School of Computing, Engineering, and the Built Environment
Edinburgh Napier University

PHD STUDENT PROJECT

Funding and application details

Funding status: Self-funded students only

Application instructions:
Detailed instructions are available at https://www.napier.ac.uk/research-and-innovation/research-degrees/how-to-apply

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:

- DIRECTOR OF STUDY: Zuansi Cai (Email: Z.Cai@napier.ac.uk)
- 2ND SUPERVISOR: Amir Hussain

Subject Group: Engineering & mathematics

Research Areas: Engineering

Project Title: Novel Machine Learning for Forecasting PV output

Project description:

The rapid proliferation of wind and solar installations, coupled with the growing impact of climate change on the volatile UK weather, creates formidable operable challenges for the UK electricity Grid. To balance the supply and demand of the electricity system, the National Grid is required to take proactive actions to curtail variable renewable energy (VRE) generation. For example, the UK wasted over £274m (equivalent to 3.7 TWh) worth of VRE in 2020 alone, and this is projected to exceed £600m (~8 TWh) in 2030. Energy storage is often seen as a solution to this problem, however state-of-the-art solutions suffer from low round-trip efficiency (30%-80%), with the most widely used hydrogen storage option being only 30% efficient.

This project aims to unify multiscale machine learning and unconventional solar forecasting approaches to help balance demand and supply. The unifying approach will integrate and widen the ability of distributed or federated machine learning algorithms to be used on low-memory smart home user devices for optimised local solar predictions for smart energy management at more granular levels. With the ambitious use of distributed Edge-based machine learning and solar geometry instead of weather dependent solar irradiance, the multi-scale forecasting approach will produce a high-frequency capacity factor as the solar output multiple days and weeks ahead. Success in the approach could transform the prediction accuracy using future weather forecasting systems.

References:

Candidate characteristics

Education:

A second class honour degree or equivalent qualification in Computing, or Engineering

Subject knowledge:

- Renewable energy system.

Essential attributes:

- Experience of fundamental Computing and Mathematics
- Competent in programming and data analysis
- Knowledge of renewable energy system
- Good written and oral communication skills
- Strong motivation, with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

- Some experience in machine learning and computer programming