

PRINCIPAL COMPONENTS ANALYSIS (PCA)

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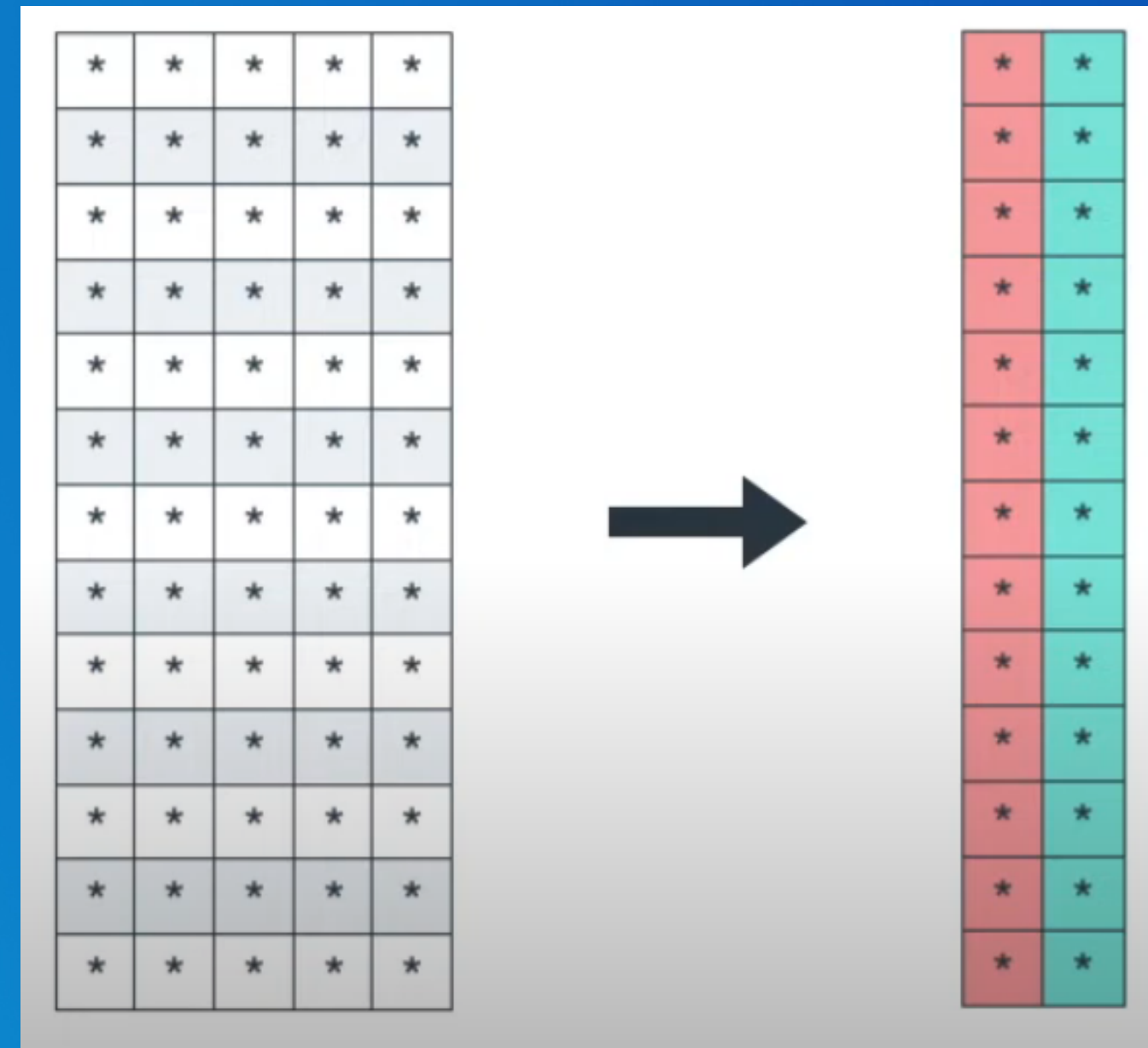
JESUS EDUARDO CASAS NAVARRO

