Karlsruhe Institute of Technology

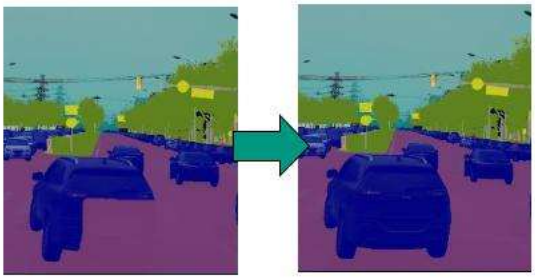
Earliest start: now!

Institute for Automation and Applied Informatics (IAI)

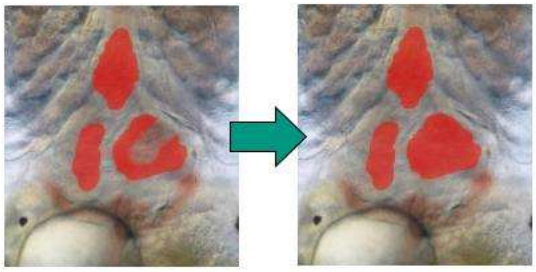
Master‘s Thesis

Investigating the potential of enhancing and stabilizing training in deep learning with cues.

Modern deep learning architectures require large amounts of data to obtain satisfying results. This raises issues in image recognition, as datasets are generally small-scale, challenging to obtain, and expensive to annotate. Therefore, datasets are often only partially annotated. To improve training with such incomplete data one can penalize contradictions in the training process. Within semantic segmentation this can mean that a generated mask must be assigned a unique class even if not all annotations are given [1]. For example, we know for certain that a car cannot be located in a place where a semantic annotation for the sky is given. The challenge of this master thesis is to compare and develop methods that improve and stabilize the training process with partially annotated data. This could mean to punish contradictory or inconsistent behaviour by programmatically defined rules or human-in-the-loop approaches.



Example 1: An urban street shot. The car in the middle is segmented contradictory to the general assumption regarding the shape of cars.



Example 2: the heart region of a Medaka fish. The right ventricle is segmented in a physically impossible way.

Tasks:

- Literature research and comparison of existing methods
- Implementation of various approaches and evaluation of the results
- Modification and optimization of the approaches to obtain a better result
- Documentation of all the outcomes in English or German

Education, Experience, and Skills:

- Knowledge in data analytics/machine learning and their application in image processing
- Initial experience with practical deep learning projects
- Analytical thinking, ability to work independently
- Programming experience with Python, version control via git
- Experience with a deep learning framework (PyTorch or TensorFlow)

[1]: Schutera M, Rettenberger L, Pylatiuk C, Reischl M (2022) Methods for the frugal labeler: Multi-class semantic segmentation on heterogeneous labels. PLoS ONE 17(2): e0263656. https://doi.org/10.1371/journal.pone.0263656

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