

ECE 472 Robotics and Vision

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Homework 2: Homography Estimation, Image Formation Pipeline

1. Use the code from the sakai resources called *hw2fillin.py* and the image *ts.jpg*. This code displays the image and accepts mouse clicks to specify four corner points.
2. Select the corners of the red pepsi billboard sign. Estimate the homography to transform this sign to a frontal view. Describe this estimation procedure with handwritten notes in a submitted pdf file. Use the homography estimation method called the *DLT algorithm* that was discussed in lecture. For transforming/warping the image, you may use your own code or use an opencv command such as *warpPerspective* or *remap*. Display the transformed image. Accept the “c” button press to close this window and move to the next part of the assignment.
3. Read in an image of your choice from the filename *testing.jpg*. (Note: Do not upload testing.jpg when submitting your homework. Use only this filename.) Estimate the homography that maps this image to the billboard sign. Insert this image onto the billboard region in ts.jpg and display the new image. Accept the “c” button press to close this window and move to the next part of the assignment.
4. Create a 3D wireframe model of a simply polygonal house. Image this house using the image formation pipeline discussed in class. Show the house using 2D line plotting commands. Accept the “q” button press to close this window and close all windows.

Use the following information to find the camera matrix:

$${}^cR_w = \begin{bmatrix} -0.707 & -0.707 & 0 \\ 0.707 & -0.707 & 0 \\ 0 & 0 & 1 \end{bmatrix}, \quad {}^ct_w = \begin{bmatrix} 3 \\ 0.5 \\ 3 \end{bmatrix}$$

.Therefore

$$M_{ext} = \begin{bmatrix} -0.707 & -0.707 & 0 & 3 \\ 0.707 & -0.707 & 0 & 0.5 \\ 0 & 0 & 1 & 3 \end{bmatrix}.$$

Also $s_x = s_y = 1$, $f = 100$ and $o_x, o_y = 200, 200$ respectively. Therefore

$$M_{int} = K = \begin{bmatrix} 100 & 0 & 200 \\ 0 & 100 & 200 \\ 0 & 0 & 1 \end{bmatrix}$$