JESUS CANUL

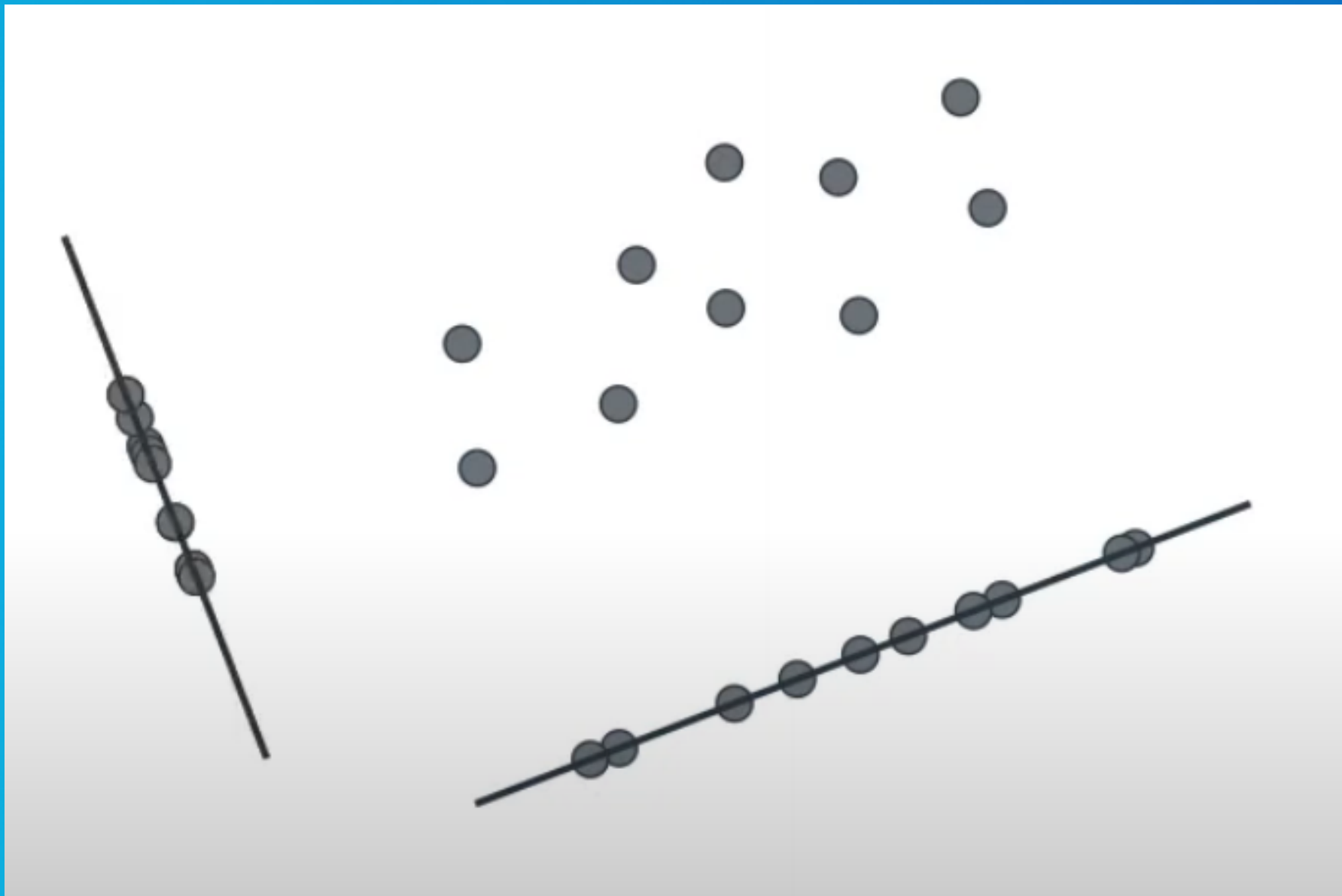
ESTEBAN RODRIGUEZ KUMUL

DIMENSIONALITY REDUCTION

Dimensionality reduction simply refers to the process of reducing the number of attributes in a dataset while keeping as much of the variation in the original dataset as possible



