SVD → the relevant case:

Let A be an $m \times n$ matrix, $m \geq n$. Then A can be factored as $A = UDV^T$;

$U = m \times n$ matrix with orthogonal columns.

$D = n \times n$ diagonal matrix of singular values in descending order, all ≥ 0

$V = n \times n$ orthogonal matrix, whose columns are singular vectors corresponding to SVs of D

U has orthogonal columns means $\underline{\underline{U^T U = I_{n\times n}}}$

and U is norm preserving in that ~~$U^T U = I_{n\times n}$~~ $\|Ux\| = \|x\|$ for any vector x.

SVD for homogeneous least squares solution:

Minimize $\|Ax\|^2$ such that $\|x\| = 1$

Or minimize $[Ax]^T [Ax]$ such that $x^T x = 1$.

Let $A = UDV^T$

Then $\|UDV^T x\| = \|DV^T x\|$.

[Note that U is norm preserving and hence $\|Ux\|^2 = x^T U^T U x = x^T x = \|x\|^2$

or $\|Ux\| = \|x\|$. Hence in above

$\|UDV^T x\| = \|DV^T x\|$].

also $\|V^T x\| = \|x\|$ (since V is orthonormal)

sub $y = V^T x$ =

Then $\|y\| = \|V^T x\| = \|x\|$.

We [illegible] minimize $\|Dy\|$ subject to $\|y\| = 1$.