Important Scientific Presentation

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The Initial Data Set

- Matrix M_t contains c column vectors, m_1 through m_c.

$$M_t = [\ m_1 \ \ m_2 \ \ \ldots \ \ m_c \ ]$$

- Taking the SVD of M_t gives us

$$M_t = [\widehat{U}_t \ \ \tilde{U}_t] \begin{bmatrix} \widehat{\Sigma}_t & 0 \\ 0 & \tilde{\Sigma}_t \end{bmatrix} [\widehat{V}_t \ \ \tilde{V}_t]^H$$

  where $\widehat{U}_t$ contains the k left singular vectors of M_t corresponding to its largest singular values, which are the orthonormal basis vectors of the desired subspace.

The First Iteration

- Now we create the next matrix M_{t+1} using the columns of M_t, discarding m_1 and using the new column m_{c+1}.

$$M_{t+1} = [\ m_2 \ \ m_3 \ \ \ldots \ \ m_c \ \ m_{c+1}\ ]$$

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- What we want are $\widehat{U}_{t+1}$ and $\widehat{\Sigma}_{t+1}$ where

$$M_{t+1} = [\widehat{U}_{t+1} \ \ \tilde{U}_{t+1}] \begin{bmatrix} \widehat{\Sigma}_{t+1} & 0 \\ 0 & \tilde{\Sigma}_{t+1} \end{bmatrix} [\widehat{V}_{t+1} \ \ \tilde{V}_{t+1}]^H$$

Multiple Column Update

- More than one column can be added and removed each iteration by adding the portion of all relevant vectors to the orthonormal basis Q.

- The matrix Q will be of dimension $r \times k + 2n$.

- The algorithm is otherwise unchanged.