

Department	School of Engineering and the Built Environment
Supervisors	Dr. Zuansi Cai, Prof. Amir Hussain
Project Title	Novel Machine Learning for Forecasting PV output
<p>PROJECT DESCRIPTION</p> <p>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.</p> <p>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 dependant 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.</p> <p>Perspective applicants are encouraged to contact the Supervisor before submitting their applications. Applications should make it clear the project you are applying for and the name of the supervisors.</p> <p>Academic qualifications A first degree (at least a 2.1) ideally in Computing or Engineering with a good fundamental knowledge of renewable energy system.</p> <p>English language requirement IELTS score must be at least 6.5 (with not less than 6.0 in each of the four components). Other, equivalent qualifications will be accepted. Full details of the University's policy are available online.</p> <p>Essential attributes:</p> <ul style="list-style-type: none"> • 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 <p>Desirable attributes: Some experience in machine learning and computer programming</p>	
Indicative Bibliography	Frederiksen, F.C.A, & Cai, Z. Novel machine learning approach for solar photovoltaic energy output forecast using extra-terrestrial solar irradiance. Applied Energy, 306, (2022)

	Yang, G, Huang K, Zhang, R, Goulermas, JY & Hussain. A. Coarse-grained generalized zero-shot learning with efficient self-focus mechanisms, Neurocomputing, Volume 463:400-410. (2021
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