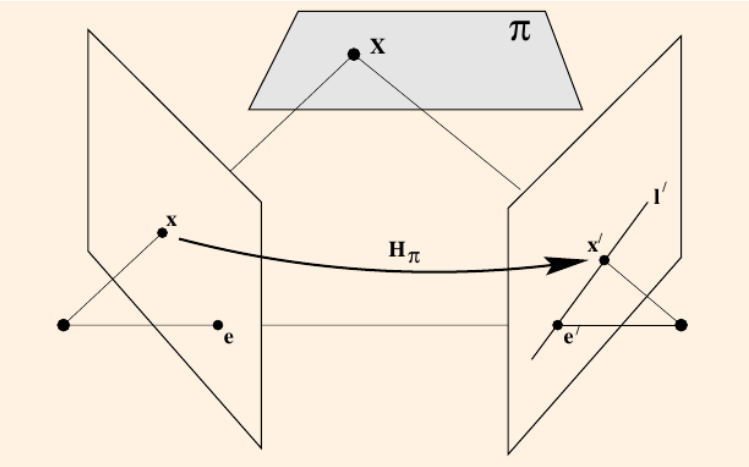
# Homework 2 of CSE 473/573

Due on Monday class of Nov. 05 (350PM)

## 1 Disparity (1 pt)

Two cameras are identical with focal length $f = 0.03$. The camera are located at $(0, 0, 0)$ and $(0.2, 0, 0)$ facing the $z$ direction. Calculate the disparity for the point $P = (0.25, 0.25, 0.25)$.

## 2 Fundamental Matrix (4 pt)




Consider two identical cameras whose focal length is 0.03, with square pixels, no pinhole point offset and zero skew. Let the 3D coordinates of a point $P$ be $\boldsymbol{x} = (x_1, x_2, x_3)$ and $\boldsymbol{x'} = (x'_1, x'_2, x'_3)$ relative to each camera's coordinate system satisfy $\boldsymbol{x'} = R(\boldsymbol{x} - \boldsymbol{t})$, where

$$R = \begin{bmatrix} \frac{\sqrt{2}}{2} & -\frac{\sqrt{2}}{2} & 0 \\ \frac{\sqrt{2}}{2} & \frac{\sqrt{2}}{2} & 0 \\ 0 & 0 & 1 \end{bmatrix} \text{ and } \boldsymbol{t} = \begin{bmatrix} -\frac{\sqrt{2}}{10} \\ -\frac{\sqrt{2}}{10} \\ 0 \end{bmatrix}.$$

1. Calculate the essential matrix $E$. (1 pt)
2. Calculate the fundamental matrix $F$. (1pt)
3. Find the epipolar line (in the right image) corresponding to the point $(1, -1)$ in the left image. [The result should be written as $x'_2 = kx'_1 + b$ or $x'_1 = c$] (1pt)
4. Find the epipoles $\boldsymbol{e}$ in the left image and $\boldsymbol{e'}$ in the right image. [The epipole should be represented as the (x,y) location in that image.] (1pt)