Problem Set 7

Computer Vision
University of Bern
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1 Registration, Outlier Rejection

In image registration the corresponding point coordinates are related by homography, $\lambda p' = Hp$, where $p = (x, y, 1)$ and $p' = (x', y', 1)$ are the coordinates on image I and I'. Note that H is equivalent to $H' = \beta H$ for any $\beta > 0$ because all equations can be satisfied by multiplying λ for all matching points by an appropriate number. It is therefore justified to set $\|H\| = 1$ for its estimation. Estimate H by eliminating λ and writing the equations in an appropriate linear system, where the entries of H are the unknowns. Solve the system by enforcing $\|H\| = 1$. What is the minimum number of correspondences needed?

2 Interest Points

Consider the following two images:

$$I^1 = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1(*) & 1 & 1 \\ 0 & 0 & 0 & 1 & 1 & 1 \\ 0 & 0 & 0 & 1(**) & 1 & 1 \end{bmatrix}, \quad I^2 = \begin{bmatrix} 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0.5(*) & 0.5 & 0.5 \\ 0 & 0 & 0 & 0.5 & 0.5 & 0.5 \\ 0 & 0 & 0 & 0.5(**) & 0.5 & 0.5 \end{bmatrix}. \quad (1)$$

1. Compute the Harris corner score at the points denoted with $(*)$ and $(**)$ using $k = 0.05$. Approximate the second moment matrix by averaging

over a 3×3 neighborhood around the points. Moreover, for boundary pixels assign 0 to their gradients.

2. Use the Hessian detector for the same images of the previous exercise.