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Wind Energy Forecasting Project
Model Training Report

Executive Summary

This report documents the training process, architecture, and hyperparameters for all machine learning models developed for wind energy forecasting. Five different model types were trained: LSTM, Transformer, XGBoost, LightGBM, and Prophet. Each model was trained on the same dataset with appropriate preprocessing and feature engineering.

Training Configuration

Parameter	Value
Train-Test Split	80% / 20%
Validation Split	20%
Target Column	wind_generation_actual
Random State	42

LSTM Model

Type: Deep Learning - Recurrent Neural Network

Description: Long Short-Term Memory network for sequence learning

Hyperparameters

Parameter	Value
Sequence Length	30

Hidden Units	[128, 64]
Dropout	0.2
Epochs	500
Batch Size	32
Learning Rate	0.001
Early Stopping Patience	15

Transformer Model

Type: Deep Learning - Attention Mechanism

Description: Transformer architecture with multi-head attention

Hyperparameters

Parameter	Value
D Model	128
Nhead	8
Num Layers	4
Dim Feedforward	512
Dropout	0.2
Sequence Length	30
Epochs	500
Batch Size	32
Learning Rate	0.001
Early Stopping Patience	15

XGBoost Model

Type: Gradient Boosting

Description: Extreme Gradient Boosting ensemble method

Hyperparameters

Parameter	Value
N Estimators	1000
Max Depth	4
Learning Rate	0.01
Subsample	0.8

Colsample Bytree	0.8
Random State	42

LightGBM Model

Type: Gradient Boosting

Description: Light Gradient Boosting Machine for fast training

Hyperparameters

Parameter	Value
N Estimators	500
Max Depth	8
Learning Rate	0.01
Num Leaves	31
Random State	42

Prophet Model

Type: Time Series Forecasting

Description: Facebook's Prophet for time series with seasonality

Hyperparameters

Parameter	Value
Yearly Seasonality	True
Weekly Seasonality	True
Daily Seasonality	False
Seasonality Mode	multiplicative