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0.1 Singular value decomposition

The singular value decomposition of $m \times n$ matrix M is:

$M = U\Sigma V^*$

Where:

- U is a unitary matrix $(m \times m)$
- Σ is a diagonal matrix with non-negative real numbers $(m \times n)$
- V is a unitary matrix $(n \times n)$

Σ is unique. U and V are not.

0.1.1 Properties

$M^*M = U\Sigma^2U^*$

$(M^*M)^{-1} = V\Sigma^{-2}V^*$

0.1.2 Calculating the SVD

The SVD is generally calculated iteratively.