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論文題目	A Study on Hybrid Models for Daily Demand Forecasting in Disrupted Situations: Application to Predict Thailand's Electricity Consumption During COVID-19		
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論文の内容の要旨

The accurate forecasting of electricity demand is crucial for global energy security, cost reduction, and grid stability. Disrupted situations such as the COVID-19 pandemic lead to unpredictable shifts in demand, posing challenges for short-term forecasting. Understanding demand patterns during such crises is essential for managing current circumstances and preparing for future disruptions.

This research aims to develop a precise model for predicting electricity demand, with the primary goal of effectively managing potential future disruptions. The proposed hybrid forecasting model is intended to address scenarios both with and without government intervention during disrupted situations, utilizing Thailand’s electricity demand during the COVID-19 pandemic as a case study. The proposed forecasting model integrates various techniques, including stepwise regression, similar day selection-based day type criteria, variational mode decomposition, empirical mode decomposition, fast Fourier transform, neural networks, long short-term memory, and grid search optimization. To enhance the model's flexibility and adaptability, this study introduces new criteria for dataset segmentation and the selection of similar days, facilitating one-day-ahead forecasting with the utilization of rolling datasets.

The study assessed the practicality and effectiveness of the proposed forecasting model through real-world implementation. Comparative analysis against existing models demonstrated the superiority of the proposed model in enhancing flexibility and accuracy, particularly in dynamic and uncertain environments. The model exhibited improved performance with efficient computational processes and independence from input variables dependent on prior forecasts. Furthermore, the study examined the impact of disruptions on the model's accuracy, revealing its robustness and adaptability. Overall, the findings provide valuable insights for decision-making across diverse scenarios.

Keywords: : hybrid approach; daily peak load forecasting; disrupted situation; VMD; EDM; FFT; similar day selection method; stepwise regression; artificial neural network; long short-term memory; COVID-19

論文審査の結果の要旨

Accurate forecasting of electricity demand is indeed essential for maintaining global energy security, reducing costs, and ensuring grid stability. During disrupted situations like the COVID-19 pandemic, unpredictable shifts in electricity demand can occur due to changes in consumption patterns, making short-term forecasting more challenging. Such disruptions can affect how energy is consumed across different sectors, requiring more sophisticated models and approaches to predict demand accurately. The main objective of this research is to develop models for predicting electricity demand in disrupted situations. The main contributions are summarized as follows.

This research proposed a hybrid model that incorporates techniques of data decomposition such as variational/empirical mode decomposition and fast Fourier transform with artificial neural network and long short-term memory for forecasting electricity demand capable of accommodating complex and dynamic environments. The proposed hybrid forecasting model was tested and evaluated under two scenarios: (1) with government intervention and (2) without government intervention during disrupted situations, using Thailand's electricity demand during the COVID-19 pandemic as a case study. In the experimental study, criteria were introduced for distinguishing between short-term, medium-term, and long-term input sets in disrupted situations, thereby enhancing the model's adaptability and accuracy. It also examined the impact of disruptions on the model's accuracy, revealing its robustness and adaptability

This dissertation has made good contributions both theoretically and practically in the field of energy forecasting and predictive modeling. The research work presented in this dissertation has resulted in two journal papers and one refereed conference paper.

In summary, Ms. ASWANUWATH Lalitpat has completed all the requirements in the doctoral program of the School of Knowledge Science, JAIST and finished the examination on August 09, 2024, all committee members approved awarding her a doctoral degree in Knowledge Science.

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