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Modelling electric vehicle charging load with point processes and multivariate mixtures

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Numerous countries are making electric vehicles their key priority to reduce emissions in their transport sector. This emerging market is subject to multiple unknowns and in particular the charging behaviours of electric vehicles. The lack of data describing the interactions between electric vehicles and charging points hinders the development of statistical models describing this interaction [1]. In this work, we want to address this gap by proposing a data-driven model of the electric vehicle charging load benchmarked on open charging session datasets. These open datasets cover all common charging behaviours: (a) public charging, (b) workplace charging, (c) residential charging. The model introduced in this work focuses on three variables that are paramount for reconstructing the electric vehicle charging load in an uncontrolled charging environment: the arrival time, the charging duration, and the energy demanded for each charging session. The arrivals of EVs at charging points are characterised by as a non-homogenous Poisson Process, and the charging duration and energy demanded are modelled conditionally to these arrival times as a bivariate mixture of Gaussian distributions. We compare the performances of the model proposed on all these datasets across different metrics.
[1] Amara-Ouali, Y. et al. 2021. A Review of Electric Vehicle Load Open Data and Models. Energies. 14, 8 (Apr. 2021), 2233. DOI:https://doi.org/10.3390/en14082233.

Keywords

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Special/invited session

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