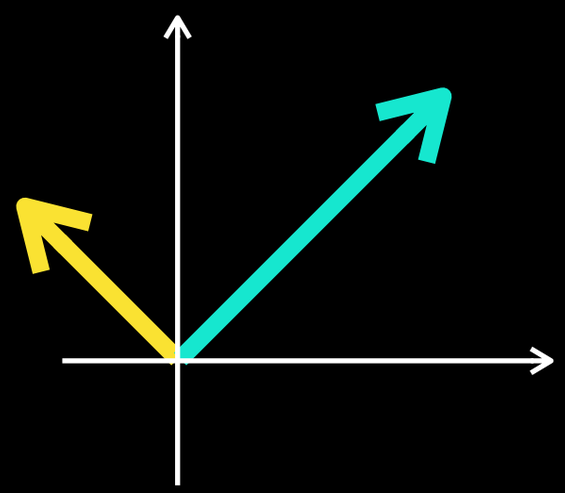
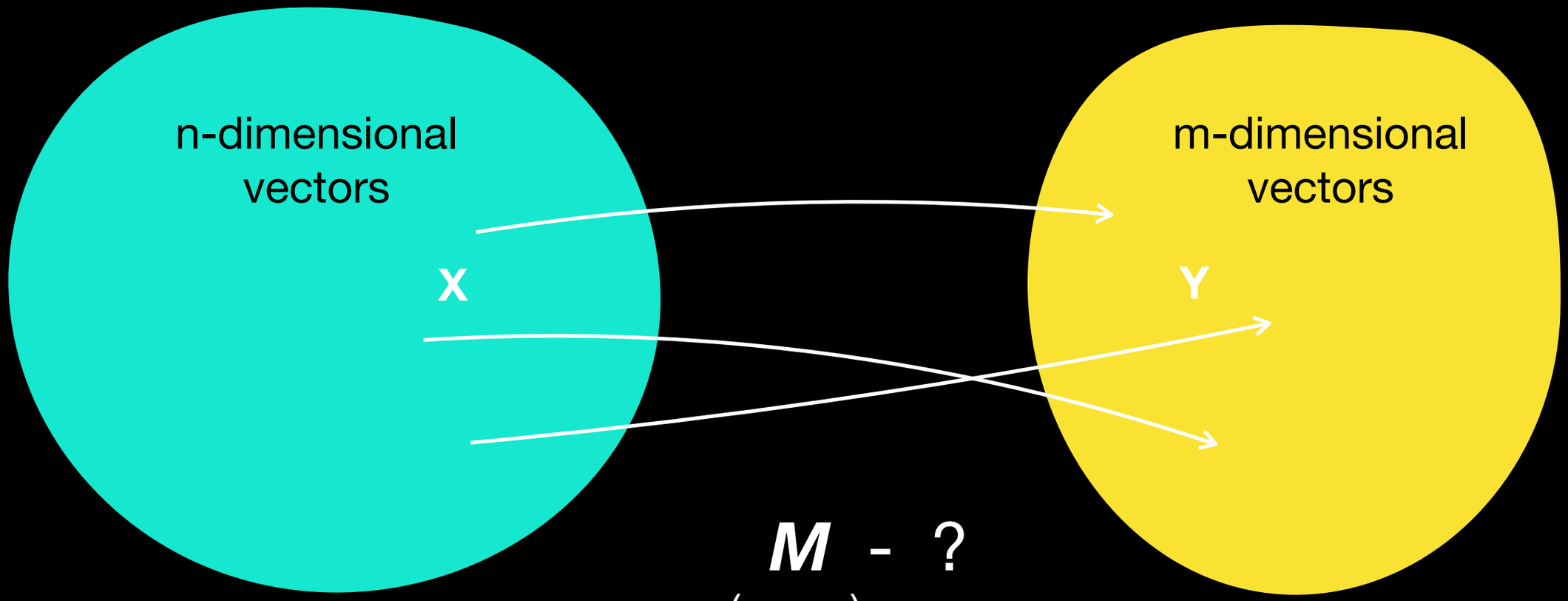
Linear regression

