

⊞—svd nr

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Ex 1

$$A := \begin{bmatrix} 3 & 1 & 1 \\ -1 & 3 & 1 \end{bmatrix}$$

$$[U \ S \ V] := \text{MSVD}(A)$$

$$\text{norme}(A - U \cdot S \cdot V^T) = 1.1 \cdot 10^{-13}$$

$$[U \ S \ V] = \begin{bmatrix} \begin{bmatrix} -0.7071 & -0.7071 \\ -0.7071 & 0.7071 \end{bmatrix} \begin{bmatrix} 3.4641 & 0 & 0 \\ 0 & 3.1623 & 0 \end{bmatrix} \begin{bmatrix} -0.4082 & -0.8944 & -0.1826 \\ -0.8165 & 0.4472 & -0.3651 \\ -0.4082 & 0 & 0.9129 \end{bmatrix} \end{bmatrix}$$

Ex 1'

$$A := A^T$$

$$[U \ S \ V] := \text{MSVD}(A)$$

$$\text{norme}(A - U \cdot S \cdot V^T) = 1.1 \cdot 10^{-13}$$

$$[U \ S \ V] = \begin{bmatrix} \begin{bmatrix} -0.4082 & -0.8944 & -0.1826 \\ -0.8165 & 0.4472 & -0.3651 \\ -0.4082 & 0 & 0.9129 \end{bmatrix} \begin{bmatrix} 3.4641 & 0 \\ 0 & 3.1623 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} -0.7071 & -0.7071 \\ -0.7071 & 0.7071 \end{bmatrix} \end{bmatrix}$$

Ex 2

$$A := \begin{bmatrix} 0 & 0 & 0 & 42 \\ 1 & 0 & 0 & 27 \\ 0 & 1 & 0 & -13 \\ 0 & 0 & 1 & 5 \end{bmatrix}$$

$$[U \ S \ V] := \text{MSVD}(A)$$

$$\text{norme}(A - U \cdot S \cdot V^T) = 0$$

$$[U \ S \ V] = \begin{bmatrix} \begin{bmatrix} -0.81 & 0 & 0 & -0.59 \\ -0.52 & 0.02 & 0.46 & 0.72 \\ 0.25 & -0.32 & 0.85 & -0.35 \\ -0.1 & -0.95 & -0.27 & 0.13 \end{bmatrix} \begin{bmatrix} 51.84 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0.81 \end{bmatrix} \begin{bmatrix} -0.01 & 0.02 & 0.46 & 0.89 \\ 0 & -0.32 & 0.85 & -0.43 \\ 0 & -0.95 & -0.27 & 0.16 \\ -1 & 0 & 0 & -0.01 \end{bmatrix} \end{bmatrix}$$

Ex 3

$$A := \begin{bmatrix} 92 & 99 & 1 & 8 & 15 \\ 98 & 80 & 7 & 14 & 16 \\ 4 & 81 & 88 & 20 & 22 \\ 85 & 87 & 19 & 21 & 3 \\ 86 & 93 & 25 & 2 & 9 \\ 17 & 24 & 76 & 83 & 90 \\ 23 & 5 & 82 & 89 & 91 \\ 79 & 6 & 13 & 95 & 97 \\ 10 & 12 & 94 & 96 & 78 \\ 11 & 18 & 100 & 77 & 84 \end{bmatrix}$$

$$[U \ S \ V] := \text{MSVD}(A)$$

$$\text{norme}(A - U \cdot S \cdot V^T) = 5.5 \cdot 10^{-11}$$

$$S = \begin{bmatrix} 363.4811 & 0 & 0 & 0 & 0 \\ 0 & 231.5016 & 0 & 0 & 0 \\ 0 & 0 & 117.8766 & 0 & 0 \\ 0 & 0 & 0 & 22.4612 & 0 \\ 0 & 0 & 0 & 0 & 17.7241 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$U = \begin{bmatrix} -0.2226 & 0.4705 & -0.0536 & 0.4124 & -0.2407 & 0.1296 & -0.5366 & 0.0362 & -0.4383 & 0.0037 \\ -0.2282 & 0.4178 & -0.1317 & -0.1262 & 0.2822 & 0.4453 & 0.0598 & 0.3788 & 0.3998 & 0.3941 \\ -0.2565 & 0.0734 & 0.6669 & 0.2445 & -0.2193 & 0.0417 & 0.5429 & 0.2332 & -0.1549 & 0.0352 \\ -0.2291 & 0.3978 & 0.0278 & -0.5274 & -0.3461 & 0.0083 & 0.0294 & -0.0851 & 0.1882 & -0.589 \\ -0.2258 & 0.4274 & 0.1097 & -0.0248 & 0.4538 & -0.6007 & 0.0865 & -0.3826 & -0.0261 & 0.1801 \\ -0.3809 & -0.2089 & 0.02 & 0.4446 & -0.2286 & -0.1655 & -0.1949 & -0.1466 & 0.688 & -0.0268 \\ -0.3865 & -0.2617 & -0.0581 & -0.094 & 0.2943 & -0.3469 & -0.1929 & 0.6567 & -0.142 & -0.2726 \\ -0.3703 & -0.0538 & -0.6888 & 0.1533 & -0.1458 & 0.008 & 0.5317 & -0.1017 & -0.2181 & -0.0048 \\ -0.3874 & -0.2816 & 0.1014 & -0.4953 & -0.334 & -0.0361 & -0.2045 & -0.1352 & -0.1674 & 0.5604 \\ -0.3841 & -0.2521 & 0.1833 & 0.0073 & 0.4659 & 0.5226 & -0.0744 & -0.4071 & -0.1372 & -0.2739 \end{bmatrix}$$

$$V = \begin{bmatrix} -0.3727 & 0.5861 & -0.473 & -0.3459 & 0.4174 \\ -0.349 & 0.6295 & 0.4358 & 0.3409 & -0.4192 \\ -0.4805 & -0.2661 & 0.6503 & -0.3274 & 0.4102 \\ -0.5043 & -0.3105 & -0.2819 & -0.3825 & -0.6507 \\ -0.504 & -0.3048 & -0.2898 & 0.7146 & 0.2416 \end{bmatrix}$$

Ex 4

Check the time and accuracy.

$$A := \text{matrix}(30, 20)$$

$$r := [1.. \text{length}(A)]$$

$$A_r := \text{eval}\left(200 \cdot 10^{-9} \cdot \text{random}\left(10^9\right) - 100\right)$$

$$t_o := \text{time}(0) \quad [U \ S \ V] := \text{MSVD}(A)$$

$$\boxed{\text{time}(0) - t_o = 27.77 \text{ s}}$$

$$\boxed{\text{norme}(A - U \cdot S \cdot V^T) = 5 \cdot 10^{-9}}$$

