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Explainable Data Driven Digital Twins for Predicting Battery States in Electric Vehicles

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Abstract: *With the automotive sector quickly moving towards electric vehicles (EVs), precise battery state prediction is essential to maximize performance, safety, and lifespan. This system introduces a new method based on Explainable Data-Driven Digital Twins for battery state prediction in electric vehicles. The approach incorporates many advanced machine learning techniques, such as Deep Neural Networks (DNN), Long Short-Term Memory (LSTM) networks, Convolutional Neural Networks (CNN), Support Vector Regression (SVR), Support Vector Machines (SVM), Feedforward Neural Networks (FNN), Radial Basis Function networks (RBF), Random Forests (RF), and Extreme Gradient Boosting (XGBoost).The main aim of this study is to improve the predictability of battery states through these different algorithms for developing an integrative digital twin model. The model is intended to make precise predictions of the principal battery parameters of state of charge (SOC) and state of health (SOH) across different operating conditions. Using explainable AI methodologies, the project also intends to interpret and reveal the underlying mechanisms driving battery behavior[1]*

Keywords: Electric Vehicles, Battery State Prediction, Digital Twins, Machine Learning, Deep Neural Networks, LSTM, CNN, Support Vector Regression, Random Forests, Extreme Gradient Boosting

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