SCIENCE · PASSION · TECHNOLOGY

Open Thesis / Project

Backpropagation-free Model Adaptation on IoT Devices

Embedded Learning and Sensing Systems Group

Motivation

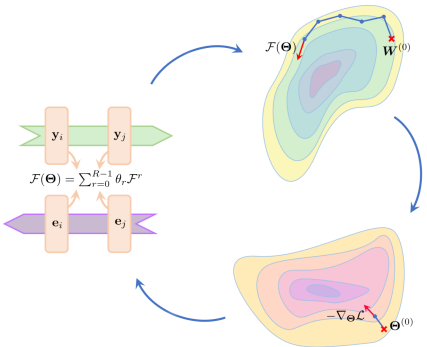
Deep models deployed on edge devices frequently encounter distribution shifts in sensed data. This issue primarily arises from a sensor drift, varying environmental conditions or context, and leads to a discrepancy between the real and the training data distributions. Model re-training using backpropagation is expensive, beside derivate computation, the memory overhead scales linearly with model depth and batch size. Machine learning frameworks for resource-constrained IoT devices therefore optimize model inference and usually do not support on-device model updates. Unfortunately, updating even a small fraction of model parameters still requires a fully-features backward pass. In this project, we aim to support on-device model adaptation by leveraging bio-inspired learning theory.
Interested? Please contact us for more details!

Target Group

Students in ICE, Computer Science or Software Engineering.

Thesis Type

Master Project / Master Thesis.



Efficient model's adaptation previously proposed

Goals and Tasks

The goal of this project is to extend the TensorFlow Lite Micro framework by adding the support for runtime fine-tuning of models in response to distribution shifts, utilizing the principles of Hebbian learning theory. The project includes the following tasks:

- In-depth understanding of standard model re-training using backpropagation;
- Familiarize yourself with TFL Micro and how it can be expended to support model updates using backpropagation-free methods;
- Implement the training algorithm and analyze its performance;
- Summarize the results in a written report.

Requirements:

- Eager to learn about deep neural networks and on-device adaptation on IoT devices;
- Programming skills in Python;
- Prior experience with machine learning frameworks (*e.g.*, TensorFlow, PyTorch).

Used Tools & Equipment

- A laptop (GPU infrastructure access and an IoT device for experiments will be provided).

Contact Persons

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