

GVG'2021 Exercise-12 EN

1. (a) Find the unknowns a, b, c in the following fundamental matrix

$$\mathbf{F} = \begin{bmatrix} a & 1 & 1 \\ b & 1 & 0 \\ c & 2 & 1 \end{bmatrix}$$

when the epipole in the first image is $\vec{e}_{1\alpha_1} = [1, 1]^T$.

- (b) Find the epipolar line in the second image that corresponds to point $\vec{u}_{1\alpha_1} = [0, 1]^T$ in the first image.

- (c) Consider two cameras with projection matrices

$$\mathbf{P}_1 = \begin{bmatrix} 1 & 0 & 0 & 1 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix} \quad \mathbf{P}_2 = \begin{bmatrix} 0 & 0 & 1 & 1 \\ 0 & 1 & 0 & 1 \\ 1 & 0 & 0 & 0 \end{bmatrix}$$

Find point \vec{X}_δ in space that projects into image points $\vec{u}_{1\alpha_1} = [2, 1]^T$, $\vec{u}_{2\alpha_2} = [2, 2]^T$.

2. Suppose we are given the essential matrix

$$\mathbf{E} = \begin{bmatrix} 2 & 0 & 0 \\ 0 & 2 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

Compute 4 pairs $(\mathbf{R}, \vec{t}_\delta)$ with $\|\vec{t}_\delta\| = 1$ such that they define \mathbf{E} (up to scale).