Ungraded quiz: camera calibration and stereo

April 22, 2020

1. When performing camera calibration, we set up a system of equations $A\|\mathbf{p}\| = \mathbf{0}$ in the parameters $\mathbf{p}$ that define the camera projection matrix. We then tried to minimize $A\|\mathbf{p}\|$ subject to $\|\mathbf{p}\| = 1$. Here, we constrain $\|\mathbf{p}\| = 1$ because:
   (a) A camera projection matrix is valid only if its Frobenius norm is 1.
   (b) The constraint makes the optimization easier to implement.
   (c) The correspondences used to form A might be noisy.
   (d) The equations $A\|\mathbf{p}\| = \mathbf{0}$ are not sufficient to produce a unique matrix P, and will produce a family of solutions.

2. For a particular camera, the intrinsic camera parameters are $K = I$. Its projection matrix P is one of the following. Which is it?
   (a) $\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$
   (b) $\begin{bmatrix} 0.8 & 0.6 & 0 \\ -0.6 & 0.8 & 0 \\ 0 & 0 & 1 \\ 1 & 0 & 0 \end{bmatrix}$
   (c) $\begin{bmatrix} 0.8 & 0.6 & 0 & 5 \\ -0.6 & 0.8 & 0 & 7 \\ 0 & 0 & 1 & 1 \end{bmatrix}$
   (d) $\begin{bmatrix} 3 & 0 & 0 & 0 \\ 0 & 5 & 0 & 0 \\ 0 & 0 & 7 & 0 \end{bmatrix}$

3. Two cameras are looking at a scene. They have projection matrices $P^{(1)} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \end{bmatrix}$ and $P^{(2)} = \begin{bmatrix} 0.8 & 0 & 0.6 & -4 \\ 0 & 1 & 0 & 0 \\ -0.6 & 0 & 0.8 & 3 \end{bmatrix}$. A 3D world point appears in the first image at the location $(2, 0)$, and in the second image at location $(-18, 0)$ (Each tuple is the (x,y) coordinates). What is the 3D location of this world point?