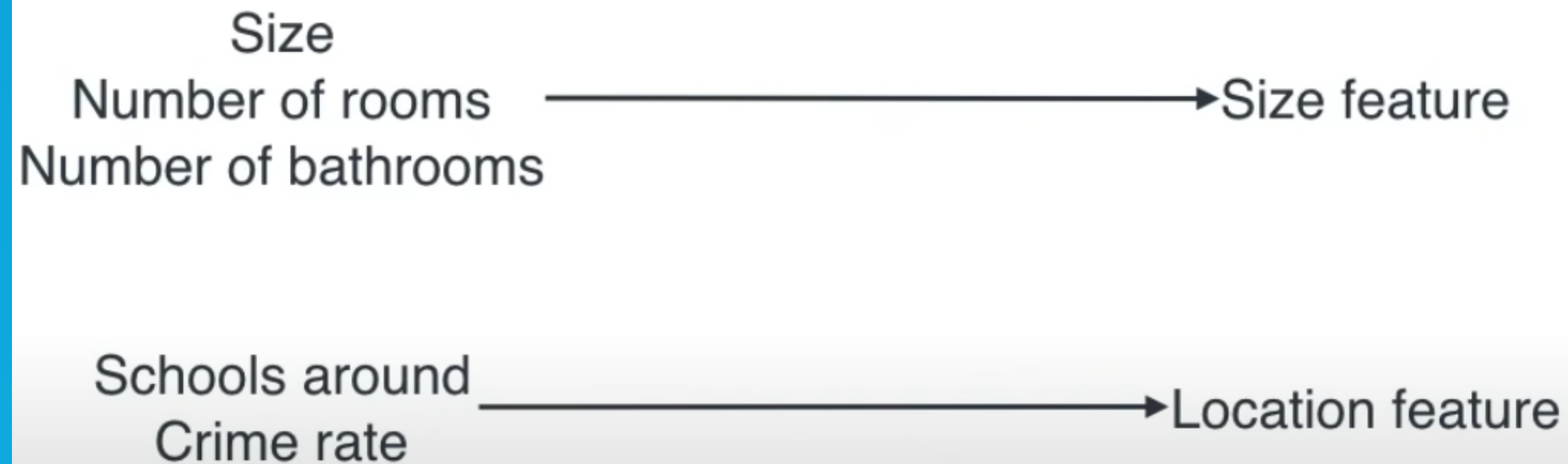
DIMENSIONALITY REDUCTION



- 2D
- 3D

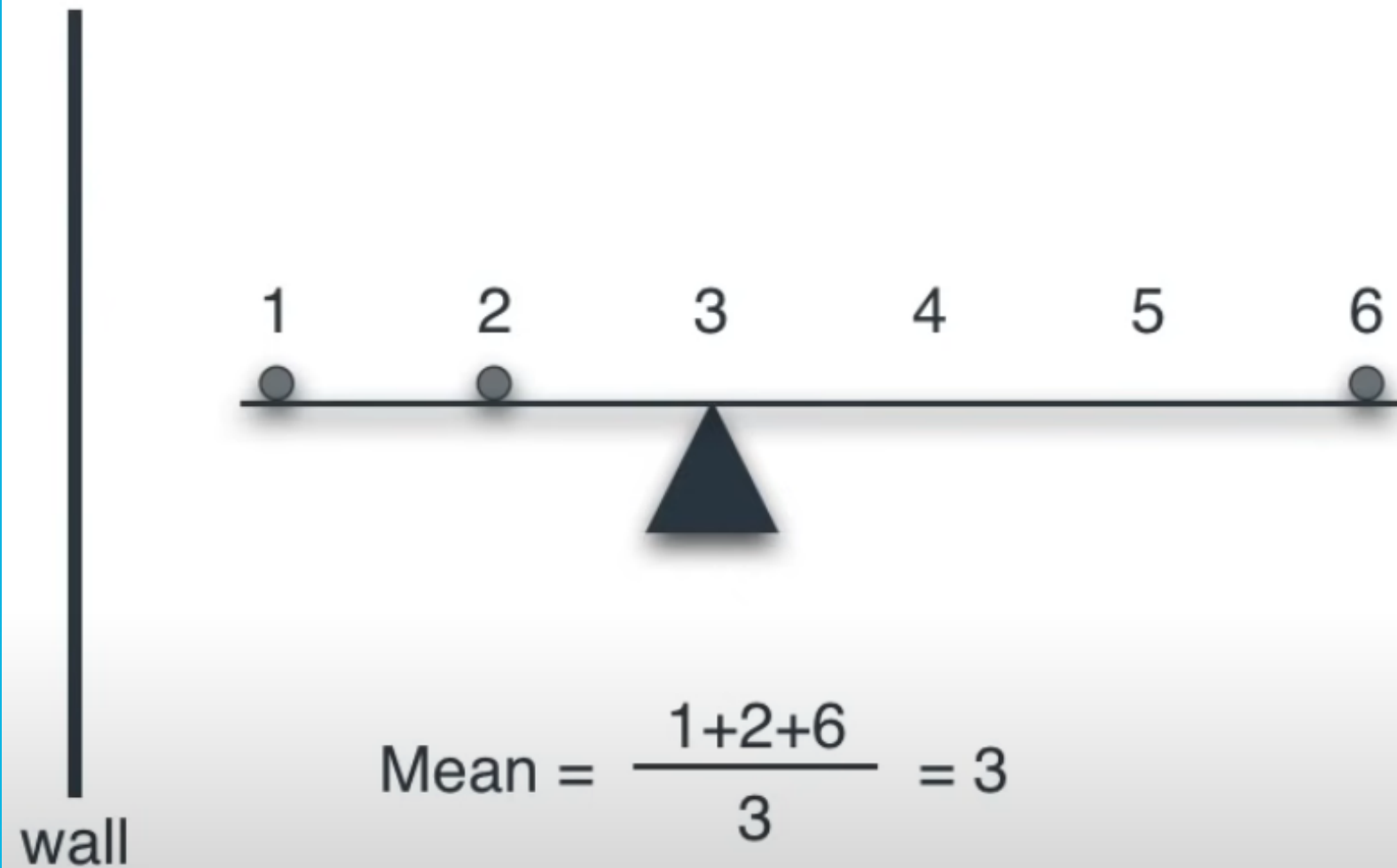
DIMENSIONALITY REDUCTION

Housing Data

