Photogrammetric Computer Vision

WS 2020/21

Exercise 4

Group: 26

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Theory

Two cameras c_1 and c_2 observe the same 3D scene in a general convergent constellation. A human operator marked interesting points within a 3D scene. Two of those points are projected to $x_1 = (1, 0, 1)^T$ and $x_2 = (2, 1, 1)^T$ within the first view.
1. What can you say about the position of those points within the second view, if the Fundamental matrix F of this system is given by

$$F = \begin{bmatrix} 0 & 1 & 0 \\ 1 & -1 & 0 \\ 0 & -1 & 0 \end{bmatrix} \tag{1}$$

2. Using this information, derive the exact position of the epipole e_2 within the second view.
From the observation, we could say that,the corresponding point of x_1 in the second view $x_1^{'}$ should lie on the epipolar line $I_1^{'} = (0, 1, 1)^T$, since $I_1^{'} = Fx_1$, similarly, the corresponding point of x_2 in the second view $x_2^{'}$ should lie on the epipolar line $I_2^{'} = (1, 1, 1)^T$. The epipole e_2 should be at the intersection of two epipole lines, which means that $e_2 = I_1 \times$ $\mathrm{I}_2 = (0, -1, 1)^T$.

3. How does the position of the epipole change, if the stereo-system is changed from a convergent to a stereo-normal view?
As the stereo-system changes, the epipole of each image would be far away from the image center, if two views are parallel to each other, then the both epipoles would go to infinity.