

## Exercise Sheet Computer Vision XX

---

Submission: 15.07 14:00 (20 Points)

### Exercise 1 Fundamental matrix (10 Points)

- a) Describe the Pinhole camera (2 Points)
- b) Use the Eight point algorithm to compute the Fundamental matrix given the following points collected with two cameras. (6 Points)

| $\mathbf{x}$                             | $\mathbf{x}'$                           |
|--|---|
| (1195.2381591796875, 17.539106369018555) | (1151.4892578125, 75.1097412109375)     |
| (937.64990234375, 64.34162902832031)     | (973.6874389648438, 58.0516471862793)   |
| (940.8167114257812, 55.39308547973633)   | (975.284912109375, 52.61429214477539)   |
| (1225.3709716796875, 49.2425651550293)   | (886.1126708984375, 178.70864868164062) |
| (982.4801025390625, 48.333927154541016)  | (1018.3585815429688, 44.8651123046875)  |
| (939.9161987304688, 53.08941650390625)   | (974.3494873046875, 50.034427642822266) |
| (981.7363891601562, 53.277523040771484)  | (1017.7317504882812, 50.03559875488281) |
| (1040.7928466796875, 97.88645935058594)  | (1048.7313232421875, 82.11563873291016) |

- c) What already known approach could be applied to the data to avoid the different scales of the coordinates  $\mathbf{x}$  and  $\mathbf{x}'$ ? Explain how it should work. (3 Points)

### Exercise 2 RANSAC (10 Points)

- a) You are given with the model  $f(x) = \theta x^2$  and you want to estimate the value of  $\theta$ . You decide to apply RANSAC as wrapper to your estimation model. Why did you decide to do this? (2 Points)
- b) How does the RANSAC algorithm work? (comment the important steps of the pseudo code) In the first iteration the algorithm computed a subset of the data points:  $D' = (1, 1.01), (2, -4.22), (1, 8.97), (1, 0.97)$  from  $D = (1, 1.01), (2, -4.22), (1, 8.97), (1, 0.97), (8, 64.006), (-7, 48.978)$ ; and estimates that  $\theta = 1.01$ . Describe and compute the support measure of the model computed on the subset of the data and explain how the algorithm would proceed in the second cycle. (6 Points)
- c) How does the algorithm change if the number of selected points for the subset is computed adaptively? (2 Points)