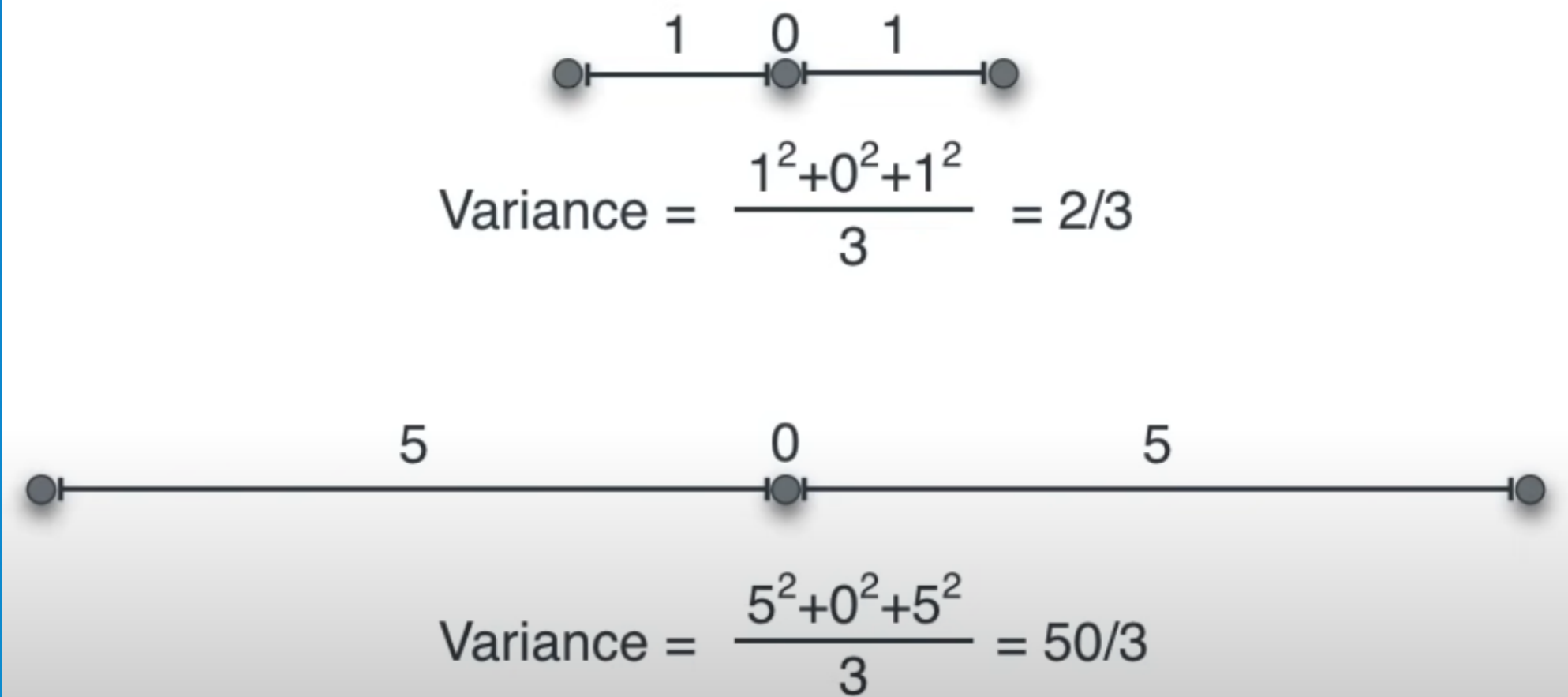


MEAN, VARIANCE, COVARIANCE

Mean

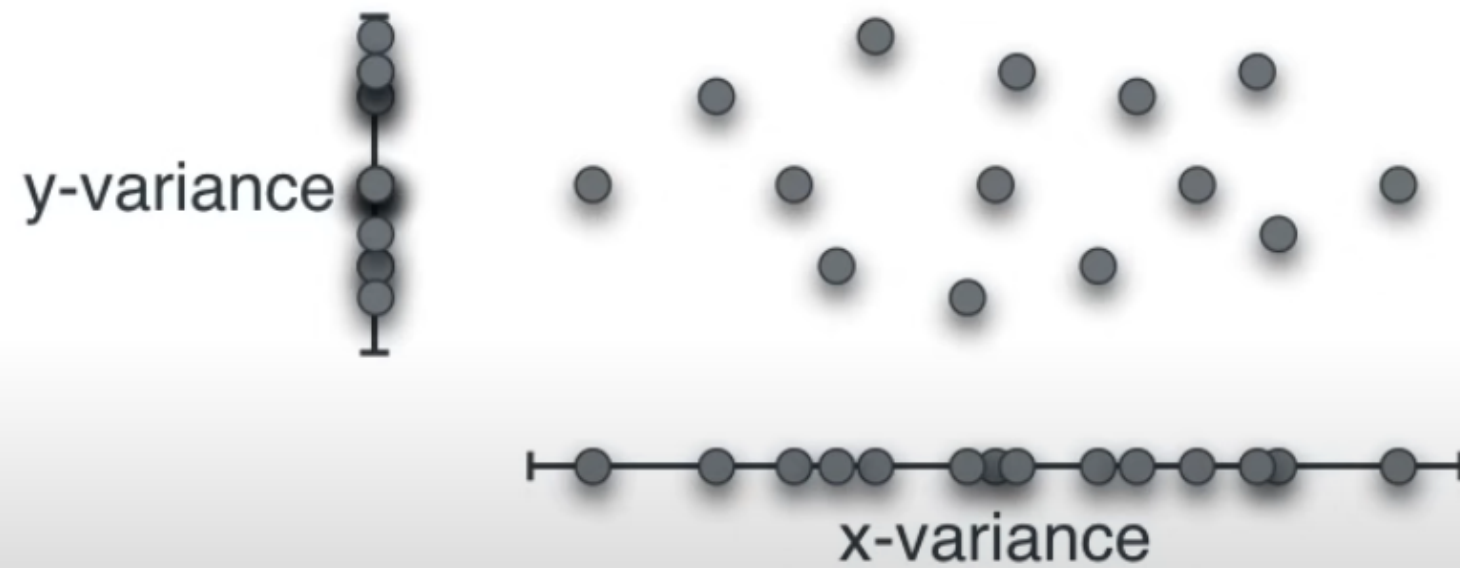


Variance



MEAN, VARIANCE, COVARIANCE

Variance?



