Mathematical Foundations of Computer Vision

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Assignment 8 – The Final$^{\mathrm{T}M}$ Sheet

Exercise No. 1 – Again the Essentials

Let the essential matrix

$$E = \begin{pmatrix} 0.76 & 4.32 & -2.4 \\ -4.32 & 1.76 & 1.8 \\ 0 & 0 & 0 \end{pmatrix} \tag{1}$$

be given. A singular value decomposition for E is

$$E = \begin{pmatrix} 0.8 & 0.6 & 0 \\ -0.6 & 0.8 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} 5 & 0 & 0 \\ 0 & 5 & 0 \\ 0 & 0 & 0 \end{pmatrix} \begin{pmatrix} 0.64 & 0.48 & -0.6 \\ -0.6 & 0.8 & 0 \\ 0.48 & 0.36 & 0.8 \end{pmatrix} \tag{2}$$

Compute the epipoles in both images. Give them in homogeneous coordinates. **(20pts)**

Exercise No. 2 – Homogeneous and projective

Consider homogeneous transformations H (expressed as 3×3-matrix) in the (projective) image plane. Determine H such that the points with homogeneous coordinates

$$\vec{a} = (0,0,1)^\top, \quad \vec{b} = (1,0,1)^\top, \quad \vec{c} = (1,1,1)^\top, \quad \vec{d} = (0,1,1)^\top \tag{3}$$

are mapped to the points with homogeneous coordinates

$$\vec{a}' = (6,5,1)^\top, \quad \vec{b}' = (4,3,1)^\top, \quad \vec{c}' = (6,4.5,1)^\top, \quad \vec{d}' = (10,8,1)^\top \tag{4}$$

respectively. **(10pts)**

Hints: 1. Be aware to work properly with homogeneous coordinates. 2. As usual for projective transformations, the matrix H is determined only up to scale! 3. At the appropriate point, you may use a computer.