GVG Lab-07 CZ

1. (a) Doplňte matici homografie

$$\mathtt{H} = \begin{bmatrix} 0 & 0 & 1 \\ a & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

   která mapuje bod se souřadnicemi

$$\vec{u}_{1\alpha_1} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

   z prvního obrazu na bod s afinními souřadnicemi

$$\vec{u}_{2\alpha_2} = \begin{bmatrix} 1 \\ 2 \end{bmatrix},$$

   ve druhém obraze.

   (b) Najděte souřadnice bodu v prvním obraze, který se mapuje na bod $[2,2]^\top$ ve druhém obraze.

2. Body v rovině (generovanou $\vec{d}_1$ a $\vec{d}_2$) o souřadnicích

$$\vec{X}_{1\delta} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \ \vec{X}_{2\delta} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \ \vec{X}_{3\delta} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}, \ \vec{X}_{4\delta} = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$$

   se homografií zobrazí do obrazu do bodů o souřadnicích

$$\vec{u}_{1\alpha} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \ \vec{u}_{2\alpha} = \begin{bmatrix} 2 \\ 0 \end{bmatrix}, \ \vec{u}_{3\alpha} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \ \vec{u}_{4\alpha} = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$$

   (a) Vypočtěte matici homografie.

   (b) Najděte souřadnice bodu roviny, který se zobrazí do bodu $[1,1]^\top$ v obraze.

3. Mějme kameru, která zachytila 2 obrazy při pevném středu. Dále kartézská souřadnicová soustava kamery γ_2 po pohybu se dostane z γ_1 před pohybem rotací kolem vektoru $\vec{c}_2$ o úhel $\theta = 90°$. Spočítejte matici homografie, která mapuje body z prvního obrazu do druhého, pokud víte, že kalibrační matice kamery je

$$\mathtt{K} = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$

GVG Lab-07 EN

1. (a) Complete the homography matrix

$$\mathtt{H} = \begin{bmatrix} 0 & 0 & 1 \\ a & 0 & 1 \\ 1 & 1 & 0 \end{bmatrix}$$

that maps point with coordinates

$$\vec{u}_{1\alpha_1} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}$$

from the first image into points with coordinates

$$\vec{u}_{2\alpha_2} = \begin{bmatrix} 1 \\ 2 \end{bmatrix},$$

in the second image.

(b) Find the coordinates of the point in the first image that maps into point $[2,2]^\top$ in the second image.

2. Points in a plane (spanned by $\vec{d}_1$ and $\vec{d}_2$) with coordinates

$$\vec{X}_{1\delta} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}, \ \vec{X}_{2\delta} = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}, \ \vec{X}_{3\delta} = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}, \ \vec{X}_{4\delta} = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$$

are mapped by a homography into image points with coordinates

$$\vec{u}_{1\alpha} = \begin{bmatrix} 0 \\ 0 \end{bmatrix}, \ \vec{u}_{2\alpha} = \begin{bmatrix} 2 \\ 0 \end{bmatrix}, \ \vec{u}_{3\alpha} = \begin{bmatrix} 0 \\ 1 \end{bmatrix}, \ \vec{u}_{4\alpha} = \begin{bmatrix} 2 \\ 2 \end{bmatrix}$$

(a) Find a homography matrix.

(b) Find the coordinates of the point of the plane that is mapped into point $[1,1]^\top$ in the image.

3. Let us have a camera that captured 2 images by keeping its center fixed. Moreover, the camera cartesian coordinate system γ_2 after the motion is obtained from γ_1 before the motion by a rotation around vector $\vec{c}_2$ by the angle $\theta = 90°$. Compute the homogrphy matrix that maps the points from the first image to the second, if you know that the camera calibration matrix is

$$\mathtt{K} = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 1 & 1 \\ 0 & 0 & 1 \end{bmatrix}$$