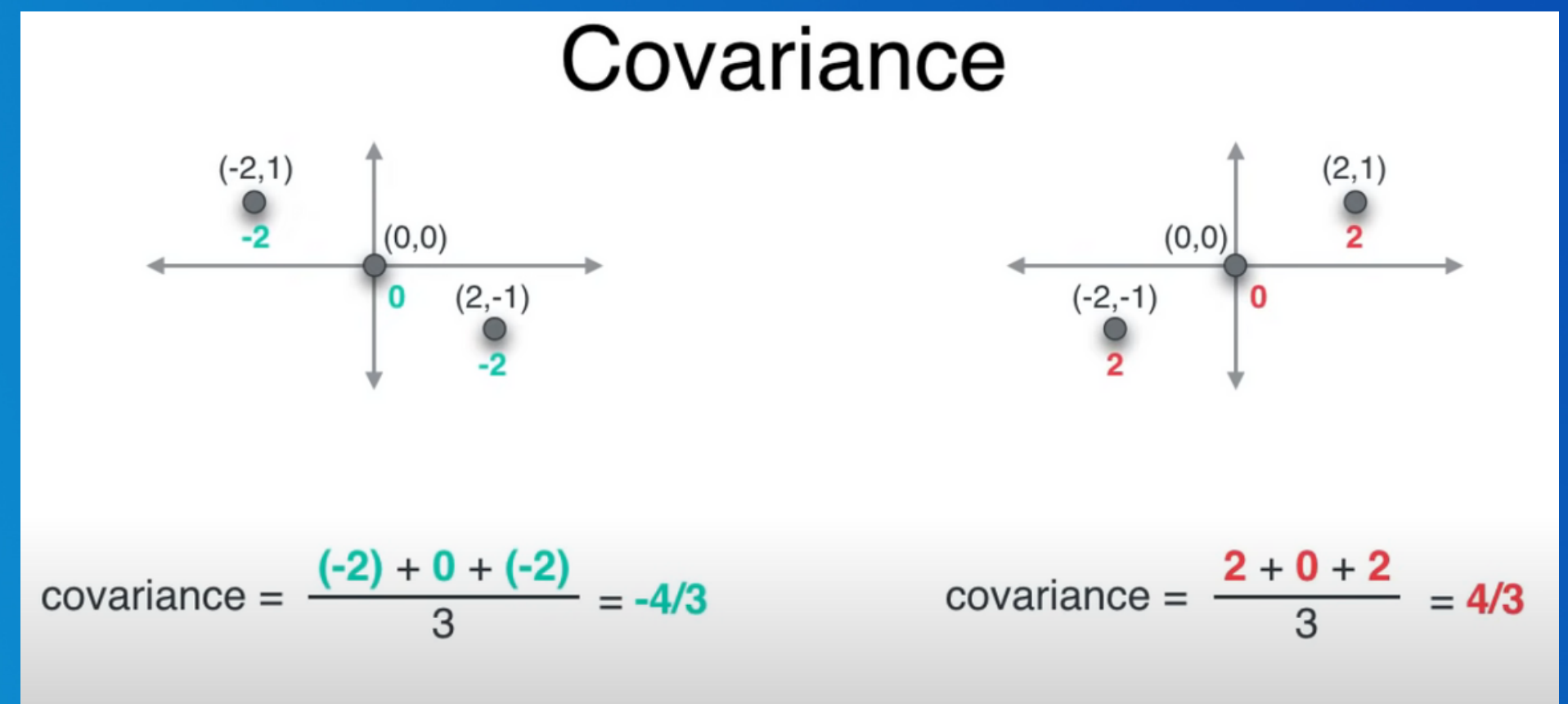
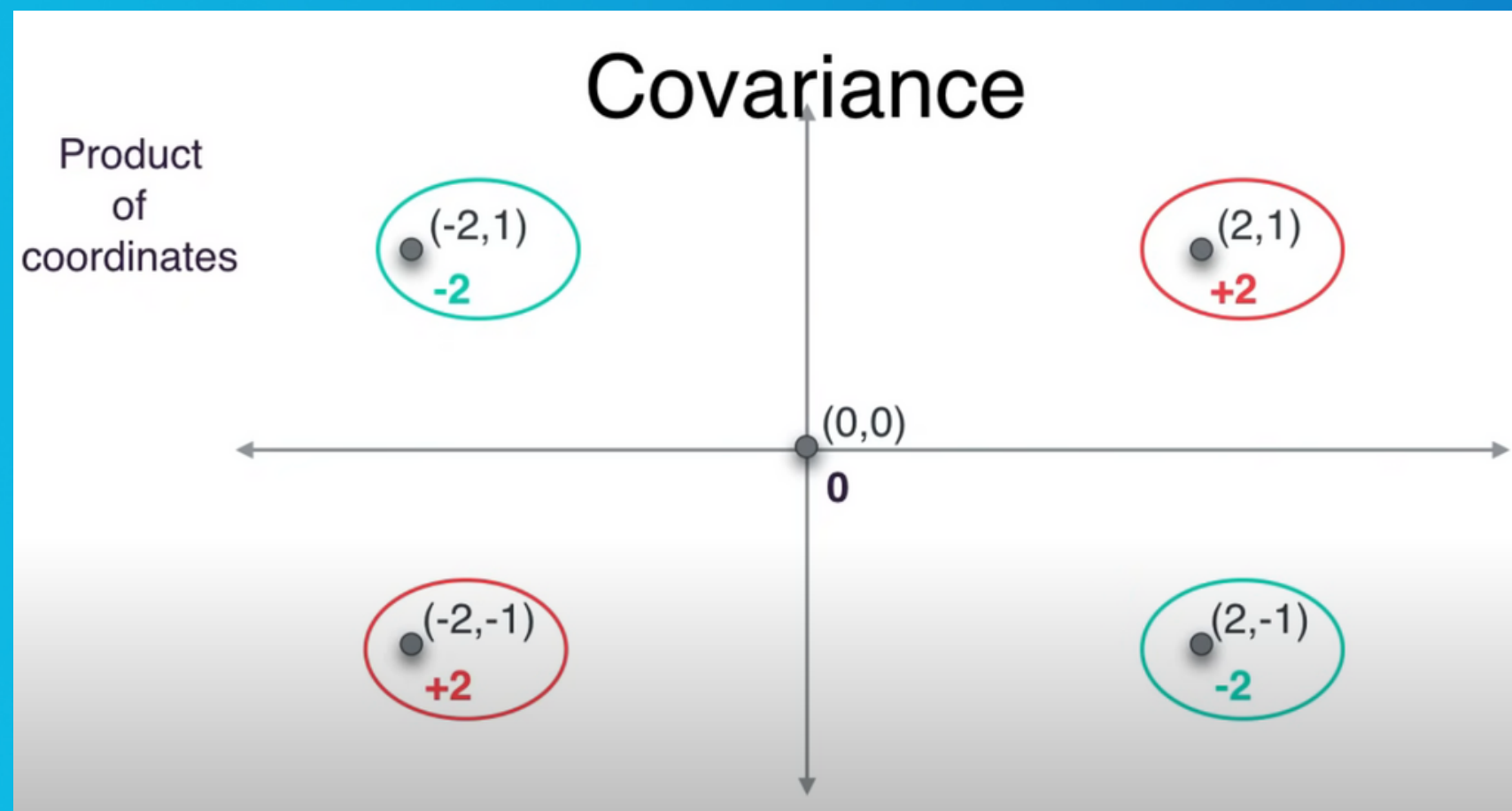
Variance?



