

Bachelor Project

AI-supported Medical Image Annotation Platform

Christoph Lippert, Digital Health - Machine Learning Group, Hasso Plattner Institute for Digital Engineering, Potsdam, Germany

Marc Lecoultre, Chair FG-AI4H WG-DASH, ML Lab, Switzerland

Joachim Krois, Charité - Universitätsmedizin Berlin, Germany

The ITU/WHO Focus Group on AI for Health

AI holds great promises for healthcare. Substantial steps have recently been made in the research and development of healthcare applications powered by Artificial Intelligence (AI) and Machine Learning (ML). With the goal of leveraging AI to promote health for all, the International Telecommunication Union (ITU) and the World Health Organization (WHO) have created the joint ITU/WHO Focus Group on AI for Health (FG-AI4H) to work on international standards in this field, and to establish an AI assessment framework in collaboration with multidisciplinary experts.

Project Description

One key ingredient of this effort of FG-AI4H that we will address in this project is to build a standardized data annotation platform for medical imaging datasets. Three-dimensional image datasets from MRI, CT, or microscopy unlock a new quality of insights into Life Science and Medical Domains. Unfortunately, these insights are hidden in very large images. Manually annotating this data is highly laborious and expensive. Therefore, the images need to be processed automatically to extract the information.

ML technologies, such as deep artificial neural networks, are well-suited for various image annotation tasks, including segmentation. They are a powerful tool for producing high-quality results on large sets of images. However, these algorithms require lots of labeled training data which is, again, expensive to obtain. As vast amounts of unlabeled data become readily available, the challenge is to efficiently obtain labels that yield an accurate model with minimal manual annotation labor.

Together with the ITU/WHO Focus Group, we will develop an AI-supported Medical Imaging annotation platform based on VISIAN (<http://visian.org>), the image annotation UI of the Digital Health - Machine Learning group. We thus want to explore new workflows that allow domain experts to perform AI-assisted data annotation with a minimum of manual effort in VISIAN while simultaneously training machine learning models on the annotated data without the need for additional engineering knowledge.

Goal

The goal of the Bachelor's project is to develop a Deep Learning backend that can be integrated with the VISIAN UI to build the foundation of a semi-automated human-in-the-loop data annotation platform for medical imaging datasets provided by the ITU/WHO Focus Group on AI for Health. The resulting system should support the end-to-end process of annotating medical images, automatically training and tuning a model from those annotations, and applying that model to more images.

Bachelor Project

AI-supported Medical Image Annotation Platform

What you will do

- Implement deep neural networks and a corresponding backend
- Integrate with an existing web-based segmentation editor
- Investigate automatic hyper-parameter tuning and similar model optimizations (AutoML)

What you will learn

- Concepts of medical image processing
- Engineering powerful systems that integrate with state-of-the-art machine learning tools
- How machine learning works in the field
- 3D data formats and challenges with large datasets
- Automatic model tuning

What you should bring with you

- Interest in machine learning technologies and automated image processing
- Enthusiasm for life science and medical applications
- Experience with Python and TensorFlow Keras/PyTorch or a comparable machine learning framework is recommended
- Experience with TypeScript and React is beneficial