Univariable Machine Learning Model for Long-Term Offshore Wind Power Forecasting

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Introduction

For the past decades, there have been an increase in the need for alternative energy sources, and move away from fossil fuel.

Our study seeks to do the following:

- Develop machine learning models to accurately predict offshore wind power production in short and long term.
- Compare the performance of different models on univariable and datasets.
- Select the best performing model from results of the tests and fine-tune the model.
- Use insights gained from the selected model to guide schedule maintenance and repair planning.
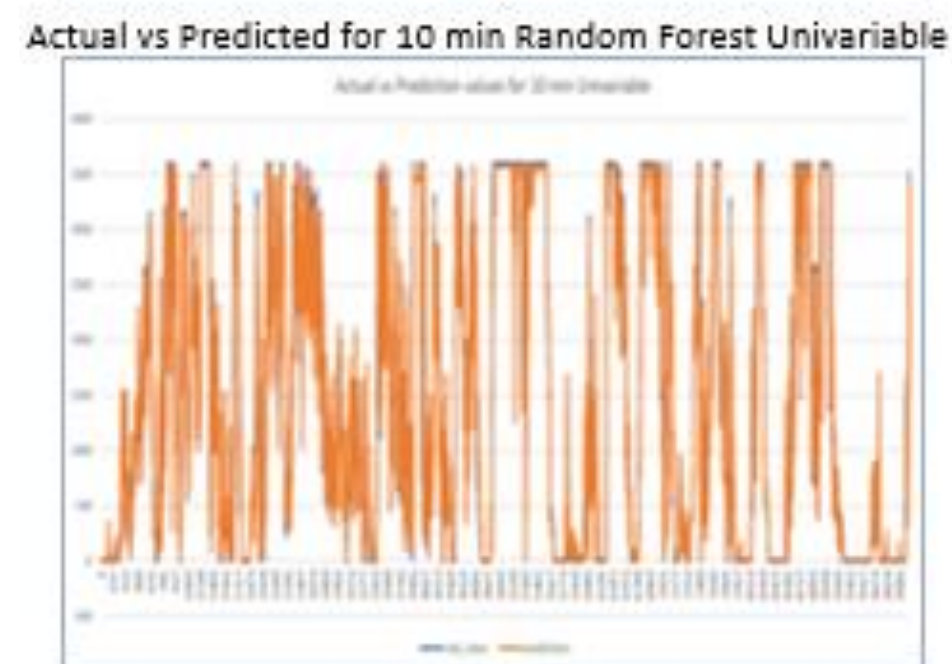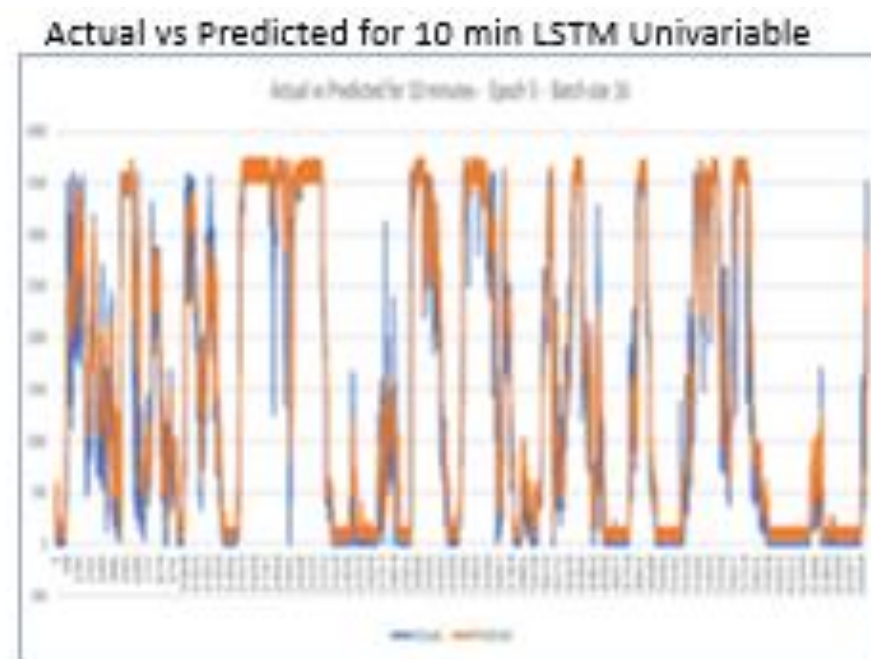

