

Exercise 3-3-14

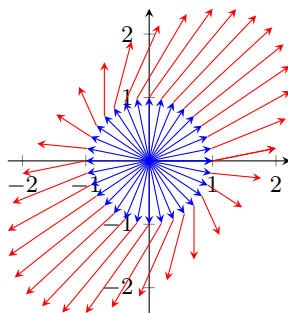
A. J. Roberts, August 11, 2020

Recall how Example 3.3.33 introduced that finding a singular vector and singular value of a matrix A came from maximizing $|A\mathbf{v}|$. Each of the following matrices, say A for discussion, has plotted $A\mathbf{v}$ (red) adjoined to the corresponding unit vector \mathbf{v} (blue). For each case:

- i. by inspection of the plot, estimate a singular vector \mathbf{v}_1 that appears to maximize $|A\mathbf{v}_1|$ (to one decimal place say);
- ii. estimate the corresponding singular value σ_1 by measuring $|A\mathbf{v}_1|$ on the plot;
- iii. set the second singular vector \mathbf{v}_2 to be orthogonal to \mathbf{v}_1 by swapping components, and making one negative;
- iv. estimate the corresponding singular value σ_2 by mea-

suring $|A\mathbf{v}_2|$ on the plot;

- v. compute the matrix-vector products $A\mathbf{v}_1$ and $A\mathbf{v}_2$, and confirm that they are orthogonal (approximately).



$$A = \begin{bmatrix} 1 & 1 \\ 0.2 & 1.4 \end{bmatrix}$$