QR Factorization

Orthonormal Basis

If vectors have unit lengths they are orthonormal.

To find the orthonormal basis of $\vec{v}$, $\hat{v}$

$$\hat{v} = \frac{1}{||\vec{v}||}\vec{v}$$

QR Factorization

For a $m \times n$ matrix A linearly independent columns,

$$A = QR$$

Q is an $m \times n$, with columns are an orthonormal basis for $\text{Col}A$.
R is $n \times n$, upper triangular, with positive entries on its diagonal.

We can get Q using the Gram-Schmidt process.
To find R, we can us $R = Q^T A$ due to $Q^T Q = I$

Properties

$$\text{Length of the } j^{th} \text{ column of } R = \text{ length of the } j^{th} \text{ column of } A$$