COS429 Homework 5

Due: 11:59pm, Thursday, November 15, 2007

This Matlab programming assignment is concerned with the estimation of affine structure from motion from point correspondences.

The data for this assignment can be found in the directory:

`http://www.cs.princeton.edu/courses/archive/fall07/cos429/hw/hw5data`

along with a Matlab function readdata.m for reading these data. It consists of six 2D point data files, one 3D point data file, and an edge data file, called respectively

pt_2d_1 pt_2d_2 pt_2D_3 pt_2D_4 pt_2D_5 pt_2D_6
pt_3D
edges

The edge data file designates the pairs of indices corresponding to points that can be linked by a straight line segment. This helps in visualizing the reconstructions.

Implement two-view affine structure from motion (as described in class and in the textbook, p. 262) using the first two views in the data set, and the Tomasi-Kanade multi-view affine structure-from-motion algorithm (as described in class and in the textbook, p. 265). Also implement affine registration, where two sets of 3D points $\mathbf{P}_i$ and $\mathbf{P}_i^{'}(i = 1, \ldots, n)$ are registered by minimizing

$$E = \sum_{i-1}^{n} |\mathbf{P}_i^{'} - \mathcal{A} \begin{pmatrix} \mathbf{P}_i \\ 1 \end{pmatrix}|^2$$

with respect to the unknown entries of the 3×4 matrix $\mathcal{A}$ using non-homogeneous linear least squares. This will require you to write

$$\mathbf{P}_i^{'} - \mathcal{A} \begin{pmatrix} \mathbf{P}_i \\ 1 \end{pmatrix} = 0$$

as a non-homogeneous linear equation in the entries of $\mathcal{A}$. Use this method to register the points recovered using the two methods you have implemented with the ground truth.

Submission: Submit the following items *in a zip(rar/tar...) file* to moodle:

1. your code and (if necessary) intructions to run your code
2. For both methods, pictures of the reconstruction before and after affine registration with the ground-truth data. Draw the 3D points as circles, and the edges joining them as straight line segments.