Assignment 5

Welcome to the fifth assignment of the lecture *Visual Computing*. **Please read all instructions carefully!** This assignment covers edges, corners, and their description.

Submission is due on Tuesday, May 25th, 2021 at 8pm. Please note that late assignments will receive zero (0) marks, so you are strongly encouraged to start the assignment early. Please submit your solutions via `read.mi.hs-rm.de`.

Exercise 1 (5 points). Write a python program `corners.py` that detects *corners* in a given image using the *Harris corner detector*.


Your program should provide *sliders* for

1. (1 point) *rotating and scaling* the image,

2. (1 point) adjusting the *kernel size of a preliminary gaussian blur filter*,

3. (1 point) adjusting the *neighborhood size* and the kernel size of the *sobel filter* used for the Harris detector,

4. (1 point) adjusting the *Harris detector free parameter*, and

5. (1 point) adjusting the *threshold for the maxima in the response map* denoting corners.

Compare the influence of the various parameters of the Harris corner detector on different scaled and rotated versions of an image.

Exercise 2 (10 points)**.** Write a python program `findcorrespondences.py` that determines features (corners) in two images and finds correspondences. Carry out your experiments e.g. with the two images of the church depicted below. You find the images on our lecture website.
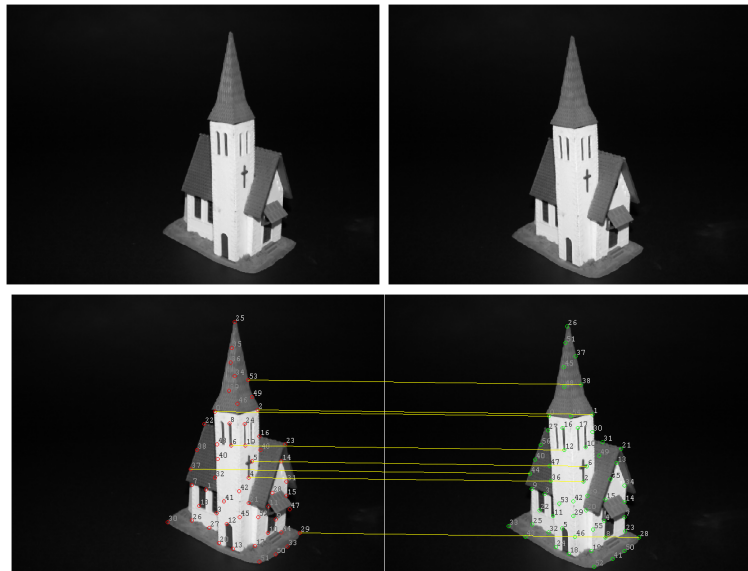
Your program should

1. (6 points) detect corners in both images using the *Harris corner detector* (see exercise 2). Than, for each detected corner in one image it should determine a corresponding corner in the second image using template matching (i.e. compare the regions around the corners found before) and

   (a) the *sum-of-squared-differences* (SSD) similarity measure

   (b) the *normalized cross-correlation* (NCC) similarity measure

   Finally, the corresponences should be marked by a line connecting them (see the image above).

2. (2 points) use the OpenCV function `goodFeaturesToTrack` instead of the *Harris corner detector*. Explain the difference between the *Harris corner detector* and the OpenCV function `goodFeaturesToTrack`.

3. (2 points) use a more modern approach such as ORB (oriented BRIEF (Binary Robust Independent Elementary Features)) to determine the correspondences. *Hint:* Using at least the three OpenCV functions `drawKeypoints`, `BFMatcher`, and `drawMatches` makes it convenient to draw the features as well as the correspondences.