Computer Vision

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Lesson 1

Exercises

Homogeneous Coordinates and Projective Camera Models

1) Two lines make a point. $\vec{P} = \vec{L} \times \vec{M}$

a) Use the cross product to derive the formula for the coefficients for the point $\vec{P}$ at the intersection of two lines $\vec{L}$, $\vec{M}$

b) Derive the formula for the same coefficients using the determinant.

2) Two points make a line $L^T = \vec{P} \times \vec{Q}$

a) Use the cross product to derive the formula for the coefficients for the line L^T passing through two points $\vec{P}$, $\vec{Q}$

b) Derive the formula for the same coefficients using the determinant.

3. Assume a camera at position (0, 0, 2) and orientation ($-\pi/2$, 0, 0) with focal length F, equipped with a 512 x 512 pixel retina in which pixels are size 0.02 (mm/col) et 0.01 (mm/row) and an optical axis that intersects the retina at pixel (256, 256).

a) Write the formula for the camera projective matrix $\mathbf{M}_s^i$.

b) A synchronization error causes each row to be shifted to the right by α pixels. Write the resulting transformation from retina to image $\mathbf{C}_r^i$ as well as the resulting projective matrix $\mathbf{M}_s^i$.