Chair of Computing in Civil and Building Engineering
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Master Thesis Proposal

Modeling and ML-based Property Prediction in Additive Manufacturing

Background

Additive manufacturing enables complex and resource-efficient components, but their structural characterization still relies on expensive and time-consuming testing. High-resolution CT scans provide detailed 2D image slices of the printed parts, yet this information is rarely used in the production process. Bridging the gap between imaging and structural performance through machine learning would enhance R&D and enable data-driven tuning of process parameters.

Thesis Goals

The thesis develops a workflow that converts CT data of printed objects using Selective Cement Activation (SCA) into digital models and predict structural properties. Automated segmentation will describe 2D material distribution, from which volumetric models will be generated, and machine learning will estimate key structural metrics. By linking internal structure to process settings and performance, the study aims to replace much of the mechanical testing effort with non-destructive, repeatable prediction.

Expected Results

- Workflow for CT-based material segmentation and volumetric model generation.
- Machine learning model predicting structural properties.
- Guidelines for parameter adjustment informed by predicted properties.

Requirements

- Interest in additive manufacturing and readiness for experimental work.
- Strong Python skills and prior experience with machine learning.
- Willingness to collaborate with the industry partner throughout the project.