# Photogrammetric Computer Vision
Assignment 3

Winter Semester 24/25
Submission Deadline: 01.12.24, 8 pm

IV. Camera calibration using a direct linear transformation (DLT)

The three-dimensional reconstruction of objects from images requires that the *interior and exterior orientation* of the cameras are known.

Acquire one image from an object of your choice and determine the *projection matrix* using a DLT to reconstruct the geometry of image formation.
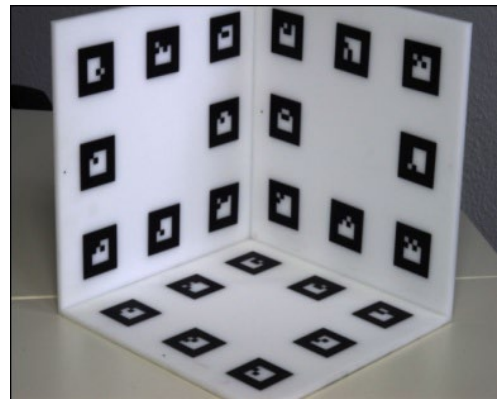
1. **Image acquisition:**
   Take one picture of an appropriate *calibration object* and transfer this image into the computer.

   a.) Describe the acquired calibration object in brief.

   b.) Specify important *technical information* of the used camera (i.e. type, resolution, etc.)

2. **Control point measurements:**
   Determine the three-dimensional object coordinates of at least 6 known *control points* (e.g. by using a folding rule) and their two-dimensional image coordinates.

   a.) How did you define the axes of the object coordinate system?

   b.) How precise where the object coordinates measured?

3. **Computation of the projection matrix:**
   Implement a function in MATLAB/Octave for spatial resection using the direct linear estimation method of the *projection matrix* with help of the singular value decomposition.

4. **Interpretation of the projection matrix:**
   Factorize the projection matrix using a RQ-decomposition (`norm, qr`) and derive all eleven parameters of the *interior* and *exterior orientation*.

   a.) Explain the *meaning* of the extracted parameters in brief.

   b.) Comment the whole calibration process. How precise is the camera orientation determined and where does the quality depend on?

Note: Please submit your source code, the used input image(s), and a `PDF` file containing your answers to the theory questions!

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