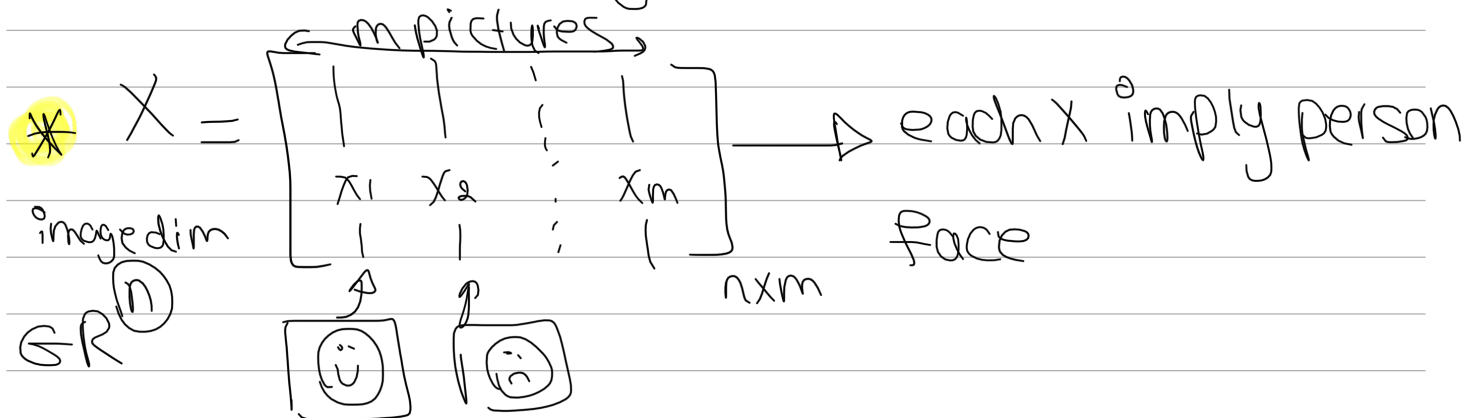# SVD

* used in data reduction ⤳ data processing

* Data reduction ⤳ (video with high resolution)

* SVD will help to reduce it using key features

* Data driven genarizlation of fourier transform (FFT) ⤳ uses cos/sin as a appoximation

* Solve $AX = b$ for non square A metrixes

* regression model

* correlation ⤳ get a high dimensions and get a key correlation in that data.
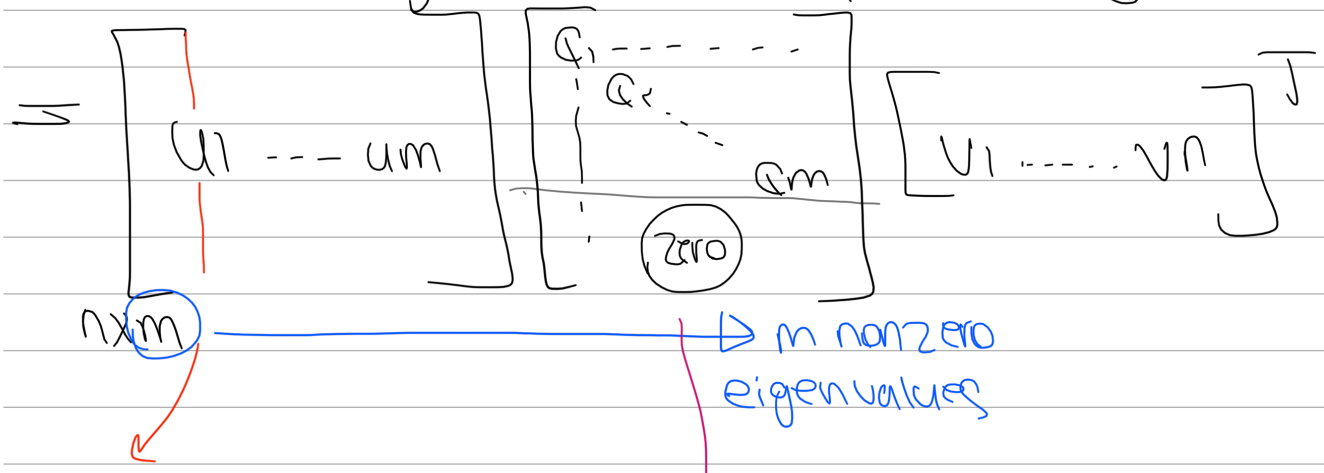
* scable ⤳ imply it on massive Dataset

* $X =$

image dim
$\in \mathbb{R}^{(n)}$

→ each X imply person face

$n \times m$

* represent X as product of three other metrics

$$* \quad X = U \varepsilon V^{T} \quad (V \& U \text{ orthogonal})$$

(diagonal)

order by importance (ε

$\underset{\smile}{U}$ $\begin{bmatrix} u_1 & \cdots & u_m \end{bmatrix}$ $\begin{bmatrix} c_1 & & \\ & c_2 & \\ & & \ddots \\ & & & c_m \\ & \text{(zero)} & \end{bmatrix}$ $\begin{bmatrix} v_1 & \cdots & v_n \end{bmatrix}^{T}$

$n \times m$ ⟶ m nonzero eigenvalues

① column of u has a same shape of X

② eigen faces

importance:

③ $u_1 > u_2 > u_3 > \cdots$

④ They are the basis we can discribe each of the column of our matrix X.

① $c_1 > c_2 > c_3 > \cdots \cdots c_m \geq 0$

② first column of u correspond to c_1 and first of them are more important than second column and second more than third and $\cdots$

* since the first values are more important we can chop some of them off and use only them.

* $V^T = \begin{pmatrix} \cdots v_1^T \cdots \\ \cdots v_p^T \cdots \\ \cdots v_n^T \cdots \end{pmatrix}$

$v_1 =$ mixture of all u's to create x_1.

scaled by singular value