Proposition for a Master's Thesis

# Tracking with Deep Learning Instance Segmentations

Contacts: Dr. Jonathan Kobold (Jonathan.Kobold@hensoldt.net), Prof. Matthias Schubert (LMU, Schubert@dbs.ifi.lmu.de)

## Introduction

Realtime tracking in videos is a demanding task. The current state of the art are deep learning models based on the siamese network architecture. These have the drawback that their computational cost is high which limits their deployability on edge devices. Furthermore, these models are inherently single object tracking methods.
Recent advances in video instance segmentation show the potential to be adapted for tracking. Instance-specific features provide a general representation that captures the inherent object properties which is invariant to the point of view. Extending frame-level features into the temporal dimension could solve segmentation and tracking problems with an end-to-end pipeline.

## Tasks

This thesis aims at adapting instance segmentation for tracking purposes. This will eliminate the expensive postprocessing associated with siamese tracking by adopting discriminative features in the video domain.

You will

- get familiar with the literature and methods for instance segmentation and deep learning based tracking.
- adapt an instance segmentation framework for tracking purposes.
- elaborate a method for efficient multi object tracking with instance representations.
- investigate the runtime and efficiency of the adapted method.
- design your own method for multi object tracking based on the previous investigations.
- compare your method to the tracking state of the art.
- write a paper about your new method.

## Material

You will work on large public datasets, including Youtube VOS (`https://youtube-vos.org/`) and TrackingNet (`https://tracking-net.org/`).
You will have access to the GPU Clusters of the LMU and Hensoldt Analytics. These provide a large number of recent (Quadro 8000 and RTX A6000) GPUs.

## Your Profile

- You have an excellent knowledge of deep learning.
- You worked with CNNs and/or Transformer Networks.
- You have good programming skills and are familiar with Pytorch.
- You are highly motivated and willing to publish the work.
- You are fluent in English (written and oral).

## Administrative Details

- The thesis will be in collaboration with LMU and Hensoldt Analytics.
- The student will be supervised by Prof. Matthias Schubert and Tanveer Hannan, from LMU.
- The mentor of the student from Hensoldt Analytics will be Dr. Jonathan Kobold.
- The student will work partially in the Hensoldt Analytics office located in Ottobrunn, Munich and partially at LMU.
- The student will receive a salary for the duration of the thesis (6 months).
- All Results on public datasets and details of the developed method can be freely published.
- Hensoldt Analytics has an unrestricted right to the commercial usage of any code and models written within the scope of this thesis.