

Student Assistant / Master Thesis

Optimization of a Digitization Pipeline for the Conversion of Physics Simulation Data

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Motivation

The SIVERT research group [1] is part of the Bergen pCT collaboration [2]. The goal of the collaboration is to design and build a clinical proton-CT device in order to improve imaging for particle therapy cancer treatment. Before the device is built, the expected performance is simulated in complex Monte Carlo simulations.

When using simulations of physical setups, the simulation output consists initially of the exact positions of physical interactions. These positions, along with the deposited energy of the interaction, need to be converted into the expected response of the real detector, in this case a silicon pixel detector, through “digitization”.

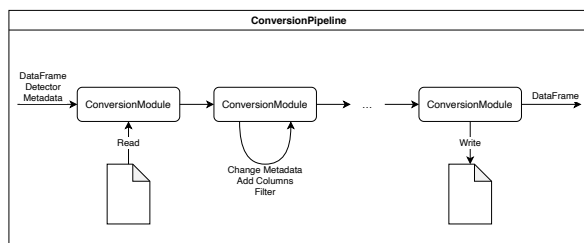


Figure 1: Current pipeline model

For this purpose, a software pipeline has been created, which can read the GATE/Geant4 [3] simulation output, process it in a number of configurable steps, and save it again for further processing (Figure 1). However, this pipeline reads the full dataset into memory and passes it along from module to module, which can not be done when simulating an entire proton-CT scan, where the output file size is multiple terabytes.

Task

The existing Python software pipeline needs to be optimized to be able to handle files which do not fit into memory:

- A suitable stream processing framework needs to be selected
- The overarching pipeline framework has to be re-implemented for stream processing
- The individual modules have to be changed in order to handle data streams

Requirements

- Programming language: Python
- Proficiency in spoken and written English

Thesis Profile

Analysis ●●○○○○
Programming ●●●●●●
Literature ●○○○○○

References

- [1] <http://sivert.info>.
- [2] <https://www.uib.no/en/ift/142356/medical-physics-bergen-pct-project>.
- [3] <http://www.opengatecollaboration.org/>.