



## Master Thesis Idea

### **Title: Embedded Vision Perception on MCU-Based Mobile Robots under Extreme Resource Constraints**

This thesis concerns the design of an embedded vision perception module for MCU-based mobile robots under extremely tight resource constraints. The focus is not only on reducing the model size, but on building a perception component that can actually run on a real robot with a camera and expose a reusable interface to other modules.

Typical tasks may include target presence detection, coarse localization, or simple motion-state recognition. The exact task can be adjusted depending on what is feasible on the chosen hardware, but the final system should remain deployable on a real embedded robotic platform.

- Investigate how low-bit model compression methods, including activation-aware quantization ideas, can be adapted to compact vision models for MCU deployment.
- Develop and deploy a lightweight camera-based perception module on a real mobile robot platform with a clear software interface.
- Evaluate the resulting system in terms of task accuracy, latency, memory footprint, and practical usability on the target hardware.

**Relevant references:** Ji Lin et al., “AWQ: Activation-aware Weight Quantization for LLM Compression and Acceleration”; Zhefan Xu et al., “Onboard dynamic-object detection and tracking for autonomous robot navigation with RGB-D camera”.

**Contact:** Hongbo Liu (hongbo.liu1@tu-braunschweig.de)