

Lecture 10 : Linear Least Square

အဲဒါနဲ့ solve linear least square အဲဒါနဲ့
မေး QR လုပ်ချင်အောင်လုပ်လို့ရလား?

QR factorization (1-3)
Householder
Givens Rotation

Solve the least-squares problem: $A = QR$

$$\begin{bmatrix} 1 & 2 \\ 0 & -2.4 \\ 0 & 1.8 \end{bmatrix} x \cong \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}$$

using QR Factorization

1. Factor $A = QR$

အဲဒါနဲ့လုပ်ချင်အောင်

$$A = \begin{bmatrix} 1 & 2 \\ 0 & -2.4 \\ 0 & 1.8 \end{bmatrix} \quad Q = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.8 & 0.6 \\ 0 & -0.6 & 0.8 \end{bmatrix} \quad R = \begin{bmatrix} 1 & 2 \\ 0 & -3 \\ 0 & 0 \end{bmatrix} \quad b = \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix}$$

မေးခွန်းရလေအောင်လုပ်လို့ရလား? အဲဒါနဲ့ Householder, Given rotations

2. Compute $c = Q^T b$

$$\begin{aligned} c &= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.8 & 0.6 \\ 0 & -0.6 & 0.8 \end{bmatrix}^T \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix} \\ &= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0.8 & -0.6 \\ 0 & 0.6 & 0.8 \end{bmatrix} \begin{bmatrix} -1 \\ 0 \\ 1 \end{bmatrix} \\ &= \begin{bmatrix} (1)(-1) + 0 + 0 \\ 0 + 0 + 1(-0.6) \\ 0 + 0 + 1(0.8) \end{bmatrix} \\ &= \begin{bmatrix} -1 \\ -0.6 \\ 0.8 \end{bmatrix} \end{aligned}$$

3. Solve $R_1 x = c_1$ for x

$$= \begin{bmatrix} -1 \\ -0.6 \\ 0.8 \end{bmatrix} \quad A = \begin{bmatrix} 1 & 2 \\ 0 & -2.4 \\ 0 & 1.8 \end{bmatrix} \quad \begin{matrix} A \text{ is } 3 \times 2, \text{ only first 2 rows} \\ \text{of } R \text{ carry equation} \end{matrix}$$

3×2

$$R_1 = \begin{bmatrix} 1 & 2 \\ 0 & -3 \end{bmatrix}, \quad c_1 = \begin{bmatrix} -1 \\ -0.6 \end{bmatrix}$$

$$R_1 x = c_1$$

$$\begin{bmatrix} 1 & 2 \\ 0 & -3 \end{bmatrix} x = \begin{bmatrix} -1 \\ -0.6 \end{bmatrix}$$

$$\therefore x = \begin{bmatrix} -1.4 \\ 0.2 \end{bmatrix} \quad \#$$