CSci 4968 and 6270
Computational Vision,
Fall Semester, 2011-2012
Homework 4
Due: Monday, November 7, 2011, 5 pm

Assignment

This homework is worth **100 points** toward your homework grade.

You are to implement a two-image matching and mosaicking algorithm based on SIFT keypoint matching and estimation of the inter-image transformation. Students in CSCI 4968 are only required to implement the affine transformation model. Students in CSCI 6270 must use the homography (and therefore get better montages) in order to receive full credit, although 90% credit will be earned for the affine implementation.

The input parameters to your function should be two color images. The output parameters should be

- The image created as the mosaic between the two images.
- The 3x3 transformation matrix that maps the first image, I_1, onto the second image, I_2.
- A display that shows which keypoints from I_1 match to which keypoints from I_2 and are used to estimate the final transformation matrix. Keypoints that do not match or that are discarded by the random-sampling algorithm should not be shown.

Start by downloading and beginning to work with the SIFT feature extraction and matching software from `http://www.vlfeat.org/`. There are both C and Matlab interfaces for the software.

The starting point for your actual work is the set of SIFT keypoints matches that have a sufficiently good ratio score. The main steps of your implementation should be

- the random-sampling technique to determine which keypoints are correct matches,
- the least-squares estimation technique for determining the final transformation between images, and
- the inter-image mapping technique for creating the final mosaic.

All of these are described in the notes for Lectures 12-15.

Images for you to work with will be posted on the course web site. You can and should use your own images as well.

Submission Details

Send me an electronic version of your solution that includes your results and your source code. Please gather your results into a single pdf — created in any way you wish (PPT, Word, Keynote, LaTeX, etc.) — that includes the following components:

- Summary of what parts of the algorithm you implemented, how you implemented them, and how successful you believe your implemenation is.

- Example runs of your program, Matlab or otherwise.
- All of the required outputs as described above. You should test the image pairs I have provided as well as other pairs you may find yourself.
- A brief discussion of the results you see.
- Anything else you believe you need in order to convince me that your implementation works correctly.

Your source code should be well-structured and carefully documented, with clear comments indicating what parts of the algorithm are being accomplished where.