Single Value Decomposition

	India Jones	Star wars	XYZ	BB1	BB2
Bob	4	5	5	4	4
Tred	3	3	3	5	4
Ann	4	5	5	5	2

Matrix → R

PCA

	Action	Scifi	classic
BoB	0.3	0.5	0.2
Tred	0.1	0.1	0.8
Ann	0.3	0.6	0.1

Matrix ⇒ U

Here bob is described as 30% action + 50% scifi + 20% classic

{ Here each user is divided into Action + scifi + Classic }

Matrix ⇒ R^T

	Bob	ann	Ted
India Jones	4	3	4
Star wars	5	3	5
XYZ	5	3	5
BB1	4	5	5
BB2	4	4	2

Matrix RT

PCA

	Action	scifi	classic
Indianjones	0.6	0.3	1
starwars	0.4	0.6	0
XYZ	0.4	0.6	0
BB1	0.8	0.2	
BB2	0.2	0	0.8

⇒ Matrix M

Here each movie is divided into "Action + classic

Matrix factorization :→

user → movie

$$R = U \Sigma M^T$$

↳ If we have missing values in R (Matrix R) we can reconstruct using Matrix U & Matrix M

↳ Thats why it is known as Matrix Factorization.

{ we describe our training data items of smaller matrices ; and missing values in that, we want to predict that.

$$R = U \Sigma M^T$$

U → user matrix

M^T → Movie matrix

↳ The way of Computing all 3 together

$\{U, \Sigma, M^T\}$ is known

U → user matrix, Σ → Sigma, M^T → Transposed Movie matrix

as Single Value Decomposition.

Note:- When the original matrices 'R' is having missing values then we can't run PCA on that. {some of them are missing}. It must be a Complete matrix

Suppose:-

	Indian Jones	Star wars	XYZ	BB1	BB2
Bob	4	5	?	?	?
ann	?	?	?	?	1
Ted	?	5	5	5	?

$$R_{Bob,XYZ} = U_{Bob} \cdot M^{T}_{XYZ}$$

↳ using SVD we calculate $R_{Bob,XYZ}$.

↳ we can treat this problem as Minimization Problem.

↳ There is not only SVD; there are some other ML techniques i.e Stochastic Gradient Descent Method

{ It will iterates until its reaches min error value }