Master Thesis: Real-Time Object Detection and Tracking in embedded systems

The thesis aims to optimize object detection and tracking algorithms (YOLO family) in embedded systems with limited computational resources.

Problem

The identification of an object in an image or video in real-time together with its classification, localization and tracking, has gathered a lot of interest in recent years due to its applications, such as surveillance, disease identification, autonomous driving, augmented reality devices and other intelligent systems. Currently, the state-of-the-art object detection algorithms used for example in automotive rely heavily on sensor output from expensive radars, lidars and depth sensors. Other techniques that are solely based on computing require high amount of GPU power and even then are not always real-time, making them impractical for everyday applications, in particular when computing power is limited. Methods like YOLO (You-Only-Look-Once) and R-CNN (Regional-based Convolutional Neural Networks) have tackled the problem with efficient and accurate models but, because of their slow execution on non-GPU enabled devices, they are bound to run on expensive and power hungry hardware. Recently, YOLO-LITE, a model based on YOLO, has achieved good performance on non-GPU devices, but with a loss of accuracy. This thesis will focus on performance optimization of the YOLO software architecture when running on an embedded platform with limited resources.

Objective

To further investigate how real-time object detection can be optimized in embedded systems, every layer of the architecture (from the neural network model, the CNN implementation, the resource management and aspects of the OS) must be taken into account. The first goal of this thesis is to provide an estimation of the optimization potential at each of these layers. Once this is achieved, the student will work with the layer that best fits his/her background, among the ones that offer reasonable optimization potential.

How to apply:

- Laboratory: Chair of Cyber Physical Systems in Production Engineering, Technical University of Munich. (See [http://www.professoren.tum.de/caccamo-marco/](http://www.professoren.tum.de/caccamo-marco/))
- Supervisor: Marco Caccamo
- If interested, e-mail both mcaccamo@tum.de and daniele.bernardini@intranetstandard.com and
- Please include in the email your CV and list of courses you have taken.