$$\text{x-variance} = \frac{2^2 + 0^2 + 2^2}{3} = 8/3$$

$$\text{y-variance} = \frac{1^2 + 0^2 + 1^2}{3} = 2/3$$

MEAN, VARIANCE, COVARIANCE



MEAN, VARIANCE, COVARIANCE

Covariance



$$\text{covariance} = \frac{-2 + 0 + 2 + 0 + 0 + 0 + 2 + 0 + -2}{9} = 0$$

Covariance



negative
covariance



covariance zero
(or very small)



positive
covariance

COVARIANCE MATRIX

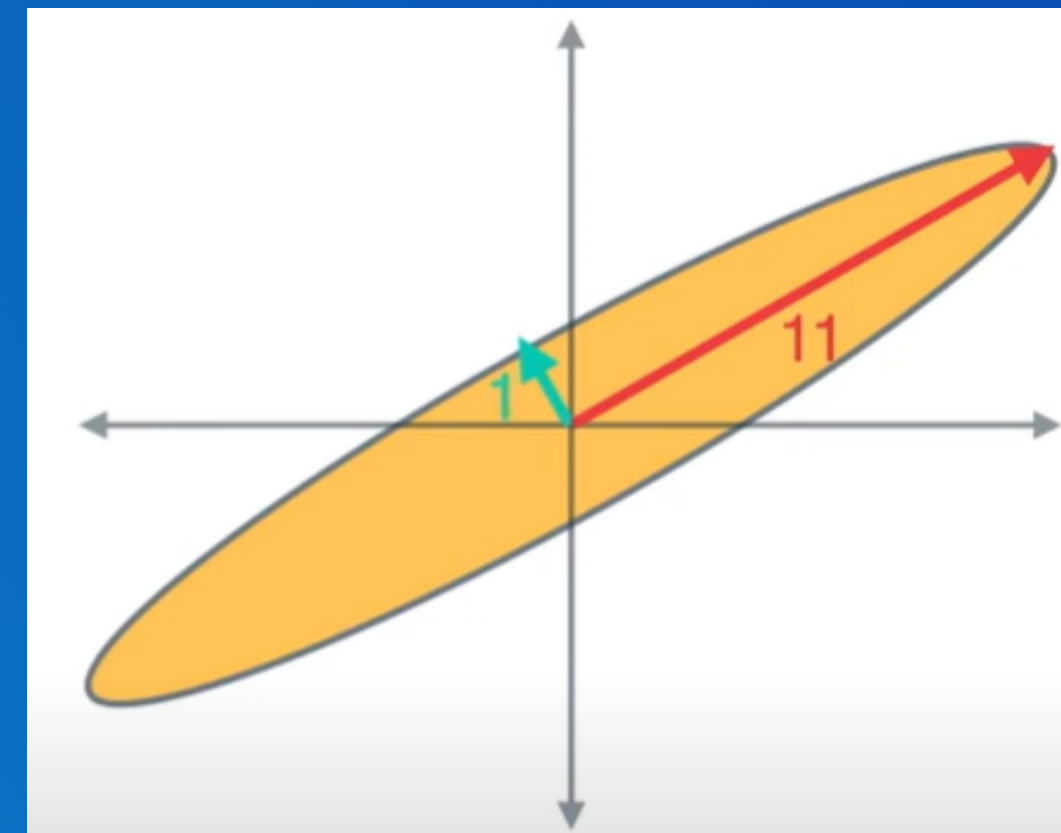
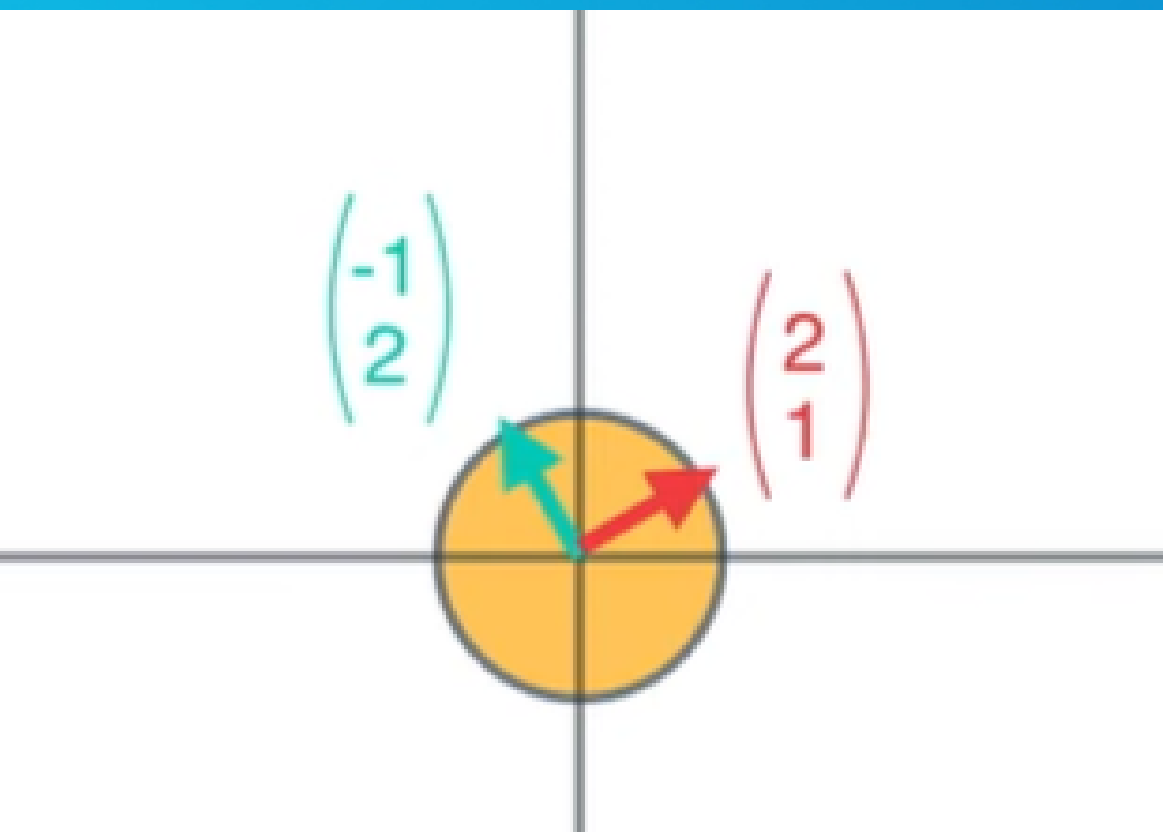


