

5627: HW5 Least Squares

1. Write your own GS function which input any $n \times m$ real matrix and output an $n \times m$ matrix Q and a $m \times m$ matrix R . Test your function appropriately.
2. Modify your GS function to create a double orthogonalization function GSO with the same external syntax. Test your function appropriately.
3. Compare the run times of your GS and GSO and the built-in QR decomposition by creating a log-log plot of the run times of the three against matrix dimension n for square matrices.
4. Compare the accuracy (use some hard problems) and run-time (a log-log-plot of the timings on an appropriate set of randomly generated problems) of the following different least square solvers.
 - 4.1. Built in linear solve for Normal Equations.
 - 4.2. QR decomposition for original equation.
 - 4.3. GS decomposition and then a linear solve.
 - 4.4. GSO decomposition and then a linear solve.
 - 4.5. LinearSolve for over determined system.
 - 4.6. SVD technique with appropriate cut-offs
5. What happens to the built-in QR, your GS, and your GSO on rank deficient matrices. Explain in words what you think should happen and show me what does happen in code.