CSE252 – Computer Vision – Assignment #3

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`http://www-cse.ucsd.edu/classes/sp03/cse252`

Target Due Date: Tue. May. 13, 2003.

1. F&P Problem 11.5.
2. F&P Problem 11.6.
3. Finding Point Correspondences.
   (a) Use normalized cross correlation to find correspondences in `fig7.6.b.gif` for five selected points in `fig7.6.a.gif`. Do some experimenting to choose an appropriate window size. For each point in Image A, indicate the top three best matches in Image B using different pointmarkers and/or the digits $\{1, 2, 3\}$.
   Matlab hints: `normxcorr2`, `text`.
   (b) Repeat the previous step using the L_1 norm on the error between vectors of filter outputs instead of normalized cross correlation. Use the filterbank `FB1` provided in `filterbank.mat` consisting of 40 kernels of size 31×31.
   Matlab hints: `conv2`.
4. Texture Recognition.
   (a) Select and download four Brodatz textures of your choice from the USC-SIPI Image Database (`http://sipi.usc.edu/services/database/`). Crop two 128×128 windows from each image, one for training, one for testing. Create a new filterbank `FB2` consisting of the even-symmetric oriented filters in `FB1` as follows: `FB2=FB1(:,:,1:2:36)`. Apply this filterbank to each image window and display a few of the resulting filtered images.
   Matlab hints: `imcrop`.
   (b) Compute the histogram for each filtered image. (Crop the borders first to remove boundary effects.) Use 15 equally spaced bins centered around zero for the histogram, and make sure that the bin definitions are the same in each case. Display the histograms corresponding to your selected filtered images in the previous step.
   Matlab hints: `hist`, `subplot`, `bar`.
   (c) Compute the average χ^2 distance between the marginal histograms of filter outputs from each testing window to each training window. Display the result in a 4×4 table and indicate the minimum distance in each case.
5. Interest point detection.
   (a) Modify the derivation of the Förstner corner detector to solve for the least-squares subpixel centers of circular features.
   (b) Implement Förstner's algorithm for the two cases of (i) corners and (ii) centers of circular features.
   (c) Demonstrate your code on `fig12.8a.gif`, and state your choices for all input parameters and thresholds. Include in your writeup a zoomed-in figure detailing the results in a selected interesting neighborhood.
   (d) Repeat the previous step for `fig7.6a.gif`.
6. RANSAC for Homography Estimation.
   (a) Devise and implement a RANSAC-based method for automatically estimating the homography H between two images.

(b) Apply your algorithm to the image pair `fig7.6{a,b}.gif`, which was acquired by a camera rotating about its optical center.

(c) Display the initial set of putative correspondences, the inliers, and the outliers consistent with the estimated H.

(d) Use the estimated H to create a mosaic out of the two images.