

## GVG'2021 Exercise-10 CZ

1. V prostoru máme dvě rovnoběžné přímky  $p$  a  $q$ . Přímka  $p$  prochází body  $\vec{X}_1 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$  a  $\vec{X}_2 = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$ . Přímka  $q$  prochází body  $\vec{Y}_1 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$  a  $\vec{Y}_2 = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$ . Najděte úběžník přímek  $p$  a  $q$  v obrazu s maticí projekce

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

2. Mějme dva úběžníky v  $\vec{u} = [0,0]^T$ ,  $\vec{v} = [2,0]^T$ , které vzniknou v obrazu z pozorovaného obdélníku. Najděte všechny hodnoty parametru  $a$  v matici

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

kamery, která obraz pořídila.

## GVG'2021 Exercise-10 EN

1. Assume two parallel lines  $p$  and  $q$  in the space. Line  $p$  passes through points  $\vec{X}_1 = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix}$  and  $\vec{X}_2 = \begin{bmatrix} 1 \\ 0 \\ 1 \end{bmatrix}$ . Line  $q$  passes through points  $\vec{Y}_1 = \begin{bmatrix} 0 \\ 1 \\ 0 \end{bmatrix}$  and  $\vec{Y}_2 = \begin{bmatrix} 1 \\ 1 \\ 0 \end{bmatrix}$ . Find the vanishing point of the lines  $p$  and  $q$  in the image by the camera with the projection matrix

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

2. Let us have two vanishing points in  $\vec{u} = [0, 0]^\top$ ,  $\vec{v} = [2, 0]^\top$ , which come from the image of an observed rectangle. Find all values of parameter  $a$  in the matrix

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

of a camera which captured the image.

## Vanishing points and lines

Image 1: We can try to estimate parallelism between various line features in the image, or height of the camera above the ground plane relative to surrounding landmarks.

Image 2: Estimate the position of the sun in the image, when it is not visible.

