Intelligent Systems Group
Universität Duisburg-Essen
Prof. Dr. Josef Pauli / Stefan Lörcks

WS 18/19
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Exercises Computer/Robot Vision - 11

PROGRAMMING (7 points)

In this exercise we will check if obstacles exist in the path of a robot using the procedure introduced in the lecture.

26. **Existence of obstacles** (7 points)
In this exercise we will analyse an image sequence taken be a camera which is mounted on a robot. The robot moves around and the camera captures the ground and a few obstacles. A script is given which extracts salient points in each image and matches them with the points extracted from the previous image. The resulting coordinates of pairs of corresponding points are provided by the script.

    a) Download sequences.zip, the workspace file corresPoints.mat and the script

    `%CRV_26.m`

    and fill in your name and student number!

    b) Execute the script. It loads each image of the sequence and defines eight tiles. In each tile (ROI) salient points are extracted. These are matched with the salient points, that have been extracted in the corresponding tile in the previous image. The points, which have a match are visualized as yellow dots. The point coordinates (of the L pairs of points that matched) are given in the vectors

$$X = \begin{pmatrix} X_1 \\ X_2 \\ \vdots \\ X_L \end{pmatrix}, Y = \begin{pmatrix} Y_1 \\ Y_2 \\ \vdots \\ Y_L \end{pmatrix}, X' = \begin{pmatrix} X'_1 \\ X'_2 \\ \vdots \\ X'_L \end{pmatrix}, Y' = \begin{pmatrix} Y'_1 \\ Y'_2 \\ \vdots \\ Y'_L \end{pmatrix}$$

    X, Y contain the coordinates in the previous image and X', Y' contain the coordinates in the current image.

    c) Extend the script such that the existence of obstacles is checked within every tile:

    - Create the matrices M_{cor} and $\overrightarrow{M_{nex}}$, if enough pairs have been found.
    - Calculate the singular values of M_{cor} and M_{cn}.
      Useful commands: `svd`
    - Define a threshold ϑ.

- For both matrices determine how many singular values exceed the threshold. If the numbers are equal (all points on a plane) visualize the points in green instead of yellow. Otherwise, if the numbers are different (points are not a plane), visualize the points in red.

Do not expect to get perfect results with this approach. There might be false positives and false negatives. For example have a look at figure 1.

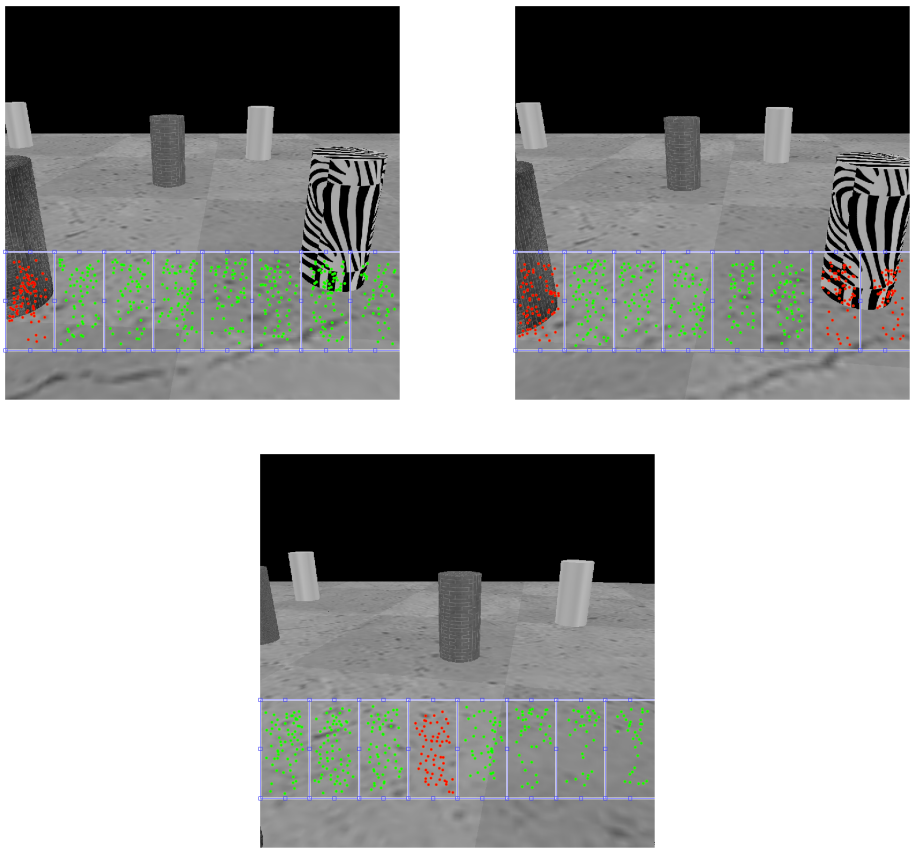

Figure 1: Examples of results for obstacle detection