(iii) Geometric interpretation

$\vec{b} \in \mathbb{R}^m$

image

$Im(A) \subset \mathbb{R}^n$

$= \text{span}\{ \vec{a}_1, \ldots, \vec{a}_n \}$

columns of A

$\vec{r} = A\vec{x} - \vec{b}$
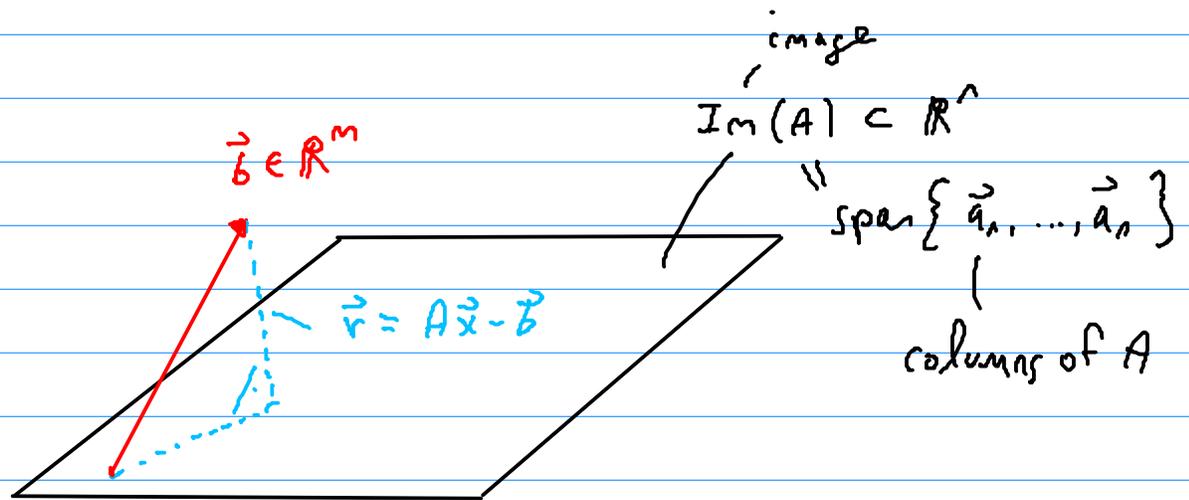
minimize $\| A\vec{x} - \vec{b} \|_2 \rightsquigarrow A\vec{x} - \vec{b}$ is normal

to $Im(A)$

(Hence normal equations)

<u>Ex.:</u> (2) Linear model $\rightsquigarrow$ slides

However, it turns out that solving the normal
equations can be problematic, i.e. ill-conditioned

(a small change in
$\vec{b}$ can lead to a large
change in $\vec{x}$)

Therefore the (following) orthogonal decomposition
method is preferred