

# Photogrammetric Computer Vision

## Assignment 1

Winter Semester 24/25

Submission Deadline: 03.11.24, 8 pm

### I. Points and Lines in the Plane

1. You would like to compute the connecting line between two 2D points.  
What happens if the two points are identical?
2. Where does the general line  $x \cos \varphi + y \sin \varphi = d$  intersect the line  $(0, 0, 1)^T$  given in homogeneous coordinates? How can this point be interpreted?
3. Show that the horizon is a straight line by showing that three points on the horizon are always collinear. (*Hint: use projective geometry.*)

### II. First Steps in MATLAB (Octave)

In the second part of the exercise, you should make yourself familiar with the use of the commercial MathWorks MATLAB or the free GNU OCTAVE system.

Helpful at the beginning are the `lookfor keyword` and `help command`.

Begin new files with the commands `clear all` and `close all`, in order to make no errors resulting from old data.

For the solution of this exercise the commands `cross`, `sin`, `cos`, `pi` and `inv` can be helpful. Further general information about the syntax in MATLAB and Octave can be found in the slides provided during the first exercise class.

1. The two points  $\mathbf{x} = (2, 3)^T$  and  $\mathbf{y} = (-4, 5)^T$  are given.
  - a. Determine the connecting line  $\mathbf{l}$  between the two points.
  - b. Move  $\mathbf{x}$  and  $\mathbf{y}$  in the direction  $\mathbf{t} = (6, -7)^T$ ,  
*rotate* afterwards using the angle  $\varphi = 15^\circ$  and finally  
*scale* with factor  $\lambda = 8$ .
  - c. Accomplish the same operations with line  $\mathbf{l}$ .
2. Examine whether the transformed points  $\mathbf{x}'$  and  $\mathbf{y}'$  are on the transformed line  $\mathbf{l}'$ . If not, what could be the reason?

