MMAE 500: Data Driven Modeling

Homework 2

Assigned: 31 Jan 2024
Due: 13 Feb 2024

1. Consider the matrix
$$A = \begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \end{bmatrix}.$$
   (a) Find the full, non-reduced singular value decomposition of A.
   (b) Find the pseudoinverse of A.
   (c) Find the rank-1 matrix A_1 that minimizes $\|A - A_r\|_F$, where the subscript F denotes the Frobenius norm of a matrix.

2. Consider the data generated by the file hw2Q2.m (in Matlab) or hw2Q2.ipynb (Python notebook), which is assembled into the matrix X. Note that this is the same data as was considered in Homework 1. Compute the SVD of X, and plot the first two left singular vectors against y (the spatial coordinate). Why are the first two singular values much larger than the rest (which are essentially zero)?

3. Change the function that generates the data in question 2 so that the spatial peaks (i.e. the Gaussians) change their location with time. How you do this is up to you, so this question is a bit open ended. How does this change the results of question 2? You may also change the amount of data in space and/or time if you wish to.