Machine Learning on Embedded Systems

Vision based workplace safety monitor in an automotive test bench (M.Sc. thesis)

The Christian Doppler Laboratory for Embedded Machine Learning is collaborating with AVL in a research project where Vision based Deep Neural Networks (DNN) should be used for monitoring and detecting safety critical system states in an automotive test bench with the help of embedded hardware.

A significant part of the research, development and final inspection of automotive powertrain systems takes place on test benches. A large number of different test benches can be combined in modern test factories, for example engine, transmission, powertrain, vehicle, exhaust, battery or inverter test benches. Complex plants consist of a large number of subsystems. High forces, torques, voltages or currents are often implemented, sometimes in the presence of flammable gases and liquids. For this reason, there are strict rules and regulations to maintain occupational safety.

Traditionally monitoring the workplace safety indicates a regularly and manual visual inspection of the engineer and is a tedious and error prone work. In order to automatically detect safety critical states e.g., leaking liquids, missing/shifted covers grids, loose cables, one can apply modern DNN methodologies for their detection.

In more detail this thesis should deal with:

1. Assisting AVL in the vision-based data acquisition process. Arguing and defining suitable safety critical scenarios. The data acquisition and the labeling process itself is done by AVL.
2. Investigating State of the Art Object Detection or Instance Segmentation Networks for their suitability of detecting the safety critical scenarios defined in step 1
3. Analyzing the applicability on embedded hardware platforms e.g., Jetson Nano and evaluating accuracy, latency and energy constraints.
4. Development of a prototypical setup. (Compact and robust unit containing of camera and inference platform)

This thesis offers you an excellent opportunity to get into the hot topic of deep learning, being part of an industrial research cooperation and working on an industrial use case, which will also lead to several visits at AVL Graz. Additionally AVL offers a one-time fee of EUR 2.600, -- brutto after successful completion of the thesis.

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