# **Imaging Beyond Consumer Cameras – Proseminar** (911.422)

Exercise sheet **B**

For the following two exercises, check out the Resources link containing templates for both exercises. In particular, there is (1) a Jupyter notebook Exercise-Sheet-B.ipynb for those who want to use it, (2) a PDF version of the Jupyter notebook Exercise-Sheet-B-Notebook.pdf, as well as an (3) Exercise-Sheet-B-1.py Python file and (4) an Exercise-Sheet-B-2.py Python file.

*The Jupyter notebook contains additional information and template code that you can (and should) use. You can also extract the code from the PDF file, in case you do not want to use the Jupyter notebook.*

**Submission**: You can either submit an updated version of the Jupyter notebook (with solutions to both exercises in it), or two separate updated Python files, one for each exercise.

**Exercise 1.**                                                                                               4 P.

Below are two examples of projections through a $2 \times 2$ grid: (*left*) from 4 directions and (*right*) from 10 directions.
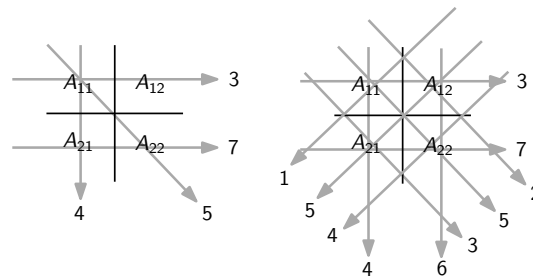


Write Python code to compute the values for $A_{ij}$ using direction reconstruction, i.e., solving the corresponding system of linear equations (algebraic reconstruction). Basically, you have to solve $\mathbf{Ax} = \mathbf{b}$ with $\mathbf{A}$ and $\mathbf{b}$ chosen appropriately (you can use numpy.linalg for that, in particular the lstsq method).

**Exercise 2.**                                                                                               6 P.

Implement the Kaczmarz algorithm from the lecture notes and solve the two reconstruction tasks from the previous question using this algorithm.