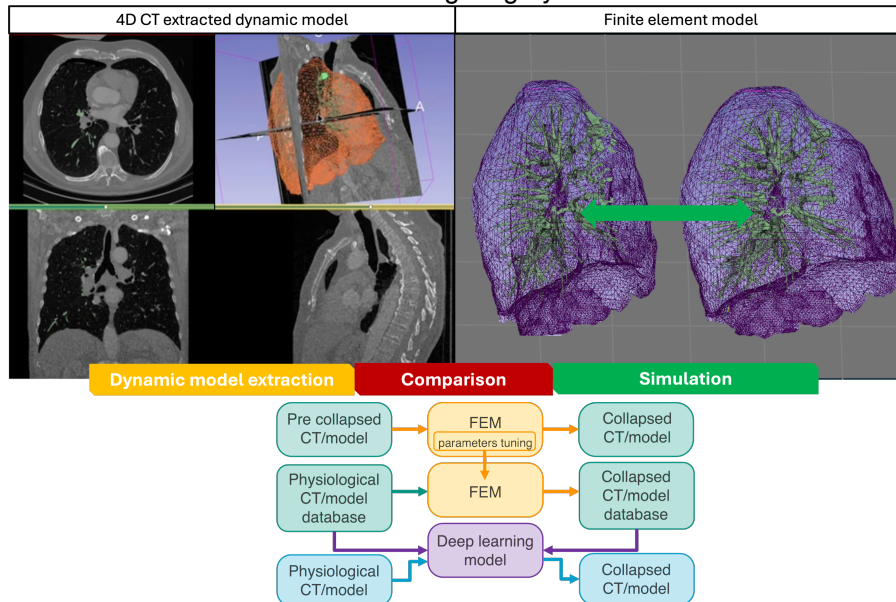


HiWi position

From FEM to AI: A Framework for Lung Collapse Modelling in Thoracic Surgery

Motivation

In recent years, the need for computational tools to support planning, navigation, and surgical training in thoracic procedures has increased significantly. This project focuses on modelling lung collapse during surgical pneumothorax using collapsed CT data and finite element simulations to capture the underlying biomechanical behavior. The extracted simulation parameters are then applied to non-collapsed CT datasets to generate realistic synthetic collapsed anatomies. These synthetic data are used to train a deep learning model that can predict lung collapse directly from undeformed CT scans, reducing the need for time-consuming FEM simulations and supporting future AI-based tools for lung surgery.



Task

The project aims to explore GNN approaches to create reliable lung simulations that can enhance surgical planning and navigation.

1. Optimizing existing finite element collapse lung model
2. Data collection and dataset creation
3. Deep learning model development
4. Validation with real patient data

Requirements

- Python coding
- C++ coding

Good to have

- Mechanical modelling basics
- Deep learning fundamentals

References:

<https://www.frontiersin.org/journals/physiology/articles/10.3389/fphys.2022.984286/full>

Field of research:

Image processing and simulation

Title of research project

Surgical soft organ simulations for surgical navigation

Program

3DSlicer – GetFEM - Python

Course of study

Biomedical engineering
Electrical engineering
Computer Science
Mechanical Engineering
Mechatronics
Physics
Mathematics

Starting date

Possible at any time



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