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Comparison of Regression Methods for Estimation of State-of-Health in Lithium-Ion Batteries

Abstract

Lithium-ion batteries are a type of rechargeable battery with a high energy density and an extended cycle life. The development of lithium-ion batteries is very rapid, but lithium-ion batteries have a limited lifespan and their energy storage capacity decreases with time and use. Therefore, the State of Health (SoH) of lithium-ion batteries is crucial when planning battery maintenance. The purpose of this study is to compare regression techniques for estimating the health of Li-ion batteries. XGBoost, Support Vector Regression (SVR), Random Forest Regression, Linear Regression, Gradient Boosting Regression, and Decision Tree Regression are the regression methods utilized in this investigation. All types of batteries from NASA's Prognostics Data Repository were utilized in the investigation. Support Vector Regression (SVR) yields the most accurate results compared to other techniques. The SVR technique yields RMSE, MSE, MAE, and MAPE values of 0.0226, 0.0005, 0.0208, and 0.0264, respectively. This indicates that the SVR method is capable of accurately estimating the SoH of a lithium-ion battery.

Keywords

Lithium-ion; Regression; State of Health (SoH); Support Vector Regression