Chair for Embedded Systems

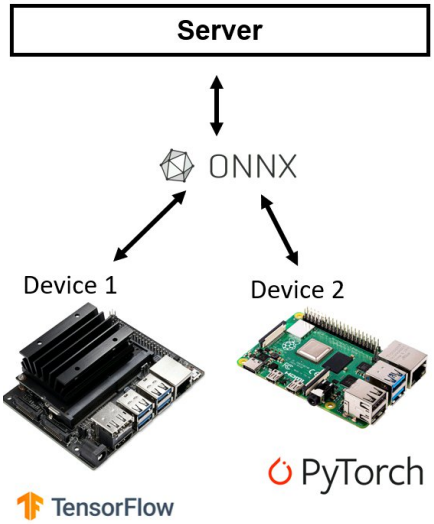
Prof. Dr. J. Henkel

Bachelor Thesis

Federated Learning Framework

In federated learning (FL), a set of distributed devices (e.g., smartphones or sensor nodes) cooperatively learn towards a specific goal. Thereby, devices train a local neural network (NN) with their private data and synchronize their knowledge with a server, therefore, benefitting from each other through jointly training. Training is usually done in synchronous rounds, where each device has to transfer its update in time. However, in real-world applications, it is unreasonable to assume that all devices can perform exactly the same amount of training since they may have different amounts of samples and varying hardware capabilities (e.g., CPU cores, RAM, or GPU availability). These real-world properties are expected to have an effect on convergence speed and achievable accuracies. To understand these effects, it is essential to not just simulate FL on a centralized server but use real-world embedded devices.

The goal of this thesis to extend an existing platform and set up an FL system with a server and many embedded devices (e.g., NVIDIA Jetson Nanos or Raspberry Pis). These devices could use different ML frameworks for training, such as TensorFlow or PyTorch. Devices are connected via Ethernet or wirelessly to a server. Additionally, it is required to simulate the distribution of data among the devices. The developed platform should be generic enough to allow benchmarking of various state-of-the-art FL algorithms and enable future research on hardware-aware FL.



Skills required for the thesis

- Programming skills (Python)
- Background on machine learning
- Experience with ML frameworks such as PyTorch or Tensorflow is beneficial but not required

Skills acquired within the thesis

- Knowledge of state-of-the-art ML frameworks
- Technical writing skills
- Work in a research environment

Language

The collaboration with the colleagues can be in English or German.

Contact

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