Università della Svizzera italiana

Faculty of Informatics

Computer Vision & Pattern Recognition

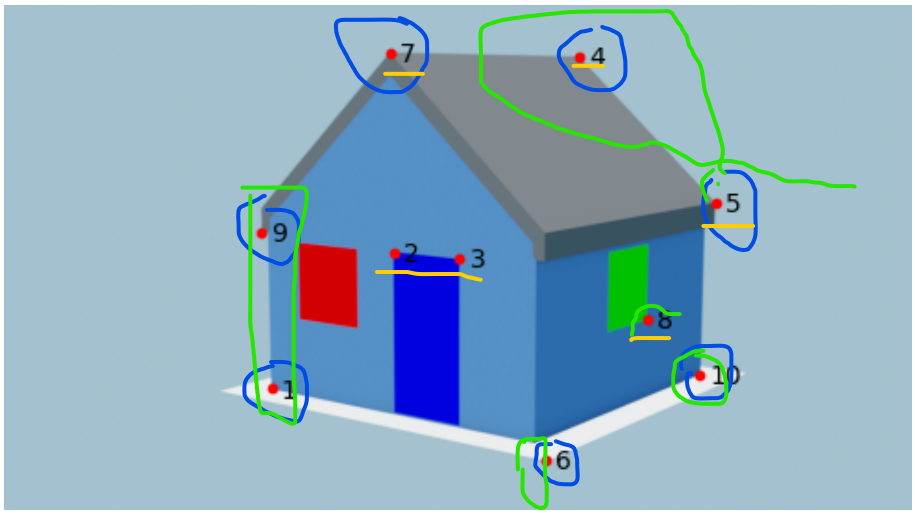
Spring 2023

Project, Part 2

May 16, 2023

Problem 2 [15 points]

Consider again the pixel image "`house1.png`" (you can find it on iCorsi) and write a program for recovering the *internal* and *external* camera parameters of the camera that was used to generate this picture. In order to do so, you can find the *world coordinates* $\boldsymbol{X}_i$, $i = 1, \ldots, 10$, of 10 cardinal points of the house marked here



in the file "`coords.tex`" (you can find it on iCorsi). Following the lecture, you should attend to the following tasks:

1. Find the image coordinates $\boldsymbol{x}_i$, $i = 1, \ldots, 10$, of the points marked in the image above (either by detecting lines with the Hough transform and intersecting them or by reading them off the image "`house1.png`" manually).
2. Reconstruct the *projection matrix* P using the DLT algorithm. Do not worry if the rank of the matrix A that is involved is not 11. In practice, a slight imprecision in the coordinates is enough to turn it into a rank 12 matrix, but taking as $\boldsymbol{p}$ (the $\mathbb{R}^{12}$ vector with the coefficients of P) the last column of V (not of V^T) of the singular value decomposition $A = U\Sigma V^T$ is still the way to go.
3. Recover the *camera calibration matrix* K, the *camera orientation* R and the (non-homogeneous) *world coordinates* $\widetilde{\boldsymbol{C}}$ of the camera from P. Make sure that the diagonal values of K are positive in your solution by suitably adapting R.

Do the same also for the second image "`house2.png`" (you can find it on iCorsi).

Hand in your code, a short description of your solution, and your estimates of K, R, and $\widetilde{\boldsymbol{C}}$ for both images.

Solutions (one per team of up to 3 students) must be returned on June 16, 2023 via iCorsi