Decentralized Federated Learning on Constrained IoT Devices

The Internet of Things (IoT) is an increasingly prominent aspect of our daily lives, with connected devices offering unprecedented convenience and efficiency. As we move towards a more interconnected world, ensuring the privacy and security of data generated by these devices is paramount. That is where decentralized federated learning comes in.

Federated Learning (FL) is a machine-learning paradigm that enables multiple parties to collaboratively train a model without sharing their data directly. This thesis focuses on taking FL one step further by removing the need for a central server, allowing IoT devices to directly collaborate in a peer-to-peer manner.

In this project, you will explore and develop decentralized federated learning frameworks specifically tailored for constrained IoT devices with limited computational power, memory, and energy resources. The aim is to design and implement efficient algorithms that can harness the collective power of these devices while ensuring data privacy and device autonomy. This involves tackling challenges related to resource-constrained environments, heterogeneous device capabilities, and maintaining security and privacy guarantees.

The project offers a unique opportunity to contribute to cutting-edge research with real-world impact. Successful outcomes will enable secure and private machine learning on IoT devices, fostering new applications in areas such as smart homes, industrial automation, and wearable health monitoring.

Responsibilities:

- Literature review on decentralized federated learning, especially in relation to IoT and decentralized systems.
- Design and development of decentralized FL frameworks suitable for constrained IoT devices.
- Implementation and evaluation of the proposed framework using real-world datasets and testbeds.
- Analysis of security and privacy aspects, along with resource utilization.
- Documentation and presentation of findings in a thesis report, possibly leading to publications in top venues.

Requirements:

- Enrollment in a Master’s program in Computer Engineering, Computer Science, Electrical Engineering or related fields
- Solid understanding of machine learning algorithms and frameworks (e.g., TensorFlow, PyTorch)
- Proficiency in C and Python programming language
- Experience with IoT devices and embedded systems development
- Excellent analytical skills and a systematic problem-solving approach

Nice to Have:
Knowledge of cybersecurity and privacy principles
Familiarity with blockchain or other decentralized technologies
Interest in distributed computing and edge computing paradigms

Contact

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Advisors

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