Methods

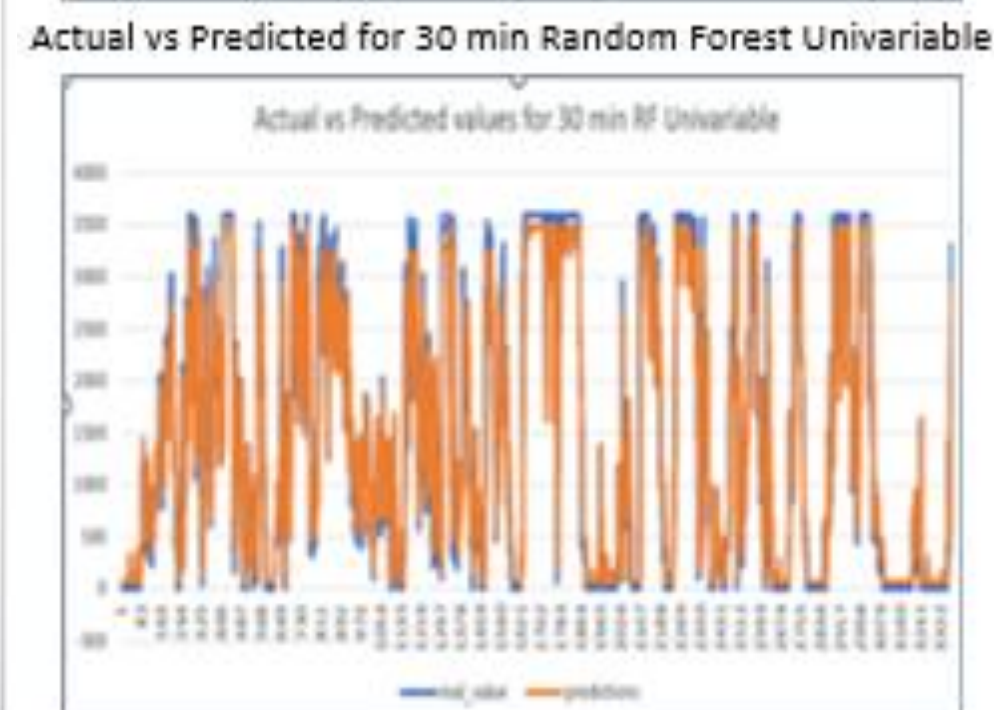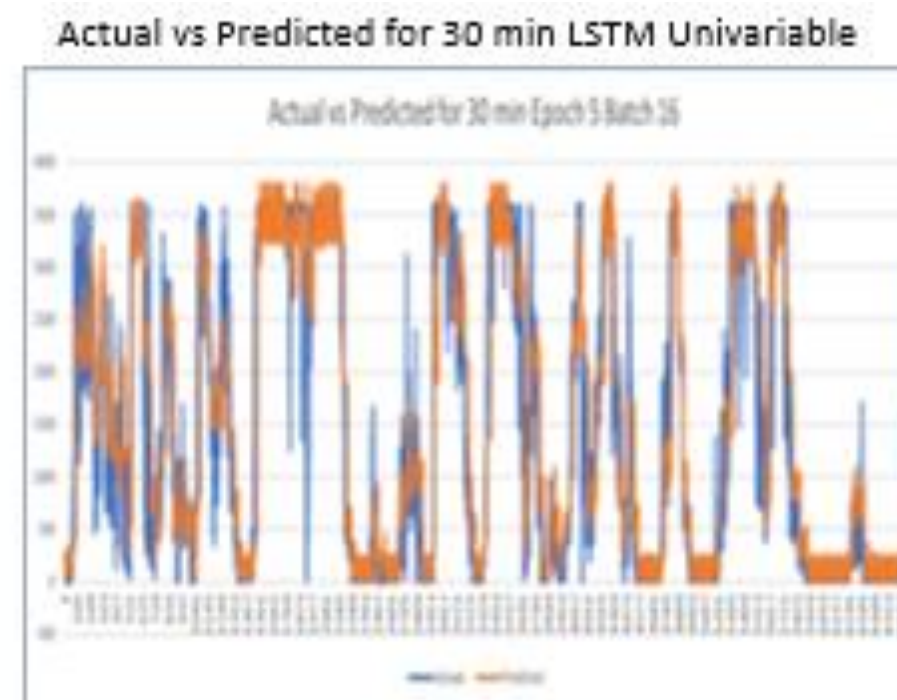**Our study employed the following approach:**

- Collect wind turbine data, clean and pre-process.

- Build and train a univariable LSTM and Random Forest models on the processed data.
- Hyperparameter tuning to increase model forecast accuracy.
- Evaluate performance of each model and compare results using 3 evaluation metrics:
  - ➢ SMAPE: The symmetric mean absolute percentage error.
  - ➢ RMSE: The root-mean-square error.
  - ➢ R^2: The coefficient of determination.

Results - 10 min

Actual vs Predicted for 10 min LSTM Univariable

Actual vs Predicted for 10 min Random Forest Univariable

Results - 30 min

Actual vs Predicted for 30 min LSTM Univariable

Actual vs Predicted for 30 min Random Forest Univariable

Evaluation Metrics

Model	SMAPE	RMSE	R^2
LSTM 10 min 5 epoch	55.23%	51.87	0.999
LSTM 10 min 15 epoch	60.94	47.97	0.999
LSTM 10 min 20 epoch	60.94	47.97	0.999
Random Forest 10 min	56.2	227.696	0.989
LSTM 30 min 5 epoch	64.46	215.383	0.987
LSTM 30 min 15 epoch	63.81	215.272	0.989
LSTM 30 min 20 epoch	64.64	233.43	0.987
Random Forest 30 min	69.53	525.499	0.929

Discussion

- Built and trained univariable LSTM and Random forest to predict short and long term.
- Fine tune both models which resulted in an overall increase in forecasting results.
- From results obtained so far, the LSTM model produced the best results for both 10 and 30 min predictions.

Future Work

Build a multivariable models using LSTM and Random Forest and compare the models to univariable using different metric errors.

Funding

Acknowledgement