36 \times \text{sepal length} - 0.08 \times \text{sepal width} + 0.86 \times \text{petal length} + 0.36 \times \text{petal width}$$

$$PC2 = 0.66 \times \text{sepal length} + 0.73 \times \text{sepal width} - 0.18 \times \text{petal length} - 0.07 \times \text{petal width}$$

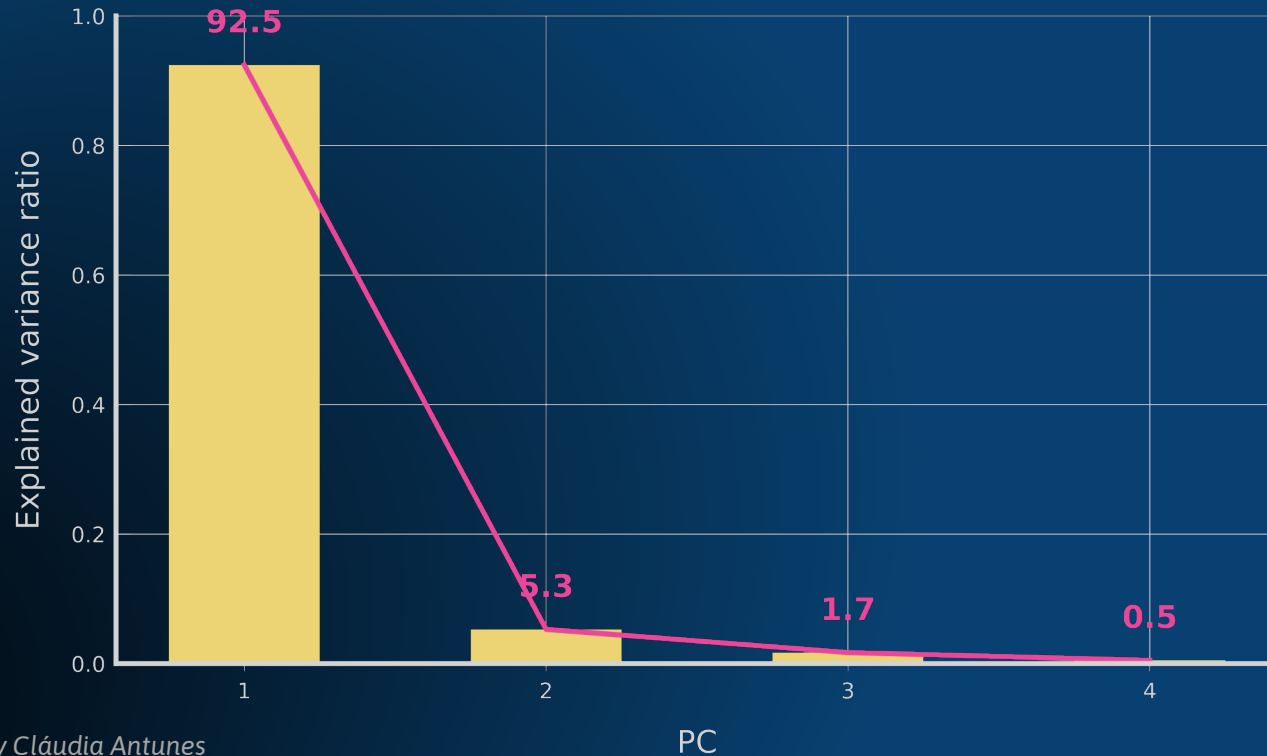
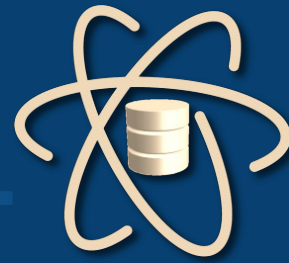
$$PC3 = -0.58 \times \text{sepal length} + 0.59 \times \text{sepal width} + 0.07 \times \text{petal length} + 0.55 \times \text{petal width}$$

