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The challenge of predicting energy demand in the Charging Stations Control Center (CSCC)

The global adoption of electric vehicles (EVs) presents a pivotal opportunity for sustainable mobility, yet it also poses significant challenges for urban energy systems. Accurate forecasting of energy demand at EV charging stations is critical to maintaining grid stability and optimizing resource allocation. This study proposes a novel framework combining advanced traffic simulations using MATSim and Artificial Neural Network (ANN)-based predictive modeling to address this challenge. By leveraging Ljubljana as a case study, the framework demonstrates the ability to predict energy demand across varying scenarios, including different numbers of EVs, trip patterns, and charging strategies. The ANN model, coupled with orthogonal least-squares approximation, achieved high predictive accuracy with minimal mean squared error, highlighting its reliability and scalability to other urban contexts. The simulations also provide insights into the impacts of charging behaviors on energy demand, offering practical guidance for grid optimization and policymaking. While the results are promising, further research is needed to validate the model in diverse settings and integrate long-term trends and renewable energy sources. This work provides a robust foundation for sustainable urban energy planning, supporting the transition to cleaner and more electrified transportation systems.

Biography

Víctor Fernández is Assistant Professor in Quantitative Methods at the University of Valencia. He holds a PhD in Telecommunications Engineering, an MSc in Mathematics, and an Executive MBA (Accenture, USA). He has led EU projects such as INTEROP, SMARTV2G, and MOBINCITY, and holds a patent for CAPPD. Formerly Strategy Manager at Accenture, he later led innovation at Stratesys and CIT Group. He has taught at Universitat Jaume I and Zaragoza. His current work focuses on e-voting, ecological inference, and quantitative methods applied to smart mobility, cybersecurity, and public decision systems.