Chair of Computational Modeling and Simulation
TUM School of Engineering and Design
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Software Lab:

Modeling:
Mathematics:
Programming:
Science:

Graph Neural Networks for CAD Model Segmentation into Machining Features

Description

The segmentation of CAD models into machining features is a critical step in advanced manufacturing processes. It enables automated interpretation and processing of CAD models, supporting applications like toolpath generation, manufacturing simulations, etc. Moden advancements in Graph Neural Networks (GNNs) offer a promising alternative to the traditional methods that rely heavily on predefined rules or heuristic approaches. This project will explore and implement GNN-based approaches to segment CAD models into their machining features. The dataset will include publicly available datasets and data from industry partners, with models in STEP format. The implementation will aim to demonstrate how GNNs can effectively learn from the graph-based representation of CAD models and provide an automated feature segmentation pipeline.

(a) B-Rep model   (b) Graph data structure
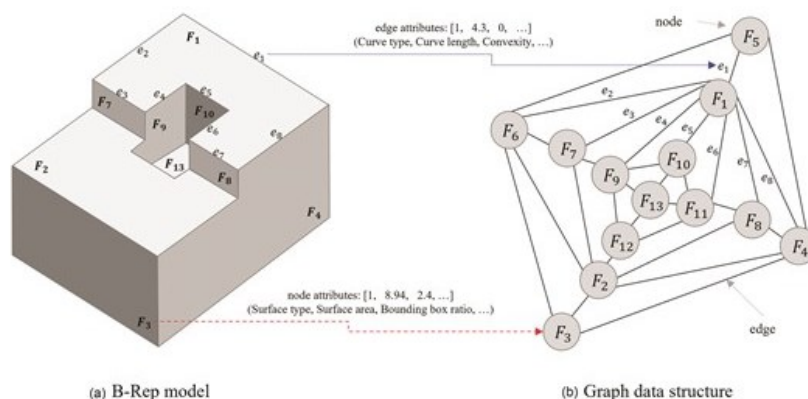
Task

To develop a framework for segmenting CAD models into machining features using Graph Neural Networks:

- Conduct a literature review on state-of-the-art methods in graph-based segmentation and GNNs, with a focus on CAD model segmentation.
- Prepare a dataset of CAD models in BRep format, create the graphs that will be input to the network.
- Implement a GNN-based segmentation pipeline to classify graph elements (nodes and edges) into machining features.
- Evaluate the performance of the implemented approach using appropriate metrics such as accuracy, precision, recall and F1-score.

Supervisor

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References

Lee, J. Y. (2023). BRepGAT: Graph neural network to segment machining feature faces in a B-rep model. *Journal of Computational Design and Engineering*, 2384-2400