Linear Algebra Essentials



General view



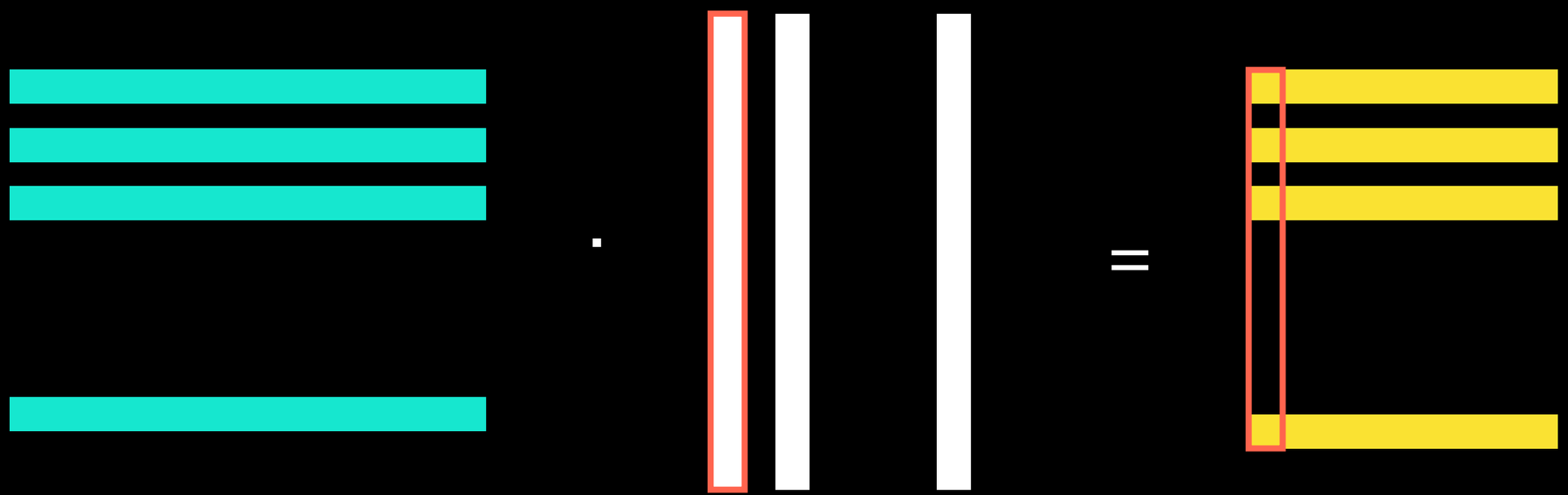
M - ?
(m x n)

M x = ŷ, ŷ ≃ y || ŷ - y || —> min

|| ***M*** x - y || —> min

$$M\,X = Y \qquad X^T\,M^T = Y^T$$

X^T M^T Y^T



a y

$$X^T\,a = y$$

Simple case

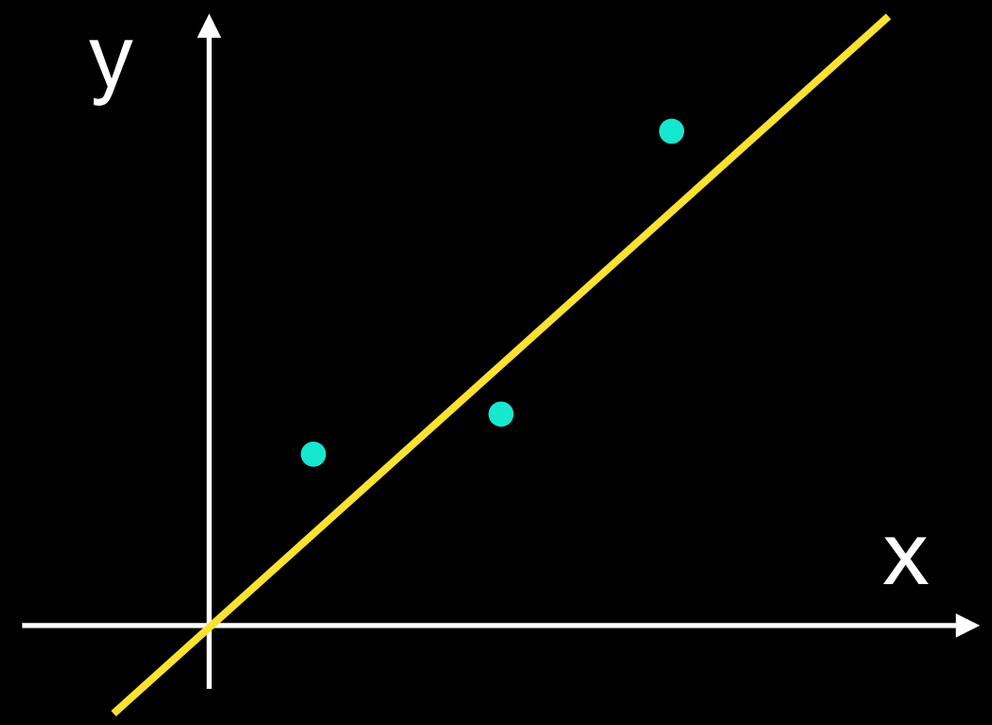
$\{ (\mathbf{x}_1, y_2), \ldots , (\mathbf{x}_k, y_k) \}$

