

## Master Thesis

# Camera Localisation and Tracking for Visually Navigated Bronchoscopy

### Motivation

A vision-based bronchoscopic navigation system helps physicians locate the bronchoscope during the endobronchial inspection and diagnostic procedures by applying video-CT registration techniques and works like a GPS system. However, the bronchoscopic video-CT registration is still challenging due to the feature-poor scene, occlusions, image artefacts and patients' coughing[1]. To suppress the influences of these challenging factors, improvements in registration methods (e.g., 3D-3D registration methods which register the reconstructed 3D airway structure based on depth estimation to the preprocedural 3D CT model, 2D-2D registration methods which register the real bronchoscopic video to the bronchoscopic video rendered from the preprocedural 3D CT model [2]) should be made.

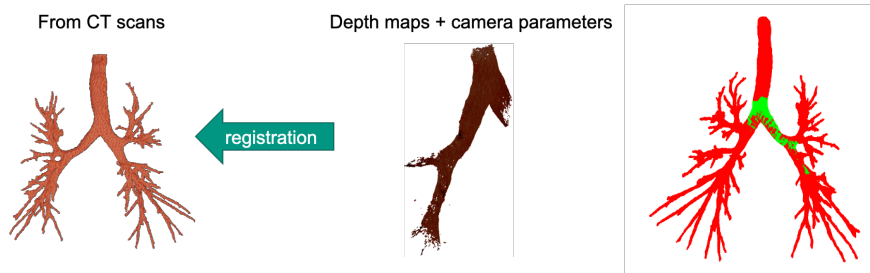


Fig. Example of 3D-3D registration of reconstructed airway structure based on depth estimation to 3D CT model using ICP

### Project Description

The goal of this work is to localise the bronchoscope camera with regard to preprocedural CTs based on bronchoscopic camera views. The scope of the work includes:

- Literature research on vision-based bronchoscopic navigation and video-CT registration methods
- Compare 2D-2D registration and 3D-3D registration methods in the context of bronchoscopic navigation (e.g. learning-based approaches)
- Develop a validation approach applied on clinical data

With this project, you will try to answer the following questions:

- What are the requirements of camera localisation in visually navigated bronchoscopy?
- Which state-of-the-art registration method outperforms when applied to visually navigated bronchoscopy? What could be further improved to enhance the registration performance?
- What are the limitations for 2D-2D registration/ 3D-3D registration approaches when applied to visually navigated bronchoscopy?
- How to validate the approach on clinical data?

### Skills needed:

- Passion for solving problems in biomedical field
- Python, PyTorch or Tensorflow framework
- Deep learning and machine learning fundamentals is a plus
- Independent working ability
- Contributing own ideas is always welcome

### Research Group

Optical Technologies in Medicine

### Project

Data-driven depth estimation for visually navigated bronchoscopy [3]

### Fields of Work

Registration, Camera localisation, Deep learning, Image processing, Programming

### Study Course

Electrical engineering, Information technology, Physics, Computer science or comparable study courses

### Start

As soon as possible

If you are interested or have any questions, please get in touch with:

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### References:

- [1] Visually Navigated Bronchoscopy using Three Cycle-Consistent Generative Adversarial Network for Depth Estimation, Artur Banach et al.  
[2] Interactive CT-Video Registration for the Continuous Guidance of Bronchoscopy, Scott A. Merritt et al.  
[3] A cGAN-based network for depth estimation from bronchoscopic images, Lu Guo et al.