

Unsupervised



$$\begin{matrix} m=3 \\ S=4 \end{matrix} \rightarrow \begin{bmatrix} 1-3 \\ 4 \\ 2-3 \\ \vdots \end{bmatrix}$$

$$U = \begin{pmatrix} | & | & | & \dots & | \\ u_1 & u_2 & u_3 & \dots & u_n \\ | & | & | & \dots & | \end{pmatrix}_{n \times n}$$

$$U = \begin{pmatrix} | & | & | \\ u_1 & \dots & u_k \\ | & | & | \end{pmatrix}_{n \times k} \quad U^T$$

$$Z_i = \begin{pmatrix} -u_1- \\ -u_2- \\ \vdots \\ -u_k- \end{pmatrix}_{k \times n} \times \begin{pmatrix} \cdot \\ \cdot \\ \cdot \\ \cdot \end{pmatrix}_{n \times 1}$$

$$Z_i = \begin{pmatrix} \cdot \\ \cdot \\ \cdot \end{pmatrix}_{k \times 1} \quad k \leq n$$

$$X_{\text{approx}}^{n \times 1} = U_{\text{reduce}}^{n \times k} X^Z \quad k \times 1$$

$n=100$ $k=80 \rightarrow 0.005$
 0.01 $k=70 \rightarrow 0.008$
 $k=60 \rightarrow 0.12$

$$S = \begin{pmatrix} S_{11} & 0 & 0 & \dots & 0 \\ 0 & S_{22} & 0 & \dots & 0 \\ 0 & 0 & S_{33} & \dots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \dots & \dots & S_{nn} \end{pmatrix}_{n \times n}$$

$$1 - \sum_{i=1}^k S_{ii} \leq 0.01$$

$$\sum_{i=1}^k S_{ii} \geq 0.99$$

$n=100$
 $k=80 \rightarrow 0.999$
 $k=70 \rightarrow 0.992$
 $k=60 \rightarrow 0.982$

$k=70$

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