Modeling the Mechanical Behavior of Soft Bodies using Graph Neural Networks

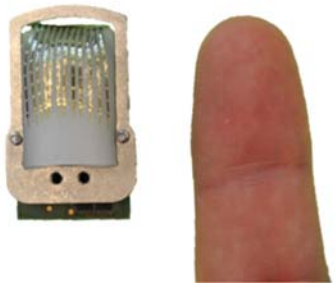
Master Thesis

Keywords

Artificial robotic finger, finite element method, graph neural networks, simulation

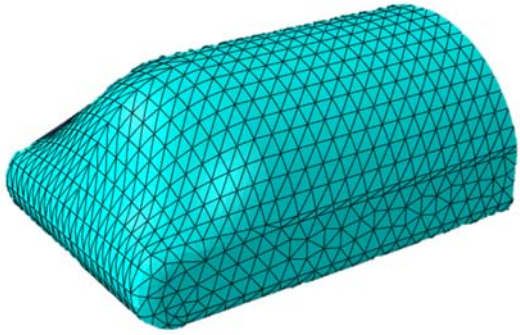
Motivation

The overall goal of this project is the implementation of a simulation model of an artificial robotic finger with integrated tactile sensing arrays on a silicone finger. To enable real time simulation for training robotic hands, a computationally efficient model is required.



Project

The goal of this project is to develop a Graph-Neural-Network (GNN) for predicting the deformation behavior of soft rubber-like artificial fingers. An existing approach can extract nodal displacements of finite-element simulations of 2D axisymmetric structures. You will extend this to 3D structures and test their generalization-ability to predict localized field variables (e.g. nodal displacements, stress or strain, …) for interactions with various indenters. You will compare computation time and accuracy with a traditional FEM simulation.



Tasks and Learning Opportunities

- Implement GNNs for predicting the mechanical behavior of soft bodies
- Work with Comsol/Abaqus and Pytorch Geometric

Your Profile

- Knowledge of machine learning fundamentals, Pytorch a plus
- Motivated to work on an interdisciplinary topic
- Structured and independent working style, innovative and creative mindset, the will to explore new approaches

Contact

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