

Bringing deep-denoising into X-ray CT reconstruction

Project Type: Semester Project

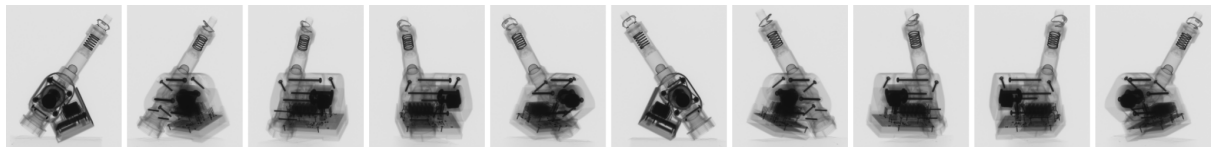
Section: Variable

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X-ray computed tomography (CT) is an imaging technique which aims to reconstruct a 3D field of x-ray attenuation. Its applications are as various as diagnosis for medicine, non destructive testing for industry and microstructure analysis for research. It is an extremely powerful technique and there are several x-ray scanners at EPFL as well as a major installation at the PSI synchrotron, the Swiss Light Source called TOMCAT.

In essence many X-ray radiographs – the measurement of the attenuation of the sample projected in a given direction – are acquired while rotating the sample:



An example of a few projections of an object as it rotates

Given the geometry and knowledge of the attenuation of the x-ray beam, a 3D voxelised volume of the x-ray attenuation field can be computed:



Example 3D rendering of the object reconstructed from the above radiographs

X-ray radiographs tend to suffer problems related to noise due to low photon counts, which means that x-ray reconstructions are also noisy. Other physics and geometry-based artefacts can also pollute measurements. Noise reduction techniques have the possibility to have large impacts in numerous fields.

This project aims to identify and implement a noise reduction method for industrial and research microCT applications, with an emphasis on deep learning denoising, and implement it in pyxu (<https://pyxu-org.github.io/>), a python-based computational imaging framework developed in EPFL.

This will be done together with an industrial partner: RX-Solutions, a leading x-ray CT manufacturer based in Annecy, France.

The stage will be mainly based at EPFL with 2 or 3 days in Annecy.

The project will cover the following aspects and deliverables:

- Establish a short bibliography of noise reduction methods for x-ray microCT
- Identify where noise reduction can be applied optimally in the image pipeline
- Implement a prototype module in Pyxu
- Identify the scope of the tool (where it performs well or not)