MINISTRY OF INDUSTRY AND TRADE
ELECTRIC POWER UNIVERSITY

SOCIALIST REPUBLIC OF VIET NAM
Independent– Freedom – Happiness

INFORMATION ON NEW CONCLUSIONS OF DOCTORAL DISSERTATION

(Information will be posted on the Website)

Name of dissertation: Research on hybrid machine learning models for solar power forecasting under real-world data conditions in Vietnam.

Major: Energy Engineering Code No: Pilot

Name of PhD. Student: Tuan Anh Nguyen

Advisors: 1. Dr. Manh Hai Pham
2. Dr. Minh Phap Vu

Training Institution: Electric Power University

Summary of new contributions of the Dissertation

1. The seasonal SE-XGB-LGBM-RF-OW ensemble model is proposed for solar power forecasting. This architecture optimizes the combination of decision tree algorithms through a stacking ensemble with seasonal weight optimization, thereby enhancing forecasting accuracy and adaptability to complex weather variations across different regions and timeframes.
2. A systematic evaluation is conducted on two major groups of models, including decision tree models (XGBoost, LightGBM, and Random Forest) and time series models (LSTM, GRU, and BiGRU), under scenarios with continuously missing data. Detailed comparative analyses of accuracy, training speed, and stability clarify the technical characteristics of each group and provide a scientific basis for model selection in future practical applications.
3. A LightGBM–LSTM hybrid model is developed, in which LightGBM is employed to fill short-term gaps in missing power data and serves as a preprocessing layer for the LSTM. This integration enhances forecasting performance under incomplete data conditions.
4. A Selector-Model is designed to automatically select the optimal forecasting model for each solar plant at a given time based on climate characteristics, plant scale, and historical data. This represents an important step toward simultaneous deployment of forecasting systems across multiple solar power plants located in different climate zones.
5. The effectiveness of radiation forecasting models (LightGBM, LSTM, and GRU) is demonstrated as an intermediate supporting layer within the power forecasting system, particularly in scenarios where measured data or meteorological forecasts from specialized centers are unavailable. These results clarify the critical role of radiation-related information throughout the entire forecasting pipeline.

Ha Noi, date….month…..year…..

Advisors **PhD. Student**

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