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Assignment 9

Programming Exercise 9.1 (Fundamental Matrix Estimation)

You can download the file `copcv19_ex09.tgz` from ILIAS. To unpack the archive, use

```
tar xzvf copcv19_ex09.tgz
```

1. Supplement the routine `compute_fundamental_matrix_TLS` in the library `fundmatrix_lib.c` with missing code so that it implements a total least squares for estimating the fundamental matrix, i.e. insert code at locations with the comment `/* --- TODO (Exercise 9.1): ... --- */`. In order to compile your programme please use the contained makefile. The compiled programme is then executed by

   ```
   ./frontend <input_image1.pgm> <input_image2.pgm> <zoom_ratio>
   ```

   where the integer parameter `zoom_ratio` is in general set to 1.

2. Use the provided image pairs `tsu1.pgm` and `tsu2.pgm` (ortho-parallel camera setup) and `jav1.pgm` and `jav2.pgm` (converging camera setup) to estimate the corresponding fundamental matrices. This can be done by pressing $F7$ after you computed a flow field. The created file containing the estimated fundamental matrix is denoted by `matrix_e.fm`.

Programming Exercise 9.2 (Visualisation)

1. In order to visualise the quality of the estimated fundamental matrices and in order to compare them to the correct matrices you can use the programme `view_epi` that can be compiled via the provided makefile. The compiled programme is then executed by

   ```
   ./view_epi <input_image1.pgm> <input_image2.pgm> <matrix_truth> <matrix_est>
   <zoom_ratio>
   ```

   The ground truth matrices for the Tsukuba and the Javier image pair are given by the files `tsu_t.fm` and `jav_t.fm`, respectively. Using the mouse or the cursor you can select any point in the left or right image. The corresponding epipolar line is then automatically drawn in the other one. This way you can check the quality of the estimated matrix by selecting characteristic points in both frames. What do you observe?

   NOTE: Initially the frontend has a black screen. The visualisation starts after you have selected a pixel.

Programming Exercise 9.3 (Fundamental Matrix Estimation)

1. In order to improve the results from Exercise 9.1, supplement the routine `compute_fundamental_matrix_TLS` in the library `fundmatrix_lib.c` with missing code so that it implements a variant of fundamental matrix estimation that uses the coordinate normalisation described in the lecture, i.e. insert code at locations with the comment `/* --- TODO (Exercise 9.3): ... --- */`.

   NOTE: The library `fundmatrix_lib.c` contains some useful routines:

`void multiply_matrix_vector(A,b,x,dim)`	computes	$x := A \cdot b$
`void multiply_matrix_matrix(A,B,C,dim)`	computes	$C = A \cdot B$
`void transpose_matrix(A,B,dim)`	computes	$B = A^\top$

   You may use these functions. In our case, `dim` is always 3.

2. Using the visualisation from Exercise 9.2, compare the results with and without normalisation.