$$R = \begin{array}{c} \\ u_1 \\ u_2 \\ u_3 \end{array} \begin{array}{c} \begin{array}{cccc} i_1 & i_2 & i_3 & i_4 \end{array} \\ \begin{pmatrix} 3 & & 0 & \\ & 2 & & 1 \\ 1 & & \square & \end{pmatrix} \end{array}$$

link prediction (centrality)

Collaborative filtering w/ context

Row or column

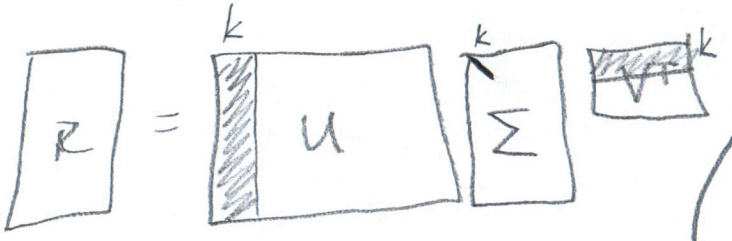
Low Rank factorization by SVD

Rank deficient means:

- There are a "small" # of independent users or items.

By SVD: $R = U \Sigma V^T$

Assume R is of Rank $k \ll m$ or n



1. Choose Random $U_k \Sigma_k V_k^T$
2. Compute $\tilde{R} = U_k \Sigma_k V_k^T$
3. Compare R with $\tilde{R}$ only w/ known entries
4. Update U_k, Σ_k, V_k^T