

Bachelor Thesis/Master Thesis

Computer simulation versus animal trial: the credibility of patient models in the development of automated neonatal ventilation

Motivation

Animal experiments on large mammals such as pigs and sheep are currently used to test ventilators. These are not only to be avoided for ethical reasons but are also costly, only feasible to a limited extent, and subject to biological uncertainties. An alternative in the sense of the 3R principle by Russel and Burch could be a test rig for lung simulation controlled by a computer model of the patient.

In this context, the credibility of computer simulations and animal experiments as patient models will be analyzed with regard to patient safety. The focus is on so-called physiological control algorithms, which are characterized by using feedback on the physiological parameters of the patient. For the development of such algorithms, high requirements regarding patient safety have to be met. As an example, the development process of a control algorithm for the automated ventilation of newborns will serve in this work, of which data from animal trials and computational modeling are available.

Tasks

The objective of this thesis is to determine the credibility of the named patient models. Your roadmap could include the following subtasks:

- ▶ Research on credibility assessment frameworks
- ▶ Define the credibility requirements for the specific use case
- ▶ Select and implement the credibility assessment activities using experimental data and the available computer model, e.g., uncertainty quantification, sensitivity analysis, data quality analysis,...
- ▶ Assess the credibility of the examined models
- ▶ Recommend actions for the design of the model-driven test bench

Prerequisites

- ▶ Ongoing master's studies in Computer Science, Engineering, or similar
- ▶ Independent working style and good analytical skills
- ▶ Enjoy working with data
- ▶ Interest and ideally prior knowledge in credibility assessment, mathematical modeling, and mechanical ventilation

Our Offer

- ▶ Insights into interdisciplinary research at the interface of engineering, computer science, and medicine
- ▶ Once possible - pleasant working atmosphere on-site, fully automatic coffee machine, and regular social events in the biomedical engineering group
- ▶ Start immediately, or by appointment

Contact

Do not hesitate to get in touch with me if you are interested in the project or in the research topic in general. Please include in your application: CV, grade transcript, relevant certificates (optional)

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