Estimating Residential Natural Gas Demand and Consumption: A Hybrid Ensemble Machine Learning Approach

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Abstract:

The present work employed a hybrid ensemble regression machine learning technique to forecast the demand for natural gas in residential settings. Precise forecasting of natural gas demand is crucial for effective resource allocation and energy management. The hybrid ensemble approach combines many regression algorithms, such as K-Nearest neighbor (KNN), support vector regression (SVR), decision tree regression (DTR), and linear regression (LR), to maximize the benefits of each unique model and improve prediction performance. The hybrid ensemble regression model has two steps in its process. In the first step, individual regression models are trained using the dataset. In the second step, each model's predictions are assessed. The predictions from each model are evaluated in the second stage. Several metrics, such as mean absolute error (MAE), mean squared error (MSE), coefficient of determination (R2), and accuracy, are produced and contrasted with those of individual regression models to assess the performance of the hybrid ensemble model. To ensure resilience, the model's predicted accuracy is also evaluated using cross-validation methods. The experimental findings showed that, in terms of prediction accuracy, the hybrid ensemble regression strategy regularly outperforms individual regression models. Combining different models makes it possible to capture the various relationships and patterns that are present in the data, thereby improving the overall performance of the model.

Keywords:

Estimation, natural gas, hybrid, ensemble, machine learning.