

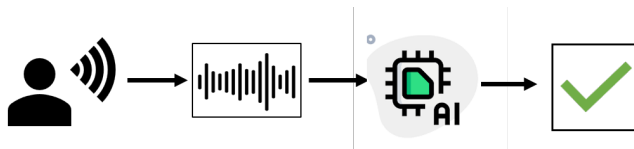
Open Thesis / Project / Paid Student Job

Leveraging AI Processors for Machine Learning on Microcontrollers

Note: *this work is suitable for a MSc project/thesis, and can also be performed as a **paid student job**.*

Motivation

Machine learning (ML) is trending in every field of research and has also found its way to low-power microcontrollers with only a few kilobytes to megabytes of memory (often referred to as TinyML). With the boom of smart devices and the IoT, a plethora of tiny but capable microcontrollers are now ubiquitous and can be used for ML tasks. Moreover, vendors are creating special hardware, such as the new Infineon PSoC Edge MCU or WiseEye2 AI processor – running an Arm Cortex M55 CPU and an Ethos U55 Neural Processing Unit (NPU) – that supposedly excel at TinyML tasks. Our goal is to benchmark the achievable performance gains using these new chips and to understand how much they can boost the performance of our ML solution running on older hardware. As a starting point, the student should explore and test the existing pipelines for keyword spotting applications (e.g., https://github.com/HimaxWiseEyePlus/Seed_Grove_Vision_AI_Module_V2/tree/main/EPII_CM55M_APP_S/app/scenario_app/kws_pdm_record), so to quantitatively benchmark the performance of various accelerators. Ultimately, our aim is to port our speaker recognition pipeline from our nRF5340 SoC to the Infineon PSoC Edge or WiseEye2, and evaluate its performance.



Goals and Tasks

Within this context, students can explore several directions and perform different tasks, such as:

- Get to know the Infineon PSoC Edge MCU or WiseEye2 and try different examples to get a running system.
- Benchmark the provided audio keyword spotting application in terms of the runtime of the M55 CPU, U55 NPU, and Helium MVE (M-profile vector extension).
- Develop a prototype of a fast speaker recognition system running on the Infineon PSoC Edge MCU or WiseEye2 AI processor.

Target Group

- Students of ICE/Telematics;
- Students of Computer Science;
- Students of Electrical Engineering.

Required Prior Knowledge

- Basic knowledge of machine learning;
- Solid skills in Python and C programming;
- Experience with microcontrollers.

Contact Person

- Dipl.-Ing. Markus Gallacher
markus.gallacher@tugraz.at
- Dr. Markus Schuß
markus.schuss@tugraz.at
- Assoc.Prof. Carlo Alberto Boano
cboano@tugraz.at

