Università
della
Svizzera
italiana

Faculty
of Informatics

Computer Vision & Pattern Recognition

Spring 2025

Assignment 5

April 4, 2025

Problem 1 [2 points]

Compute the Cartesian coordinates of the intersection point of the two lines with homogeneous coordinates $\boldsymbol{l} = (2, 4, 8)^T$ and $\boldsymbol{m} = (-2, 3, -1)^T$.

Problem 2 [3 points]

Show that the three points with homogeneous coordinates $\boldsymbol{x} = (x_1, x_2, x_3)^T$, $\boldsymbol{y} = (y_1, y_2, y_3)^T$, and $\boldsymbol{z} = (z_1, z_2, z_3)^T$ are collinear, if and only if the determinant of the matrix

$$M = \begin{pmatrix} x_1 & y_1 & z_1 \\ x_2 & y_2 & z_2 \\ x_3 & y_3 & z_3 \end{pmatrix}$$

vanishes.

Problem 3 [5 points]

Write a Python program that reads the homogeneous coordinates of three lines, checks if they are *concurrent* (i.e., they all pass through a common point), and prints out `true` if that is the case and `false`, otherwise. Moreover, your program should generate a plot that shows the three lines and all intersection points of these lines. You are allowed to use the `numpy` and the `matplotlib` libraries. Test your program with the input

$$\boldsymbol{l} = (1, 1, -2)^T, \qquad \boldsymbol{m} = (2, -1, 1)^T, \qquad \boldsymbol{n} = (-1, 2, 0)^T$$

and

$$\boldsymbol{l} = (2, -1, 1)^T, \qquad \boldsymbol{m} = (-3, -5, 5)^T, \qquad \boldsymbol{n} = (-5, -2, 2)^T$$

and

$$\boldsymbol{l} = (1, 2, 3)^T, \qquad \boldsymbol{m} = (-2, -4, 0)^T, \qquad \boldsymbol{n} = (0, 0, 2)^T.$$

Hand in your code and the output generated by your program for each of these three cases.

Solutions must be returned on April 15, 2025 via iCorsi