Computer Vision: Exercise 2

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1 Camera Calibration

1.1 Data normalization

In this part of the code, I have normalized the data as described on the exercise sheet. So the normalized data is shifted around the origin and the average distance to the origin of the shifted data is $\sqrt{2}$ and $\sqrt{3}$ for 2D and 3D point respectively. Transformation matrices T and U are the inverse of the matrices where diagonals are filled with the scales and the last column represents the minus mean point in homogeneous coordinates.

1.2 DLT and Gold Standard Algorithm

I have implemented these two algorithms exactly as described on the exercise sheet, although the matrix A from the equation $AP = 0$ is a vertical concatenation of sub-matrices for each data point. Thus the size of matrix A is $2n \times 12$. The selected points are shown in Figure 1.1 and their reprojections in Figure 1.2.

The reprojection errors are given in the Table 1.1 The error is defined as the average euclidean distance to the original point. From the table we can conclude that the normalization has the positive effect on the reprojection error, probably due to stability improvements of the algorithm. Also the Gold Standard Algorithm has improved the results on the normalized data.
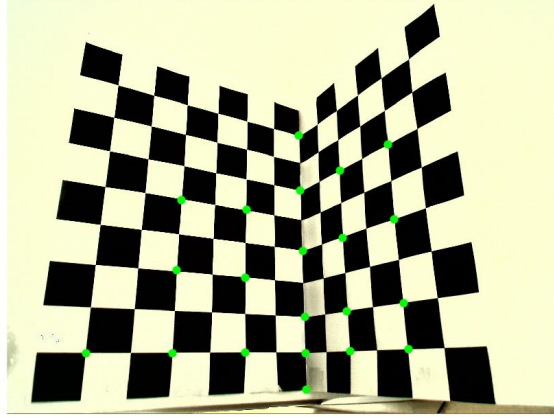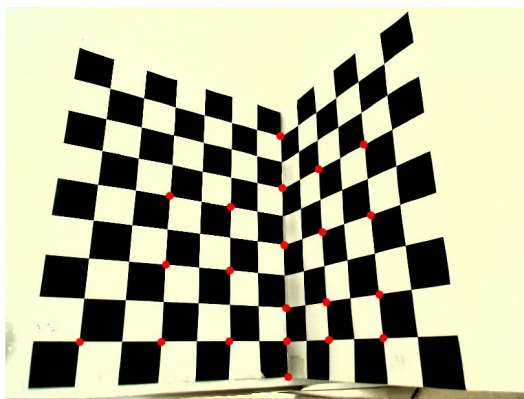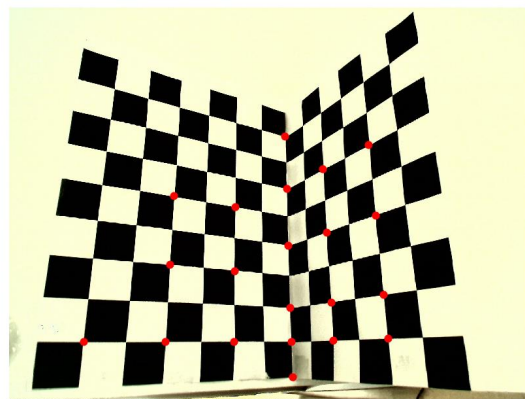
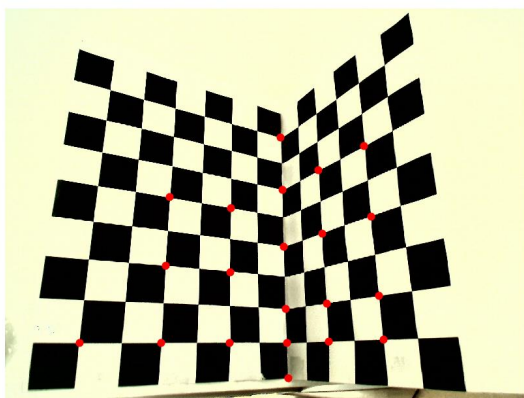Figure 1.1: Selected points

Table 1.1: Reprojection errors

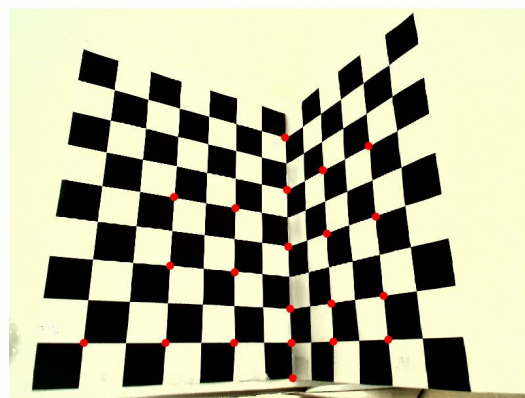|	Without Normalization	With Normalization
DLT	1.6144	1.6129
Gold	1.6144	1.6009

(a) DLT

(b) DLT with normalization

(c) Gold

(d) Gold with normalization

Figure 1.2: Reprojected points