Master thesis in computer vision on edge devices

Starting date:	**as soon as possible**
Duration:	**6 months minimum (can be increased to 12 months if student is interested)**
Working Place:	**Posieux or Tanikon (home office possible)**
Language:	**English**
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Benchmarking the Raspberry PI, Raspberry PI AI and NVIDIA Orin for computer vision tasks in agriculture

The agricultural landscape is undergoing a significant transformation, driven by the adoption of innovative technologies. Among these advancements, computer vision (CV) stands out as a powerful tool capable of revolutionizing various aspects of agricultural practices. CV algorithms, with their ability to extract valuable insights from visual data, are paving the way for a more efficient, sustainable, and data-driven approach to farming.

This master thesis delves into the exciting realm of CV deployment within the agricultural domain. The research will focus on benchmarking three distinct computer vision deployment and inference stacks – software and hardware configurations specifically designed for efficient execution of CV algorithms – across four diverse hardware platforms: Raspberry Pi (CPU), Raspberry TPU and Raspberry Pi AI Kit (GPU) and the NVIDIA Orin NX under 3 different production scenarios: daily snapshots, movement detection and continuous broadcasting

The primary objective of this thesis is to comprehensively assess the performance of three pre-selected computer vision deployment and inference stacks across the four designated hardware platforms. The student researcher will be provided with the necessary hardware resources, pre-trained computer vision models, and a robust infrastructure to facilitate experimentation. Additionally, they will receive dedicated guidance and supervision from two researchers with expertise in both computer vision and embedded systems.

The research will encompass the following core aspects for the benchmark:

- Ease of Deployment: This entails evaluating the complexity of installation, configuration, and integration of the CV model within each deployment and inference stack.
- Inference Speed: This component focuses on measuring the time required for each hardware-software combination to process and generate results from the pre-trained CV model.
- Energy Efficiency: The power consumption of each platform during CV model execution will be meticulously evaluated to determine the most energy-efficient solution depending of the different scenarios

This research will provide a comprehensive manual that serves as a valuable resource for the agricultural community. This guide will detail the deployment and inference strategies employed during the study, providing step-by-step instructions and reproducible pipelines for implementing the tested solutions.

The focus of this research will primarily be on object detection tasks, a fundamental CV application. However, the student researcher will have the opportunity to expand the scope to encompass other computer vision tasks such as semantic segmentation, provided time constraints allow. Furthermore, the research findings will shed light on the strengths and limitations of each evaluated platform, enabling developers to optimize CV algorithms and applications for optimal performance within agricultural settings.

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