Inhomogeneous Markov Models for Describing Driving Patterns

It has been predicted that electric vehicles will play a crucial role in incorporating a large renewable component in the energy sector. If electric vehicles are integrated in a naive way, they may exacerbate issues related to peak demand and transmission capacity limits while not reducing polluting emissions.

Optimizing the charging of electric vehicles is paramount for their successful integration. This paper presents a model to describe the driving patterns of electric vehicles, in order to provide primary input information to any mathematical programming model for optimal charging. Specifically, an inhomogeneous Markov model that captures the diurnal variation in the use of a vehicle is presented. The model is defined by the time-varying probabilities of starting and ending a trip and is justified due to the uncertainty associated with the use of the vehicle. The model is fitted to data collected from the actual utilization of a vehicle. Inhomogeneous Markov models imply a large number of parameters. The number of parameters in the proposed model is reduced using B-splines.

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