$$\Sigma = \begin{pmatrix} \text{Var}(X) & \text{Cov}(X,Y) \\ \text{Cov}(X,Y) & \text{Var}(Y) \end{pmatrix}$$

$$\begin{bmatrix} \text{Cov}(x, x) & \text{Cov}(x, y) & \text{Cov}(x, z) \\ \text{Cov}(y, x) & \text{Cov}(y, y) & \text{Cov}(y, z) \\ \text{Cov}(z, x) & \text{Cov}(z, y) & \text{Cov}(z, z) \end{bmatrix}$$

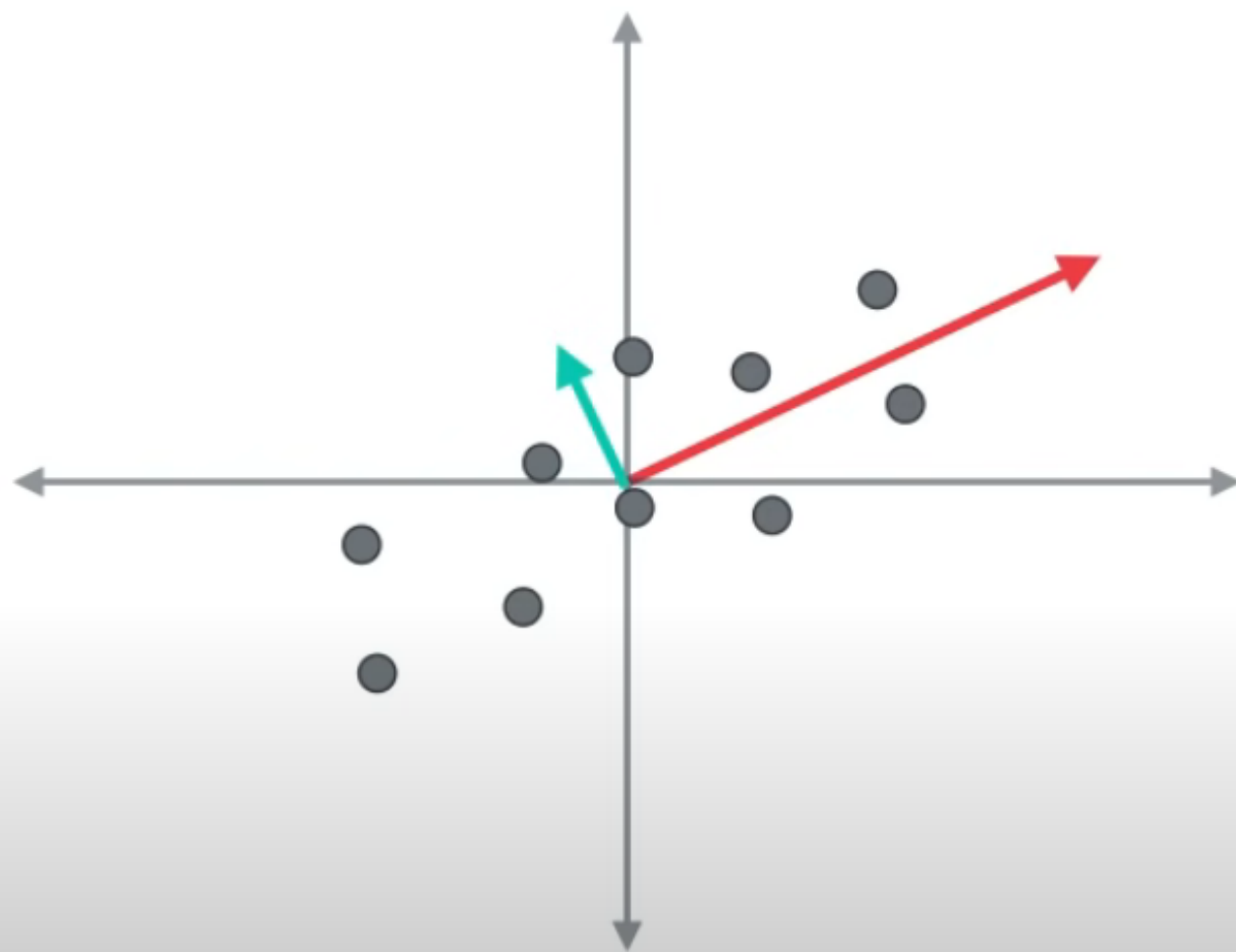
$$\begin{pmatrix} 9 & 4 \\ 4 & 3 \end{pmatrix}$$

