

UNIVERSITY OF DELAWARE
DEPARTMENT OF COMPUTER AND INFORMATION
SCIENCES

CISC 4/689: COMPUTER VISION, Spring 2006
Programming Assignment-2 Due 4/20/06 (Thu.) by 10PM.

Write a Matlab program that implements stereo analysis involving i) SSD, and ii) normalized cross-correlation as region matching scores. The program should be able to perform multi-resolution stereo analysis, where the no. of levels are set by the user. The template and search neighborhood at each level can be set differently by the user, so is the matching measure to be used (SSD or correlation).

The stereo analysis operation is performed as follows:

- i. At the coarsest level, stereo matching is done and disparity calculated.
- ii. Validity check is then performed, wherein if the left-to-right match does not correspond to right-to-left match, a 'zero' is placed at that location in the disparity. One way to do this is, once left-to-right correspondence is obtained, using this correspondence calculate right-to-left matching (using the same matching measure); if this is within a threshold, consider the correspondence to be valid, else invalid.
- iii. Perform averaging in the neighborhood to fill these gaps (zeroes). The neighborhood window can be as big as needed (for example, if 3X3 does not provide atleast 5 non-zero values, make the window 5X5, and so on). Some may use quadratic fits in this neighborhood to get the interpolated values in the gaps - I will leave this upto you.
- iv. Propagate disparity to the next lower (finer) level. Again, you may duplicate disparity from 1-pixel to the corresponding 4-pixels in the lower level, or only transfer 1-pixel into the lower level, and then perform interpolation to get the missing (three) pixels at each location.
- v. Use this disparity as starting point of the search and perform stereo matching and update disparity.
- vi. Go back to (ii) until matching of the finest level is completed.

Note that:

- you don't need to create left and right images at each lower level from the higher level, instead create from the full resolution images (or store it somewhere while creating higher levels).
- you may end up with sub-pixel values of disparity while interpolating. This is just fine, and good.
- Stereo pairs data is available on the web-site. Please also visit the pages:
<http://cat.middlebury.edu/stereo/>
http://www-dbv.cs.uni-bonn.de/stereo_data/
for more data and stereo evaluation strategies.
- Better your stereo analysis results, better will be your grade. So you may incorporate your own constraints and improve in anyway the accuracy of the algorithm.
- Prepare a html page explaining results and indicating parameters used for each result.

Extra Credit

The extra credit analyses use of corner detectors to compute correspondences between left and right images before performing the region-based approach suggested above. One way to do this is, i) find features (corners) in left and right images, ii) perform matching between features, iii) use the resulting disparity (at the matched features) as tie-points to warp the right image towards the left image (or vice-versa), and iv) perform the multiresolution region based stereo analysis described in the main problem above.

You may use corner detectors and image warping code vailable on the web.

Score sheet

The assignment has a total of 15 points and is the same for both graduate and undergraduate students. The total score would be normalized such that graduate students would be scored out of 7.5 while undergraduate would be scored out of 15.

Extra Credit is worth 2.5 points.