EN4553 2018: Assignment 02

June 14, 2018

Please note that your must implement the key Matlab functions and scripts on your own. If you copy from the Internet or others, you will not get the learning experience intended though this assignment.

1. We can express the 1-D difference of Gaussians operator as

$$D(x,\sigma,k) = \frac{g_{k\sigma}(x) - g_{\sigma}(x)}{k\sigma - \sigma}$$

   where $g_{\sigma}(.)$ is the Gaussian operator with standard deviation σ.

   (a) By using several reasonable values of k, check when $D(x,\sigma,k)$ best approximates the second derivative with respect to x.

   (b) Build the DoG scale space of a Graffiti image and show it as images. Graffiti images are available at `http://www.robots.ox.ac.uk/~vgg/data/data-aff.html`.

   (c) Detect keypoints using the scale-space extrema detection followed by the Harris criterion.

   (d) Assign orientations to these keypoints.

   (e) Plot these (using oriented squares) on the images.

2. Implement the Kanade-Lucas-Tomasi tracker with iterative refinement:

$$\begin{bmatrix} \sum I_x I_x & \sum I_x I_y \\ \sum I_x I_y & \sum I_y I_y \end{bmatrix} \begin{bmatrix} u \\ v \end{bmatrix} = - \begin{bmatrix} \sum I_x I_t \\ \sum I_y I_t \end{bmatrix}$$

   with

$$x' = x' + u$$
$$y' = y' + v$$

   See the relevant slide for more details.

3. Write a program to transform one of the graffiti images onto another by

   (a) Computing an affine transformation

   (b) Computing a homography

   Do the point-pair finding by mouse clicking using the Matlab's ginput function or otherwise.

Upload a four-page report named as your_index_a02.pdf. The report must include important parts of code, image results, and comparison of results (when possible, e.g., true homographies are available with the images). The interpretation of results and the discussion are important in the report. Extra-page penalty is 2 marks per page.