

QR Decomposition

-> over determine system (m>n)
To solve out without using inversion

now, A = QR supper thiangular matrix (nxn)

matrix (mxn)

$$(QR)^{\dagger} (QR)^{\chi} = (QR)^{\dagger} b$$

$$\Rightarrow Rx = Q^Tb$$

for mation of a matrix:

U1, U2, U3

Gram-schmidt process

orethonormal

orethnormal matrix: एक म्यादिकः
कलामञ्चलात्क vector विख्या कर्ता रक्टेव्युलाः
set orethonormal set २००।

Gram Schmidt Process

eg
$$x_0 = -3$$
 $x_1 = 0$ $x_2 = 6$

$$f(x_0) = 0$$
 $f(x_1) = 0$ $f(x_2) = 2$

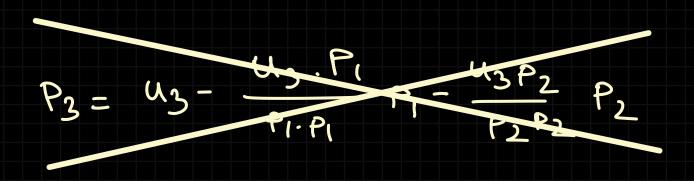
$$x_3 = 0$$

$$x_4 = 0$$

$$x$$

$$= \begin{bmatrix} -3 \\ 0 \\ 6 \end{bmatrix} - \frac{(-3x) + (1x0) + (1x6)}{(1x0) + (1x1) + (1x1)} \begin{bmatrix} 1 \\ 1 \\ 1 \end{bmatrix}$$

$$= \begin{bmatrix} -3 \\ 0 \\ 6 \end{bmatrix} - 1 \begin{bmatrix} 1 \\ 1 \end{bmatrix}$$



we got two vectors P₁, P₂ who are orthogonal vectors.

now we make them orthonormal.

$$Q_{1} = \frac{P_{1}}{|P_{1}|} = \frac{1}{\sqrt{3}} \begin{bmatrix} 1 \\ 1 \end{bmatrix} = \begin{bmatrix} 1/\sqrt{3} \\ 1/\sqrt{3} \\ 1/\sqrt{3} \end{bmatrix}$$

$$Q_{2} = \frac{P_{2}}{|P_{2}|} = \frac{1}{\sqrt{42}} \begin{bmatrix} -4 \\ -1 \end{bmatrix} = \begin{bmatrix} -4/\sqrt{42} \\ -1/\sqrt{42} \\ 5/\sqrt{42} \end{bmatrix}$$

$$R = Q^{T} A$$

$$= \begin{bmatrix} 1/\sqrt{3} & 1/\sqrt{3} & 1/\sqrt{3} \\ -4/\sqrt{42} & -1/\sqrt{42} & \sqrt{42} \end{bmatrix} \begin{bmatrix} 1 & -3 \\ 1 & 0 \\ 1 & 6 \end{bmatrix}$$

$$\begin{bmatrix} \sqrt{3} & \sqrt{3} \\ 0 & \sqrt{42} \end{bmatrix} \begin{bmatrix} a_0 \\ a_1 \end{bmatrix} = \begin{bmatrix} 1/\sqrt{3} & 1/\sqrt{3} & 1/\sqrt{3} \\ -4/\sqrt{42} & \sqrt{42} \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ \sqrt{42} \end{bmatrix}$$

$$\begin{bmatrix} \sqrt{3} & \sqrt{3} \\ 0 & \sqrt{42} \end{bmatrix} \begin{bmatrix} a_1 \\ a_1 \end{bmatrix} = \begin{bmatrix} 2/\sqrt{3} \\ 5\sqrt{2} & \sqrt{2}1 \end{bmatrix}$$

using backward substitution,

$$\sqrt{3}$$
 $\sqrt{3}$ $\sqrt{3}$ $\sqrt{3}$ $\sqrt{3}$ $\sqrt{3}$ $\sqrt{3}$ $\sqrt{3}$ $\sqrt{3}$

$$P_1(x) = 90 + 91x$$

$$= 3 + 51x$$

$$2x_1 - 5x_2 = 1$$

 $5x_1 + x_2 = 10$
 $x_1 - 7x_2 = 5$

Sd:
$$\begin{pmatrix} 2 & -5 \\ 5 & -\frac{1}{7} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 1 & 1 \\ 2 & 1 \end{pmatrix}$$

$$\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} x_1 \\ x_1 \end{pmatrix} = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} x_1 \\ x_1 \end{pmatrix} = \begin{pmatrix} x_1 \\ x_1 \end{pmatrix} = \begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} x_1 \\ x_1 \end{pmatrix} = \begin{pmatrix} x_1 \\ x_$$