StatML Industrial PhD Project with Shell

Internal Supervisors: Mikko Pakkanen, Axel Gandy

External Supervisor: Robert Doel

Shell operates a large network of electric vehicle (EV) charging stations that automatically collect data on charging sessions along with vehicle and customer characteristics. The aim of this industrial project is to analyse and model such data sets, which are vast — consisting of hundreds of thousands of samples, using modern data science and machine learning methods, in order to answer research questions of both technical and behavioural nature:

(i) *How do EV battery management systems respond to different temperatures?*

(ii) *How do EV batteries age in the field, in particular in terms of their maximum capacity and peak charging rates?*

(iii) *Can we predict the course of a charging curve from a few initial points even if do not know the vehicle make and model?*

(iv) *Can we segment customers and model their geographic distribution in ways that help us understand them better?*

(v) *Can we monitor how people's behaviours evolve as they get more experiences with their EV and possibly move from one segment to another?*

The proposed research problems are expected to involve both unsupervised and supervised statistical learning techniques, including: deep neural networks (i–iii), Gaussian processes (ii–iii), non-linear regression (i–iii), change-point detection (v), clustering (iv–v), density estimation (iv) and spatial statistics (iv). While the research questions are application-driven, there is also scope in this project for developing novel methodology.

This is a unique opportunity to work on an extensive industrial data set that is not publicly available. The project aims to be both academically rigorous and practically relevant, with a view to advancing the adoption of EVs and the transition to carbon neutrality.

During the PhD project, the student will interact with R&D staff of Shell and spend time in Shell's London office.