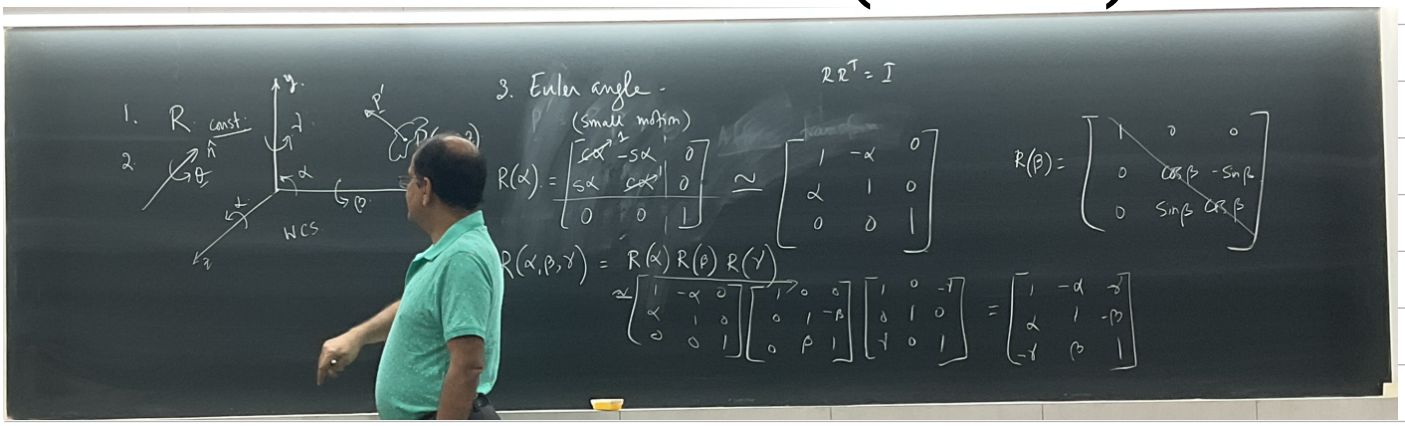
EE702: Lec-11 (14 Feb)



Rotation Quaternion $\longrightarrow$ $\tilde{q} = \left[n \sin\frac{\theta}{2} \quad \cos\frac{\theta}{2} \right]$

$\begin{bmatrix} r_{11} & r_{12} & r_{13} \\ \vdots & \ddots & \\ & & r_{33} \end{bmatrix}$

\# $Q_x = f\, q_x / q_z$

$$\begin{bmatrix} q_x \\ q_y \\ q_z \end{bmatrix} = R \begin{bmatrix} p_x \\ p_y \\ p_z \end{bmatrix} + \begin{bmatrix} t_x \\ t_y \\ t_z \end{bmatrix}$$

I measure corresponding images, but don't know depth

Depth

$f = 1 \Rightarrow$

$$Q_x = \frac{(r_{11}p_x + r_{12}p_y + r_{13}p_z + t_x)/p_z}{(r_{31}p_x + r_{32}p_y + r_{33}p_z + t_z)/p_z}$$

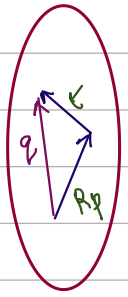
$$= \frac{r_{11}P_x + r_{12}P_y + r_{13}P_z + t_x/p_z}{r_{31}P_x + r_{32}P_y + r_{33}P_z + t_z/p_z}$$

(Here, p_z, t_x, t_y, t_z are unknowns :/)

Elegant way:

$$\begin{bmatrix} q_x/q_z \\ q_y/q_z \\ q_z/q_z \end{bmatrix} \cdot \left(t \times R \begin{bmatrix} p_x/p_z \\ p_y/p_z \\ p_z/p_z \end{bmatrix} \right) = 0$$

Q_x, Q_y, 1 $\leftarrow$ $\begin{bmatrix} q_x/q_z \\ q_y/q_z \\ q_z/q_z \end{bmatrix}$; $\begin{bmatrix} p_x/p_z \\ p_y/p_z \\ p_z/p_z \end{bmatrix} \rightarrow P_x, P_y, 1$



$\vec{a} \times \vec{b} = \vec{c}$

All are in a plane!

$\therefore$ box pdt is 0 !!

Eight-Point Algorithm

$$\begin{bmatrix} Q_x & Q_y & 1 \end{bmatrix} \underbrace{\begin{bmatrix} 0 & t_x & -t_z \\ -t_x & 0 & t_y \\ t_z & t_y & 0 \end{bmatrix} \begin{bmatrix} R \end{bmatrix}}_{E_{3\times 3}} \begin{bmatrix} P_x \\ P_y \\ 1 \end{bmatrix} = 0$$

$\Rightarrow Q_{x_i} P_{x_i} e_{11} + Q_{x_i} P_{x_i} e_{12} + Q_{x_i} P_{x_i} e_{13}$

$+ \quad \cdots$

$+ \quad \cdots$

"Epipolar Line"

$\Rightarrow Q_x a' + Q_y b' + c' = 0$ $\rightarrow$ Straight line!

$\rightarrow fn(R, t, P)$

$E \triangleq t \times R$

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