EIGENVALUES AND EIGENVECTORS



PRINCIPAL COMPONENT ANALYSIS (PCA)

Principal Component Analysis (PCA)



$$\Sigma = \begin{pmatrix} 9 & 4 \\ 4 & 3 \end{pmatrix}$$

$$\begin{pmatrix} 2 \\ 1 \end{pmatrix}$$

$$\begin{pmatrix} -1 \\ 2 \end{pmatrix}$$

Eigenvectors
(direction)

11

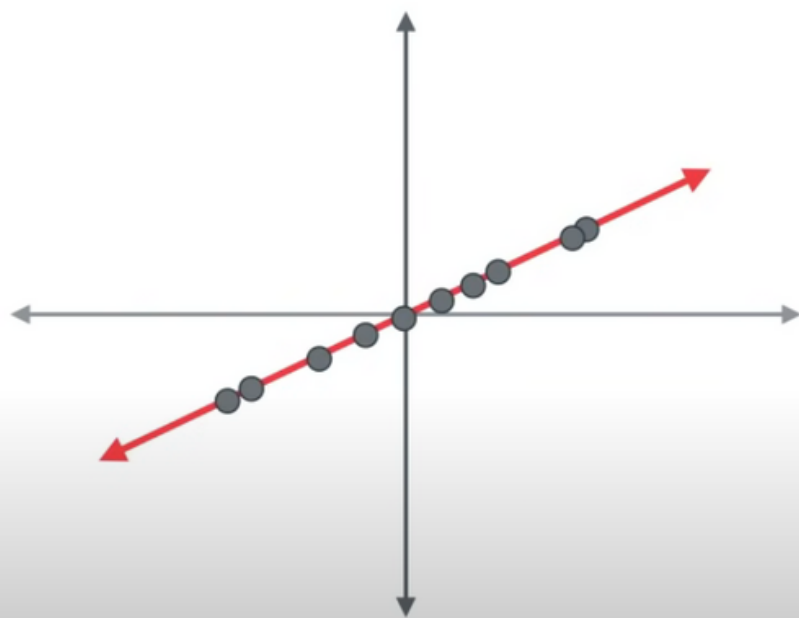
1

Eigenvalues
(magnitude)



PRINCIPAL COMPONENT ANALYSIS (PCA)

Principal Component Analysis (PCA)



$$\Sigma = \begin{pmatrix} 9 & 4 \\ 4 & 3 \end{pmatrix}$$

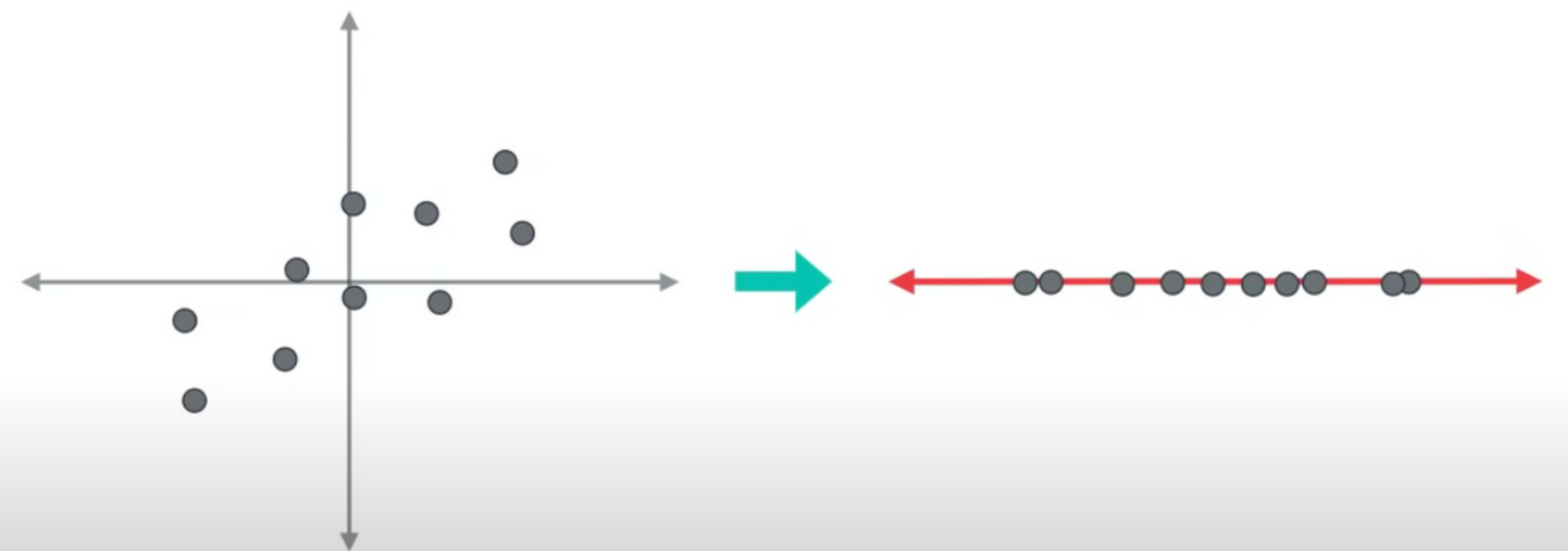
$$\begin{pmatrix} 2 \\ 1 \end{pmatrix}$$

11

Eigenvectors
(direction)

Eigenvalues
(magnitude)

Principal Component Analysis (PCA)



PRINCIPAL COMPONENT ANALYSIS (PCA)

