

Diploma/Master Thesis Topic:

Energy Consumption Analysis of AI/ML-Based Compression on Wireless Sensor Devices

Task description:

Wireless sensor networks (WSNs) play a crucial role in IoT applications, enabling real-time monitoring and data collection across various domains such as industrial automation, environmental sensing, and smart infrastructure. However, sensor nodes are often battery-powered, making energy efficiency a key challenge. Traditional methods of data transmission consume significant power, prompting the need for efficient on-device data processing. AI/ML-based compression techniques offer a promising solution by reducing the amount of transmitted data while preserving essential information. However, their computational requirements may impact energy consumption, latency, and overall system performance.

This thesis aims to measure and analyze the energy consumption of running AI/ML-based compression on wireless sensor boards. Key objectives include:

- Setting up an experimental framework to measure power consumption of different sensor platforms.
- Benchmarking AI/ML compression models in terms of energy usage, processing time, and memory footprint.
- Analyzing trade-offs between compression efficiency, energy savings, and data transmission costs.
- Investigating additional performance metrics, such as latency and data fidelity, under varying sensor workloads.

Required Qualifications:

- Experience with Wireless Sensor Networks (WSNs) and IoT technologies
- Knowledge of AI/ML algorithms, preferably in data compression and signal processing
- Proficiency in embedded programming (C/C++, Python) and working with microcontrollers (e.g., ARM Cortex, ESP32, STM32)
- Familiarity with power measurement techniques and tools such as oscilloscopes, power analyzers, or software-based profiling methods
- Basic understanding of energy-efficient computing and low-power communication protocols (e.g., BLE, LoRa, Zigbee)
- Ability to conduct experimental research, analyze data, and document findings effectively

To apply, please send a tabular CV and a short motivation letter in English to Dr.-Ing. Maroua Taghouti maroua.taghouti@tu-dresden.de . We are already looking forward to your application!