

Master of Science – Biomedical Engineering  
Thesis Proposal

**Incorporation of Uncertainty into Annotations for Deep Learning-based Image Segmentation**  
*How true is the “ground truth”?*

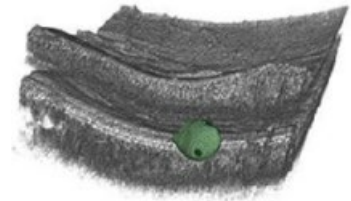
**Context**

Deep Learning is a powerful technology that uses artificial neural networks to perform image segmentation, which is the process of separating an image into different regions or objects. This is useful in fields such as medical imaging, where the accurate identification of different structures within an image is crucial for diagnosis and treatment planning. However, while supervised Deep Learning algorithms can produce highly accurate results with uncertainty maps of the prediction, they currently do not consider the uncertainty that is underlying in the manual annotations – also called ground truth.

**Task Description**

The aim of this master’s thesis is to generate uncertainty-guided Deep Learning models based on single annotations. The ground dataset will be a dataset of choroidal tumour annotations in optical coherence tomography data. However, further datasets can be explored. The following steps describe the thesis:

- Conducting a literature review on existing uncertainty maps for Deep Learning
- Generate different uncertainty maps for the annotated datasets
- Incorporate this uncertainty into the training and evaluation of a Deep Learning model



**Benefits**

This master’s thesis offers the opportunity to work on a deep learning image analysis project by working in an interdisciplinary research group. It is suited for students looking to deepen their image analysis and programming skills. Further, insights into current clinical challenges of OCT imaging can be gained.

**Nature of the Thesis**

Programming: 80%  
Documentation: 20%

**Specific Requirements**

Experience with Python, Image Analysis, Machine Learning

**Supervision**

Dr. med. Philippe Valmaggia (Ph.D. student)  
Prof. Dr. Philippe Cattin (Group leader)

**Contact**

Dr. med. Philippe Valmaggia

[philippe.valmaggia@unibas.ch](mailto:philippe.valmaggia@unibas.ch)