

CS282K: Numerical Methods for Scientific Computing and Machine Learning

Homework 2

Issued: September 4

Due: September 15 (11:59PM, Beijing time)

Please submit the PDF file of your solution to the “Drop Box” on Sakai.

Problem 1: Linear Equation Solver

Apply Gaussian elimination without pivoting to solve the following linear equation by hand calculation. Next, apply LU decomposition to solve the same linear equation by hand calculation. Show all steps in detail.

$$\begin{bmatrix} 1 & 2 & 3 \\ 4 & 5 & 6 \\ 7 & 8 & 10 \end{bmatrix} \cdot \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} = \begin{bmatrix} 6 \\ 15 \\ 25 \end{bmatrix} \quad (1)$$

Problem 2: Linear Regression

Build two regression models (linear and quadratic) for a one-dimensional function $f(x)$ where $x \in [0, 1]$. The linear model has the form of:

$$f(x) \approx bx + c. \quad (2)$$

and the quadratic model has the form of:

$$f(x) \approx ax^2 + bx + c. \quad (3)$$

The following table lists five sampling points that you should use to fit both models.

x	0.00	0.25	0.50	0.75	1.00
$f(x)$	0.00	0.25	0.50	0.75	1.00

Write your MATLAB code to build the over-determined linear equation and then solve the model coefficients. You can use the backslash “\” in MATLAB to solve the over-determined linear equation. Plot the fitted models and print out the model coefficients for both cases. Submit them along with your MATLAB code.