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Abstract

Quantifying the potential of electrification with large-scale vehicle trajectory data

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Cities are keen to encourage the shift to electric vehicles, its major promise being a cut in air pollution. With recent advances in battery technology and the resulting decrease in charging times, a strong focus is placed on the range of electric vehicles.

At the same time, the emergence of ubiquitous mobile positioning enables the gathering of large amounts of data. Taxis represent a significant fraction of the urban mobility in a city and need to be equipped with GPS-tracking devices under German law.

Motivated by these developments, a data-driven framework is introduced that analyses vehicle trajectories and driving patterns to assess the potential electrification of vehicles, taking into account available charging infrastructure. As a case study, this research uses trajectory data of more than 153 thousand trips, performed by a fleet of taxis operating in Hamburg over a one-month period. Both a battery and a charging behaviour model are applied to the reconstructed vehicle trajectories to compute distributions of electric driving share. While outcomes of the simulation are based on different electrification scenarios, it is clear that a significant fraction of vehicles could operate as an electric vehicle, even with a small or medium size battery. When collectively considered, the results presented in this study underline the ability of data-driven approaches to assess the electrification of vehicles. Furthermore, strong arguments for the adoption of electric vehicles for certain individuals or companies (e.g. fleet vehicles) are provided.