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Lab 7 - 8 point algorithm

Estimation of the fundamental matrix

In this lab we will implement the 8 points algorithm, to estimate the fundamental matrix F. To asses your implementation use this stereo pairs: Mire, Rubik. You will find both images and corresponding points.

We start off from the characteristic equation of the fundamental matrix, which relates corresponding points in the two views

$$\mathbf{x}'^{T} F \mathbf{x} = 0$$

From 8 (or more) corresponding points we may compute the following homogeneous system of the form A**f**=0:

$$\begin{bmatrix} x_1'x_1 & x_1'y_1 & x_1' & y_1'x_1 & y_1'y_1 & y_1' & x_1 & y_1 & 1 \\ x_2'x_2 & x_2'y_2 & x_2' & y_2'x_2 & y_2'y_2 & y_2' & x_2 & y_2 & 1 \\ & & & \cdot & & & & & \\ x_n'x_n & x_n'y_n & x_n' & y_n'x_n & y_n'y_n & y_n' & x_n & y_n & 1 \end{bmatrix} \begin{pmatrix} f_{11} \\ f_{12} \\ \cdot \\ \cdot \\ \cdot \\ f_{33} \end{pmatrix}$$

The 8-points algorithm

1. Normalize the points: you may use the function already adopted within lab. 5
2. Write down the matrix A
3. Compute the SVD decomposition of A and select as solution f the last column of the right singular vectors
4. Reshape column vector f so to obtain a matrix F
5. Force the rank of F to be 2: use again the SVD to decompose the matrix, $F=UWV^T$, set W(3,3)=0, recompute the final F: $F=UWV^T$.
6. De-normalize the resulting F. Pay attention: the de-normalization is slightly different from the one of lab. 5.

Interface

To verify your implementation, your code should provide a visualization of the stereo pairs with (possibly) epipoles and the epipolar lines of the corresponding points. Given a point **x** of the left image, the corresponding epipolar line on the right image is l'=F**x**. Similarly, for a point on the right image **x**', the corresponding (left) epipolar line can be computed as $l=F^T\mathbf{x}'$. To compute left and right epipoles, recall that they are respectively, the right and left null space of F, thus you can simply perform the SVD decomposition of F, $F=UWV^T$, and then select the last columns of U and V.

It might be of help having another modality, that shows the two images and, when clicking on a point of one of them shows the corresponding epipolar line on the other.

Submission status

Submission status	No attempt

Grading status	Not graded
Due date	Thursday, 12 December 2013, 2:20 PM
Time remaining	6 days 23 hours

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