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ADVANCED TECHNOLOGIES.
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VOICE AND A BRAIN.**

Are you looking for a New Mission?

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:

SIMULTANEOUS DETECTION AND SEGMENTATION OF DIFFERENT OBJECTS

A Convolutional Neural Network (CNN) for object detection 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. In contrast, a CNN for segmentation generally consists of an encoder as stated above followed by a decoder, which converts back the compressed representation into pixel level classification.

Bounding box detection is quite accurate for objects having square/rectangular shapes (e.g. traffic signals), but not acceptable for curvy shapes (e.g. road lane). If it is required to simultaneously detect objects of different shapes, then one CNN is typically used for object detection and another for segmentation using the same images/frames, which almost double the computational load on an embedded platform.

The objective of this thesis project is to use a single encoder for both object detection and segmentation as it is common in both CNNs and evaluate the corresponding accuracy degradation if it happens.

This thesis project consists of the following steps:

- Select one of state-of-the-art CNN, e.g. MobileNet
- Train/test it for object detection using few classes
- Freeze the encoder and use it for segmentation CNN
- Train (only decoder)/test it for segmentation
- Finetune/train/test the segmentation architecture
- Simultaneous train/test both networks

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 und 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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