# PCA - DIMENSIONALITY REDUCTION

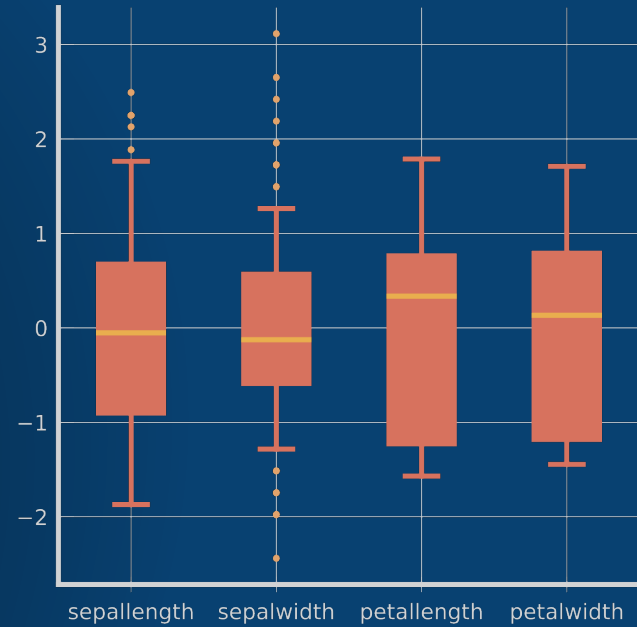
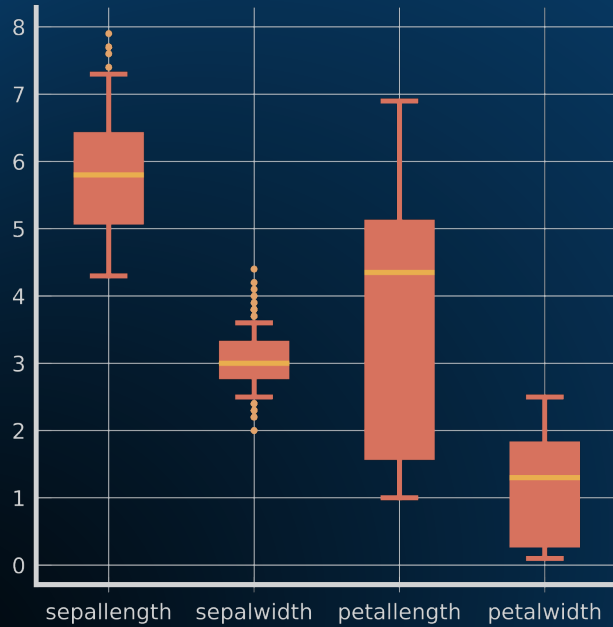




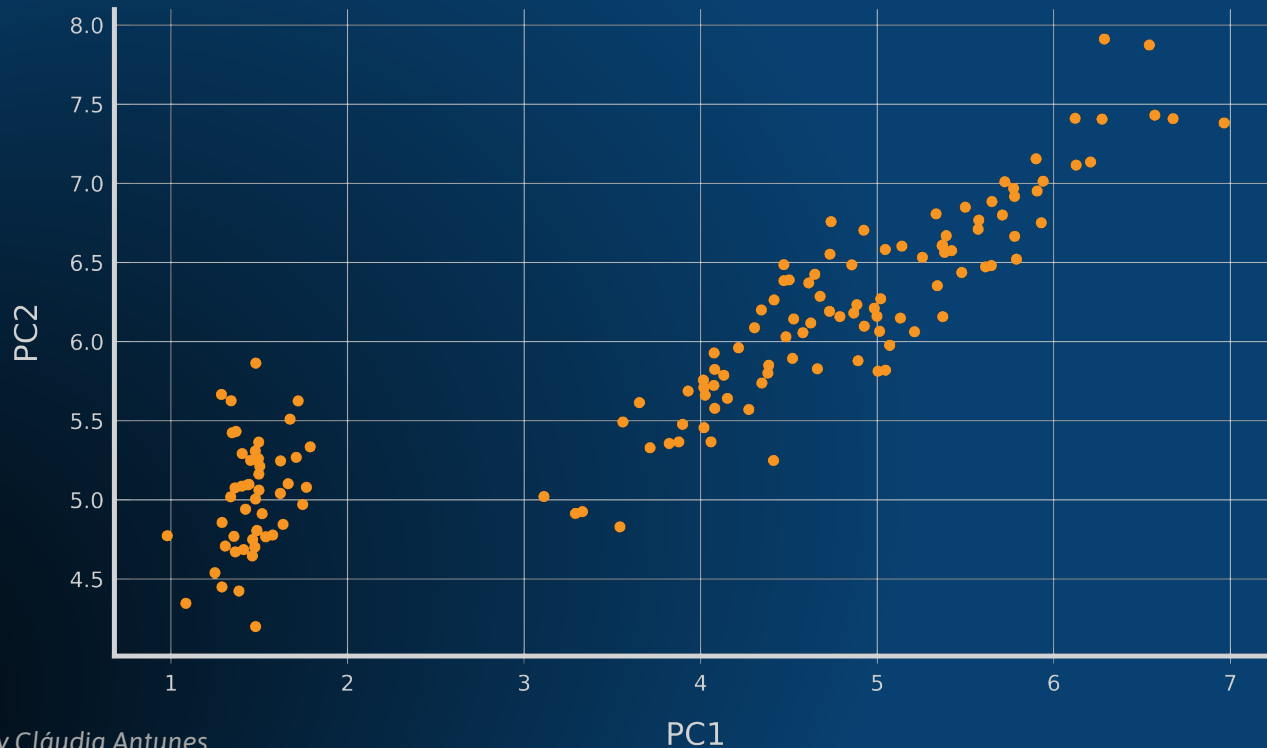
# PCA - CHOOSING DIMENSIONALITY



# PCA REMARKS



# PCA - SEMANTICS RECOVERY





*Thank  
you!*

