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Lappeenranta University of Technology

LUT Engineering Science
Computational Engineering and Technical Physics
Arto Kaarna
Spring term 2017

BM40A0901 Computer Vision
Exercise 5, February 9, 2017.
Image features: edges, corners and regions.

1. Edge detectors (1 point).

   The task is to compare different edge detectors.

   Download a block image (blocks_bw.png) to be used in experiments.

   Matlab function `edge` can be used for the edge detection in gray-scale images. It includes several popular algorithms, including Canny and Sobel edge detectors.

   Using the block image given, find experimentally the threshold values which give visually most satisfying results. Do this for Prewitt, Sobel and Canny edge detectors. Note that Canny algorithm uses two thresholds while both Prewitt and Sobel use only one.

   Which of the above methods gave visually best results? Why? What more could be done to get better edges?

   Example code:

   ```
   » cannyedges=edge(img,'canny',t1,t2);
   » sobeledges=edge(img,'sobel',t);
   ```

2. Corner detection (2 points).

   The task is to implement Tomasi-Kanade corner detection.

   Implement a Matlab function `corners = findcorners(img, N, t)`, which performs corner detection based on the Tomasi-Kanade method described in the lectures. The function takes as input a gray level image `img`, the size `N` of local neighborhood `Q` and a threshold value `t` (as defined in the lecture slides). It outputs a matrix which contains the `(x,y)` coordinates of all detected corners.

   Then use your function with the gray-scale block image (blocks_bw.png). First convert the image to the type `double`) and then diplay the image and the detected corner points in the same figure. One possible choice for parameters in the experiments is $N = 2, t = 1$.

   Note: You don't need to implement the pruning of corner list (the removal of adjacent corners). You can use `conv2(img,mask,'same');` for the convolution filtering to get a result which is of the same size as the input image.

   Does the Harris cornerness measure find the same corners as Tomasi-Kanade corner detector?

3. Region features (2 points).

   The target of this experiment is to use histograms for feature detection. Download the grayscale Lena image (lena_bw.png) for the Matlab experiment.

   First, manually extract a rectangular region of the right eye from the image and compute the histogram of the extracted region. This histogram will be used as the template. Then extract 5 other regions of the same size from the image, one of the extracted regions should be the region corresponding to the left eye. Now compute the histograms for all (5) extracted regions. The last task is to compare the histograms of the template and of the other regions, use the Euclidean distance as the distance measure between the two histograms (template, extracted). Can you find similarities between the histograms?

   How does the number of bins in the histogram affect to the distance? Or similarity? Implement an application where one can automatically find the position of the right eye in Lena image using the histogram information.

   Get familiar with Matlab-function `regionprops`. Which region properties are computed in the function?

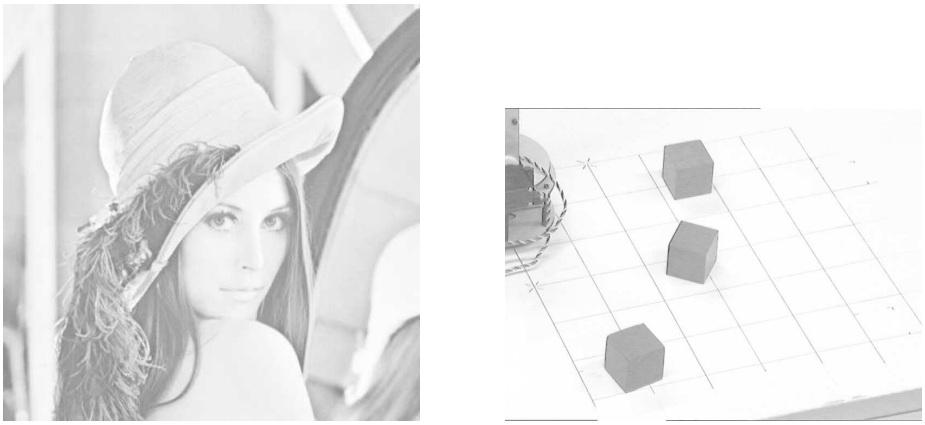

Figure 1: Images in the experiments. Left: Lena image. Right: Blocks.