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20710-214	TUTTOETS 12 / TUT TEST 12	2023
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Doen die gereduseerde SVD-ontbinding van die matriks A hieronder in die vorm $A = \bar{U}\bar{\Sigma}\bar{V}^T$. Die singulierwaardes moet van groot na klein gerangskik word.

Do the reduced SVD of the matrix A below as $A = \bar{U}\bar{\Sigma}\bar{V}^T$. The singular values must be sorted from large to small.

$$A = \begin{bmatrix} -0.8 & 2.8 & 18.4 \\ 5.6 & 10.4 & 21.2 \end{bmatrix}$$

$$AA^T = \bar{U}\bar{\Sigma}^2\bar{U}^T = \begin{bmatrix} -0.8 & 2.8 & 18.4 \\ 5.6 & 10.4 & 21.2 \end{bmatrix} \begin{bmatrix} -0.8 & 5.6 \\ 2.8 & 10.4 \\ 18.4 & 21.2 \end{bmatrix} = \begin{bmatrix} 347.04 & 414.72 \\ 414.72 & 588.96 \end{bmatrix}$$

$$\lambda^2 - 936\lambda + 32400 = 0$$

$$\lambda_1 = 900 \quad \text{or} \quad \lambda_2 = 36$$

$$\sigma_1 = \sqrt{900} = 30 \quad \checkmark$$

$$\sigma_2 = \sqrt{36} = 6 \quad \checkmark$$

$$\lambda_1 = 900 \quad \begin{bmatrix} -552.96 & 414.72 \\ \mu \end{bmatrix} \begin{bmatrix} x_1 \\ \mu \end{bmatrix} = 0$$

$$x_1 = \frac{414.72\mu}{552.96} = 0.75\mu$$

$$\lambda_2 = 36 \quad \begin{bmatrix} 311.04 & 414.72 \\ \mu \end{bmatrix} \begin{bmatrix} x_1 \\ \mu \end{bmatrix} = 0$$

$$x_1 = \frac{-414.72\mu}{311.04} = -1.333\mu$$

$$\underline{x}_1 = \begin{bmatrix} 0.75\mu \\ \mu \end{bmatrix} = \begin{bmatrix} 3 \\ 4 \end{bmatrix}, \quad \underline{x}_2 = \begin{bmatrix} -1.333\mu \\ \mu \end{bmatrix} = \begin{bmatrix} -4 \\ 3 \end{bmatrix}$$

$$A = \bar{U}\bar{\Sigma}\bar{V}^T, \quad \bar{U}^T A = \bar{\Sigma}\bar{V}^T$$

$$\bar{U} = \frac{1}{5} \begin{bmatrix} 3 & -4 \\ 4 & 3 \end{bmatrix}$$

$$\bar{\Sigma} = \begin{bmatrix} 30 & \\ & 6 \end{bmatrix}$$

$$\bar{V} = \frac{1}{15} \begin{bmatrix} 2 & 10 \\ 5 & 10 \\ 14 & -5 \end{bmatrix}$$

$$\bar{\Sigma}\bar{V}^T = \frac{1}{5} \begin{bmatrix} 3 & 4 \\ -4 & 3 \end{bmatrix} \begin{bmatrix} -0.8 & 2.8 & 18.4 \\ 5.6 & 10.4 & 21.2 \end{bmatrix} = \frac{1}{5} \begin{bmatrix} 20 & 50 & 140 \\ 20 & 20 & -10 \end{bmatrix}$$

$$\bar{V}^T = \begin{bmatrix} \frac{1}{30} & 0 \\ 0 & \frac{1}{6} \end{bmatrix} \begin{bmatrix} 4 & 10 & 28 \\ 4 & 4 & -2 \end{bmatrix} = \begin{bmatrix} \frac{2}{15} & \frac{5}{15} & \frac{14}{15} \\ \frac{2}{3} & \frac{2}{3} & -\frac{1}{3} \end{bmatrix}$$