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Your mission is to gain practical experience while working on your diploma thesis? We are happy to support you with our know-how and experience while working on different projects.

Mission Embedded develops and supplies high-reliability embedded systems for professional applications in

safety-critical environments such as: transportation, industry, air traffic management and medical technology.

Together with the *Christian Doppler Laboratory Embedded Machine Learning* at Vienna University of Technology, we offer a research opportunity for the following Master thesis topic. We are also open for cooperation with other universities and institutes.

MACHINE LEARNING ON EMBEDDED SYSTEMS:

## FPGA EVALUATION OF YOLOV4 OBJECT DETECTION

**A Convolutional Neural Network (CNN)** for object-detection (e.g. YOLOv4/YOLOv5) generally consists of two parts:

(1) feature extractor also called encoder, which compresses the original image and provides low dimensional representation of the original image.

(2) A classifier (a fully connected layer) and a localizer (a bounding box regressor), which provides the object class and the location of the object, respectively.

A GPU can be used for both training and inference of such a CNN; however, FPGA is currently emerging as an alternative to GPU for deep neural networks (DNNs), especially for the inference task.

#### Deep Neural Network Development Kit (DNNDK)

from Xilinx contains reference implementation for various object detection algorithms, e.g. SSD and YOLOv3.

However, state-of-the-art YOLOv4 and YOLOv5 networks have improved the object detection accuracy by introducing few new layer types and activation functions.

The objective of this thesis project is to first highlight the differences between YOLOv3 and YOLOv4, and then implement such differences (all or few) into the existing reference implementation of YOLOv3.

#### This thesis project consists of the following steps:

- Study object detection architectures, e.g. YOLOv3 and its available FPGA implementation
- Run the example implementation on a FPGA board, e.g. Xilinx UltraScale+
- Find the differences between YOLOv3 and YOLOv4 architecture
- Incorporate all or few of the differences into existing YOLOv3 implementation
- Show the updated implementation on the selected FPGA

#### 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 under resource constraints.

Some of the M.Sc. projects may be combined with a part time position.

Are you ready for your New Mission?  
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