

TinyML for the Internet of Things

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Research description

We live in a connected world with a range of devices, such as smart appliances, smartphones, wearables, smart cars, and others composing the Internet of Things (IoT). Sensor data streams from devices are processed not only in the clouds but often in the edge computing clusters and the devices themselves to increase system responsiveness, reduce network traffic, and preserve energy resources.

Advancements in tiny machine learning (TinyML) have revolutionized the capabilities of smart IoT devices. These devices can now perform on-device sensor data analytics at low-power levels. This breakthrough in technology enables a wide range of always-on use cases and is particularly beneficial for battery-operated devices. The integration of TinyML with low-power communication technologies such as LoRaWAN and NB-IoT further enhances the efficiency of IoT systems.

The primary objective of this research is to develop algorithms that can effectively decompose and deploy sensor data processing services on the available hardware infrastructure—devices/edge clusters/clouds—and the communication technologies that connect them. This will ensure the desired system properties and data processing quality, accordingly to the system use-case. The research will involve a series of experiments to analyse the operation of typical Internet of Things systems, their modeling, and analysis, with a focus on practical application and real-world impact.

The research includes designing and evaluating prototypes based on cutting-edge technologies such as micro Kubernetes clusters (e.g., MicroK8s, k3s, k0s, Microshift), low-power devices, and ML frameworks such as FogML and Tensorflow Lite.

Supervision Environment

The candidate will participate in collaborative research, working with experts within the NUSE research group (with extensive experience in IoT and Machine Learning for embedded devices) and an extensive network of international partners.