$(\mathbf{a}, \mathbf{x}_j) \simeq y_j$

$$\begin{bmatrix} x_{11}\ x_{12}\ \ldots\ x_{1n} \\ x_{21}\ x_{22}\ \ldots\ x_{2n} \\ \ldots \\ x_{k1}\ x_{k2}\ \ldots\ x_{kn} \end{bmatrix} \cdot \begin{bmatrix} a_1 \\ a_2 \\ \ldots \\ a_n \end{bmatrix} = \begin{bmatrix} y_1 \\ y_2 \\ \ldots \\ y_k \end{bmatrix}$$

if $n = k$

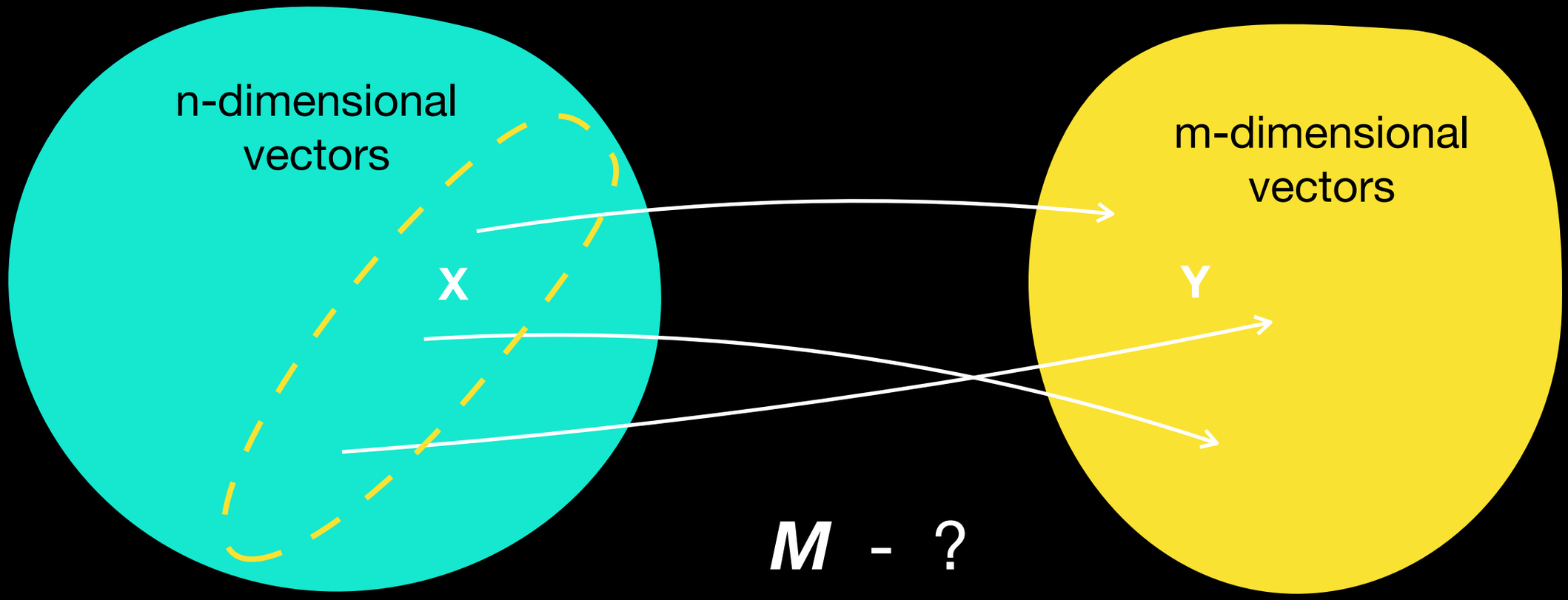
$$a = (X^T)^{-1} y$$



if $n < k$

overdetermined system of linear equations

Dimensionality reduction



M - ?

{ x } - *n-dimensional vectors*

M x ≃ (y_1, …, y_m, 0, 0, …)

n —> *m*