Unit – 5

Singular Value Decomposition

Assignment

Quadratic forms:

1. Which of the following are Quadratic forms

A. $Q = x^2 + 3z^2 + 6xy + 2z$

B. $2xy^2 + 3z^2 + 6xy$

C. $3xy + 3xz + 6yz$

Quadratic forms:

2. Find the Quadratic form of $A = \begin{pmatrix} 5 & 1/3 \\ 1/3 & 1 \end{pmatrix}$ $A = \begin{pmatrix} 4 & 3 & 0 \\ 3 & 2 & 1 \\ 0 & 1 & 1 \end{pmatrix}$ $A = \begin{pmatrix} 0 & -2 & 0 \\ -2 & 0 & 2 \\ 0 & 2 & 1 \end{pmatrix}$

Definiteness:

1. Verify whether these are positive definite A= $\begin{pmatrix} 2 & -1 \\ 2 & 2 \end{pmatrix}$

B= $\begin{pmatrix} -2 & 2 \\ 2 & 2 \end{pmatrix}$ C= $\begin{pmatrix} -2 & 1 & 0 \\ 1 & -2 & 0 \\ 0 & 0 & -2 \end{pmatrix}$

Definiteness:

2. Verify for definiteness of $A = \begin{pmatrix} 1 & 1 & 0 \\ 1 & 1 & 0 \\ 0 & 0 & 2 \end{pmatrix}$ $B = \begin{pmatrix} -2 & 0 & -1 \\ 0 & -2 & -1 \\ -2 & -4 & -3 \end{pmatrix}$

Singular Values:

3. Find singular values of $A = \begin{pmatrix} -5 & 0 \\ 0 & 0 \end{pmatrix}$ $A = \begin{pmatrix} \sqrt{6} & 0 \\ 0 & \sqrt{6} \end{pmatrix}$ $A = \begin{pmatrix} 2 & -1 \\ 2 & 2 \end{pmatrix}$

SVD:

10. Find SVD of $A = \begin{pmatrix} -3 & 1 \\ 6 & -2 \\ 6 & -2 \end{pmatrix}$ $A = \begin{pmatrix} 3 & 2 & 2 \\ 2 & 3 & -2 \end{pmatrix}$

12. Find SVD of $A = \begin{pmatrix} 4 & -2 \\ 2 & -1 \\ 0 & 0 \end{pmatrix}$

Covariance:

11. Construct the sample covariance matrix of $A = \begin{pmatrix} 19 & 22 & 6 & 3 & 2 & 20 \\ 12 & 6 & 9 & 15 & 13 & 5 \end{pmatrix}$

$A = \begin{pmatrix} 1 & 5 & 2 & 6 & 7 & 3 \\ 3 & 11 & 6 & 8 & 15 & 11 \end{pmatrix}$