# ECE4580 Homework #6

Due: Feb. 23, 2017

**Problem 1.** (25 pts) Using the left and right camera views from the stereo problem given by the `stereo01.mat` file, and the known homogeneous matrix description of the right camera frame with respect to the left camera frame, identify the epipolar lines for the right image given the three (homogeneous form) left image points

$$\vec{r}_{L,1} = \left\{ \begin{array}{c} 552.0000 \\ 85.0000 \\ 1.0000 \end{array} \right\}, \quad \vec{r}_{L,2} = \left\{ \begin{array}{c} 589.0000 \\ 405.0000 \\ 1.0000 \end{array} \right\}, \quad \vec{r}_{L,3} = \left\{ \begin{array}{c} 531.0000 \\ 212.0000 \\ 1.0000 \end{array} \right\}.$$

The camera projection matrix is

$$\Psi = \begin{bmatrix} 400 & 0 & 320 \\ 0 & -400 & 240 \\ 0 & 0 & 1 \end{bmatrix},$$

and the camera resolution is $640 \times 480$, for both cameras. To make life easier, the old stereo extrinsic parameters, the camera projection matrix, and the image coordinates for the left camera are located in the file `epipolar.mat`.

(1) What is the essential matrix $E$ associated to this stereo camera system?

(b) What is the fundamental matrix $F$ associated to this stereo camera system?

(b) What are the equations for the epipolar lines in the right camera of the points viewed in the left camera? You can either return in the form of

$$ax + by + c = 0,$$

or in the form

$$y = mx + b.$$

*Note: Since these lines should be in image coords, the fundamental matrix should be used to generate the epipolar equations.*

(c) Plot the epipolar lines for the right image plane (limit the axis to the image resolution limits) and indicate which ones actually cross the right camera image plane.

(d) Suppose that the projections of the given three points onto the right camera only led to the following two points being imaged:

$$\text{(a)} \left\{ \begin{array}{c} 417.0000 \\ 54.0000 \end{array} \right\} \quad \text{(b)} \left\{ \begin{array}{c} 428.0000 \\ 421.0000 \end{array} \right\}$$

Identify which are the corresponding points on the left image by seeing where they plot relative to the epipolar lines. Which left image point failed to have a match in the right image? (The points are also provided in the given Matlab file).

**Problem 2.** (20 pts) Hopefully everyone is getting the hang of the learning modules. Naturally, you and your module partner, if you elected to have one, should keep on keeping on. Move on the Week #3 of the learning module.

The group submission should reflect the work of the group, and should also be submitted individually with the name of your partner in the document. If submitting video or links to video for the pair, then only one member need to do so, while the other member should just note as much. The prior expectaction for deliverables continues to hold.