SVD

EECS 16B CSM

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$$oldsymbol{A} = \sum_{i=1}^{r} \sigma_{i} oldsymbol{u}_{i} \left[oldsymbol{v}_{i}
ight]^{\!\top} = oldsymbol{U} oldsymbol{\Sigma} \left[oldsymbol{V}
ight]^{\!\top} = egin{bmatrix} oldsymbol{u}_{1} & oldsymbol{u}_{2} & \cdots & oldsymbol{u}_{r} \end{bmatrix} egin{bmatrix} \sigma_{1} & 0 & \cdots & 0 \ 0 & \sigma_{2} & \cdots & 0 \ \vdots & \vdots & \ddots & \vdots \ 0 & 0 & \cdots & \sigma_{n} \end{bmatrix} egin{bmatrix} \left[oldsymbol{v}_{1}\right]^{\!\top} \\ \left[oldsymbol{v}_{2}\right]^{\!\top} \\ \left[oldsymbol{v}_{n}\right]^{\!\top} \end{bmatrix}$$

$$(1)$$

- U: orthonormal matrix
- lacksquare Σ : diagonal matrix
- $[V]^{\top}$ orthonormal matrix

Applications

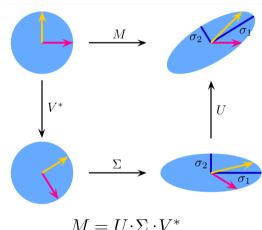
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- PCA
- least squares, pseudoinverse
- splitting up matrix operations

Visualization

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$$M = U \cdot \Sigma \cdot V^*$$