SUPERVISOR/S: Panos Patros
PROJECT TITLE: Federated Learning on Serverless Edge
FIELD: Serverless Computing
DIVISION/SCHOOL: HECS - School of Computing and Mathematical Sciences
PROJECT LOCATION: Hamilton

PROJECT ABSTRACT:
Rural AI applications require access to local computing resources that are easy to use. Serverless computing, which is slowly becoming the dominant cloud paradigm, abstracts away the management of hardware resources and simplifies software operations.

The Ohu Rangahau Kapua Aunoa (ORKA) Lab has prototyped a solution on top of (and in collaboration with) the FuncX serverless platform (which packages Python functions and ships them to the intended hardware for execution) to run federated learning on 3 local zones, whose models are then submitted to a central zone for aggregation. The prototype was conducted on virtualized clusters running on 6 desktop machines and is currently expanded on clusters of Raspberry Pis. For this project, we seek to deploy the federated learning part of the three edge zones on embedded devices that contain GPUs (Jetson Nanos) to speed up the execution time of AI and replicate realistic hardware deployment scenarios.

The end-users and beneficiaries of this research are expected to be rural businesses (farms, foresters, etc.) and off-the-grid communities of Aotearoa New Zealand in need of affordable and secure AI services (although the methods developed will have a broader impact). Crucially, this project aims to expand on our current collaboration with FuncX, run by the University of Chicago and Argonne National Laboratory of the US. We are working with three Kiwis of the FuncX project (Ian Foster, Kyle Chard, Ryan Chard) who are keen to collaborate and give back to NZ.

Additionally, the student taking on this task will develop valuable practical and research skills on serverless computing, which is becoming the dominant form of cloud computing, deployment of AI technologies on actual embedded hardware with GPUs that it is intended to run on, as well as familiarity with the embedded devices themselves.

STUDENT SKILLS:
- General Software Engineering Skills
- Cloud Computing
- Embedded Systems
- Willingness to learn concepts of federated learning

PROJECT TASKS:
- Reading on existing ORKA work and conduct a brief review on state-of-the-art management systems for edge clusters
- Investigate how to best migrate the FuncX serverless platform code from the prototype cluster and Raspberry Pis to the Jetson Nanos
- Develop and unit-test the system
- Conduct basic experimental evaluation and compare speedup against baseline
- Document results

EXPECTED OUTCOMES:
- Student’s Research Poster (as per clause 6 of the Scholarship regulations)
- A working live demo of a federated learning system on serverless
- Reusable software artifacts
- A short paper on the topic