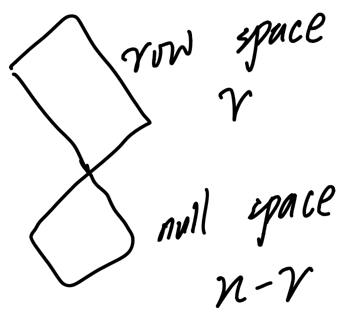
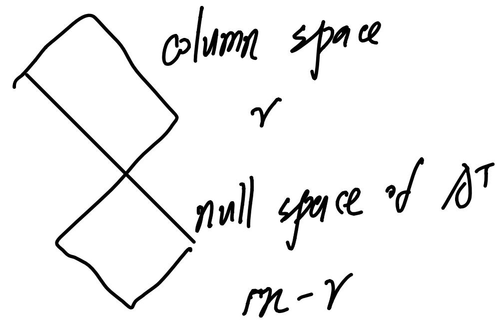
Orthogonal : 正交





Orthogonal vectors: $\perp$ $\quad x^T \cdot y = 0$

Subspace S is orthogonal to subspace T. $\Rightarrow$ every vector in S is orthogonal to vector in T.

Conclusion: Row space is orthogonal to null space
column space is orthogonal to null space of A^T

Why? if x in null space, $Ax = 0$

$$\begin{bmatrix} \text{row1} \\ \vdots \\ \text{rown} \end{bmatrix} \begin{bmatrix} x \end{bmatrix} = \begin{bmatrix} 0 \end{bmatrix}$$

So. x is orthogonal to every row of A

$\Downarrow$

any combination of row A is orthogonal to x.

Solve $Ax=b$, if it has no solution

$\Downarrow$

$$A^TA\hat{x}=A^Tb$$

$$N(A^TA)=N(A)$$

A^TA is invertible exactly A has indepedant columns.