Exercise Sheet 1 - Introduction

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The aim of the entire course is to implement a complete reconstruction pipeline by yourself. Each exercise will build upon the previous exercises. This exercise consists of two parts: in the first part, you should setup your development environment and get familiar with Python. In the second part, you start implementing your first class for the reconstruction pipeline: a grid class. Simply spoken, the grid class will represent an image with additional physical information.

1. **PyCharm Setup:** We recommend to use PyCharm as IDE.
   - Make sure that a Python version 3.x is installed on your computer. It is recommended to use Python 3.7. Higher versions will have compatibility problems with PyConrad, which is used for Exercise 5.
   - Download and install PyCharm (community version, which is free to install): `https://www.jetbrains.com/de-de/pycharm/`. Start PyCharm, select "Create New Project", choose a location on your system and select your python 3.x interpreter.
2. **Check Shepp-Logan phantom:** Import the phantom class and test if your interpreter works:
   - Put phantom.py and SheppLoganShow.py files into the project folder
   - Run SheppLoganShow.py to check whether you can see the Shepp-Logan phantom. If yes, your Python interpreter works.
3. **Grid class:** Create the grid class. This class should represent an image with physical properties.
   - Create your class `Grid`.
   - Create a constructor `__init__(self, height, width, spacing)` that initializes all non static class variables: height, width, spacing, and origin. Also initialize an empty buffer as 2D numpy array.
   - For consistency purpose, the **height** dimension of our grid corresponds to the **0-th** dimension of a 2D numpy array, and the **width** dimension corresponds to the **1st** dimension of a 2D numpy array.

- Add the following methods:
  - set_buffer/get_buffer
  - get_origin
  - get_spacing
  - get_size
  - index_to_physical/physical_to_index
  - set_at_index/get_at_index
  - get_at_physical (hint: you need to apply interpolation here. You find a already implemented interpolation method in interpolate.py.)

4. **Use your grid class:**
   - Create a new python file.
   - Now, create an instance of your Grid class and fill its content with the information of the Shepp-Logan phantom.
   - Test your implemented methods on this phantom.