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

Problem Set 2

This problem set is due 18 March 2016.

This document contains hyperlinks and is best viewed at html.

1 Projective Transformations

1. Using this image of a tile floor calculate the projective transformation $\mathbf{H}$ which will remove the perspective distortion using 4 point correspondences as described in Example 2.12 on page 34 of Hartley and Zisserman. Apply $\mathbf{H}$ to the image. Alternately you can use an image of your own choosing. Remember that $\mathbf{H}$ maps a projective plane ($\mathbb{P}^2$) to another projective plane ($\mathbb{P}^2$).

   Note: You must solve for $\mathbf{H}$ on your own (i.e. your final solution may not use `cp2tform` to recover the transformation nor may it use the version of `maketform` which accepts to sets of points).

   Note: Matlab uses pre-multiplication (e.g. $\mathbf{x}^\top\mathbf{H}^\top$) the vision community, the book and I all use post-multiplication (e.g. $\mathbf{Hx}$). Notice that matlab will want the transpose of the matrix we use.

2. Using the same image you used in Problem 1 calculate the projective transformation $\mathbf{H}$ which will perform an affine rectification using vanishing points and $\mathbf{l}_\infty$ as described in Section 2.7 (pg 47–50) of Hartley and Zisserman. Apply $\mathbf{H}$ to the image.

3. Compare the transformations and transformed images produced in Problems 1 and 2.

4. Use the cross ratio to calculate the vanishing points used in Problem 2.

   Note: Remember the cross ratio uses points in $\mathbb{P}^1$. You will want to choose the coordinate frame wisely.

   Note: The cross ratio is very sensitive to error in point location.

2 Turning it in

Turnin your images (if you used your own), the points you selected (as a .mat file), transformations, transformed images, any code you wrote to recover the transformations and/or

transformed images, and a comparison of the two transformations and transformed images in electronic form using svn. Your materials should be placed in the `ProblemSet2` directory of your class repository (`http://svn.csse.rose-hulman.edu/repos/1516c-csse461-<your username>`).