University of Basel

Department of
Biomedical Engineering

University of Basel, Department of Biomedical Engineering, Gewerbestrasse 14, 4123 Allschwil

Master of Science – Biomedical Engineering
Thesis Proposal

***Neural network-based acceleration of rapid ventilation and perfusion MRI of the lung***

Continuous monitoring of chronic lung diseases plays a pivotal role in patient management since prompt specialist care can help to reduce the occurrence of disease-related complications.
Magnetic resonance imaging (MRI) provides valuable information about lung structure and function, and is thus perfectly suited for follow-up and frequent examinations. Functional imaging of the lung requires almost ten minutes of measurements, which is notable considering the already lengthy basic protocols. Our project aims to reduce the measurement time up to fivefold by employing neural network-based algorithms to quantify pulmonary ventilation and blood perfusion. Rapid pulmonary functional MRI might become attractive compared to other routine techniques, change clinical approaches and paradigms, and improve patient care.

The Radiological Physics group at the University of Basel/University Hospital has a long experience in MR method development. In recent years, the group has shown worldwide excellence in pulmonary MR imaging acquisitions and developed ground-breaking postprocessing. The group has robust synergetic collaborations with several clinical centers for a rapid rollout of the promising technical advancements.

**Master thesis goal.**
In this project, the candidate will participate in developing, optimizing, and investigating current deep learning-based algorithms for calculating perfusion and ventilation pulmonary maps from reduced image time-series. Thus, we will explore the feasibility of a shortened functional MRI protocol and the relationship to clinical pulmonary function tests outcome parameters. Existing clinical datasets will be used.

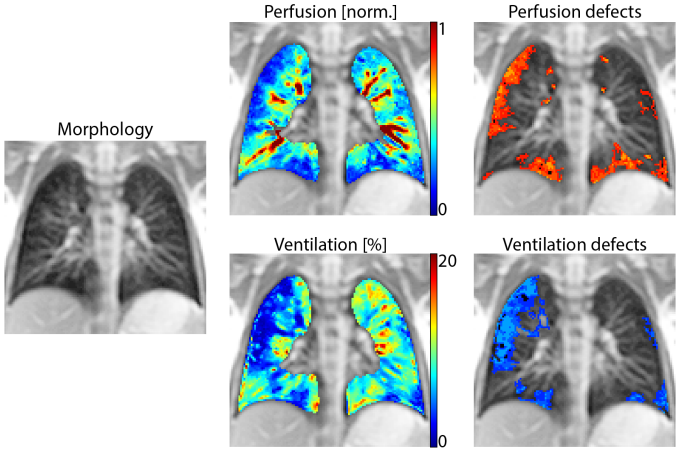
**Nature of the Thesis**
Experimental: 60%
Programming: 30%
Documentation: 10%

**Specific Requirements**
Basic knowledge of Python and/or other scripting languages.

**Supervisor**
Dr Orso Pusterla, University of Basel, Radiological Physics.

**Collaborators**
Dr Francesco Santini and
Dr Grzgorz Bauman, Radiological Physics.

**Contact**
Dr Orso Pusterla, orso.pusterla@unibas.ch




*Exemplary functional lung MRI obtained in a 6-year-old girl with cystic fibrosis. On the left, morphology, in the middle blood perfusion and ventilation, and on the right masks of functional defects.*

University of Basel
Department of Biomedical Engineering
Gewerbestrasse 14
4123 Allschwil, Switzerland

Dr. Orso Pusterla
Lab of Prof. Bieri
T +41 61 32 85 177
Orso.pusterla@unibas.ch