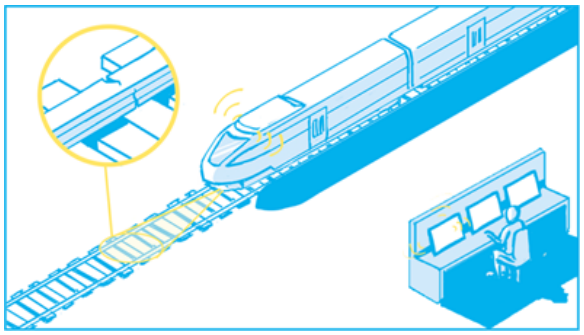
TECHNISCHE UNIVERSITÄT WIEN

Institut für Computertechnik
Institute of Computer Technology

Christian Doppler Forschungsgesellschaft

Bachelor Thesis: Adapting a Railroad Anomaly Detector for Embedded Hardware

In the **Harmony** project, the *Institute of Computer Technology*, with its partners *Mission Embedded* and *Frequentis*, develops a *vision-based machine-learned monitoring system* for railway systems. The main goal is to *detect anomalies* on the rails and the track bed and report any findings to an operator. The operator may react by performing maintenance on the railway before critical failure *(predictive maintenance)*.



A suitable anomaly detector is already being researched, and development is almost complete. However, the detector runs on a powerful computer system but should be able to operate on an embedded device in order to be mounted on regular trains without complications. Here, the Embedded Machine Learning (EML) unit comes into play. The EML team is part of the Christian Doppler Laboratory and does research on Deep Neural Networks (DNNs) in resource-constrained embedded devices. It studies how energy consumption and resource usage can be minimized while keeping high accuracy. The solution space is characterized by architecture parameters, DNN optimization and transformations, implementation platform configurations, and mapping options. This design space is huge, poorly understood, and rapidly evolving.

In this work, you would adapt and optimize the already existing anomaly detection model to execute it in real-time on an *Nvidia Jetson* embedded device. Accordingly, this thesis project consists of the following steps:

- Examine the already existing anomaly detection algorithm
- Adapt and optimize this existing model for real-time inference on an Nvidia Jetson platform
- Train and validate the adapted model, and evaluate it and its output.

This thesis offers you an excellent opportunity to get into the hot topic of deep learning. It allows you to become an expert in configuring neural networks. Moreover, you acquire critical skills in using neural networks in embedded systems and resource constraints.

For details, please consult the following:

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