

CSSE 461 – Computer Vision
 Rose-Hulman Institute of Technology
 Computer Science and Software Engineering Department

Problem Set 6

This problem set is due 06 May 2016.

This document contains hyperlinks and is best viewed as html.

1 Auto-Calibration

1. Use one of the images from Problem Set 4 to recover the camera calibration matrix \mathbf{K} . See Example 8.27 in Section 8.8 of Hartley and Zisserman for details.

- Identify 3 sets of parallel lines. You may want to use an edge or corner detector to aid in finding the lines. Some tools to help find and select line segments are available on the course website.
- Find the vanishing point for each set of parallel lines.

The best way to do this is discussed in Section 8.6.1 of Hartley and Zisserman, but the details are beyond the scope of this course. You may use this method, but you are not required to.

A reasonable solution can be obtained by noting that if \mathbf{x}_1 and \mathbf{x}_2 are the end points of a line segment then $\mathbf{x}_1^\top [\mathbf{x}_2]_\times$ is the line containing the two endpoints and $\mathbf{x}_1^\top [\mathbf{x}_2]_\times \mathbf{v}$ is a measure of how well the vanishing point \mathbf{v} fits that line segment. Two or more such line segments can be used to build a coefficient matrix $\mathbf{A}\mathbf{v} = 0$ where the rows of \mathbf{A} are $\mathbf{x}_1^\top [\mathbf{x}_2]_\times$ for each line segment and which is solved in the standard way using svd.

- Solve for ω using the 3 vanishing points and constraint that the camera has square pixels.
- Solve for \mathbf{K} by inverting the Cholesky factorization of ω .

2 Turning it in

Turn in the 3 sets of parallel lines saved as `seg1`, `seg2`, and `seg3` in “`segments.mat`”, the image with the selected line segments displayed (you can use `showLineSegs.m` for this), the 3 vanishing points, ω , and \mathbf{K} in electronic form as a `.mat` file using using svn. Your materials should be placed in the `ProblemSet6` directory of your class repository (<http://svn.csse.rose-hulman.edu/repos/1516c-csse461-<your username>>).