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Wind Turbine Power Production in Neom city

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INTRODUCTION

NEOM is where the present and future of renewable energy converge. Thanks to its location, it offers a unique vantage point for leveraging wind power in one innovative dual system, paving the way for the next frontier in clean energy.

Renewable energy remains one of the most important topics for a sustainable future. Wind, being a perennial source of power, could be utilized to satisfy our power requirements. wind power forecasting would prove to be quite useful.

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Objectives

Wind energy (or wind power) describes the process by which wind is used to generate electricity. Wind turbines convert the kinetic energy in the wind into mechanical power. A generator can convert mechanical power into electricity. Mechanical power can also be utilized directly for specific tasks such as pumping water.

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Design:

in our project there is a solution based on Long Short-Term Memory (LSTM) networks
The model performed well on the training data as well as the test data, and the measurement used to estimate the accuracy of the model is mean squared error
It is presented where the model is trained with a dataset and forecasts the hourly wind turbine power production for 41 days

Data:

The dataset is taken from the Kaggle website and it contains the theoretical power required for a turbine to move along with the timestamps of throughout the year. The dataset contains five features namely Date/Time, LV Active Power, Wind Speed, Theoretical power curve and wind direction.

Algorithms:

The dataset contains 50,530 which is good enough to train an LSTM model. The model performed well on the training data as well as testing data and the measure used to estimate the accuracy of the model is mean squared error

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Tools:

- Technologies:
- Python -Jupyter Notebook.

- Libraries:
  - Pandas
  - –NumPy
  - –Matplotlib
  - – Keras –
  - sklearn –
  - Tensorflow -

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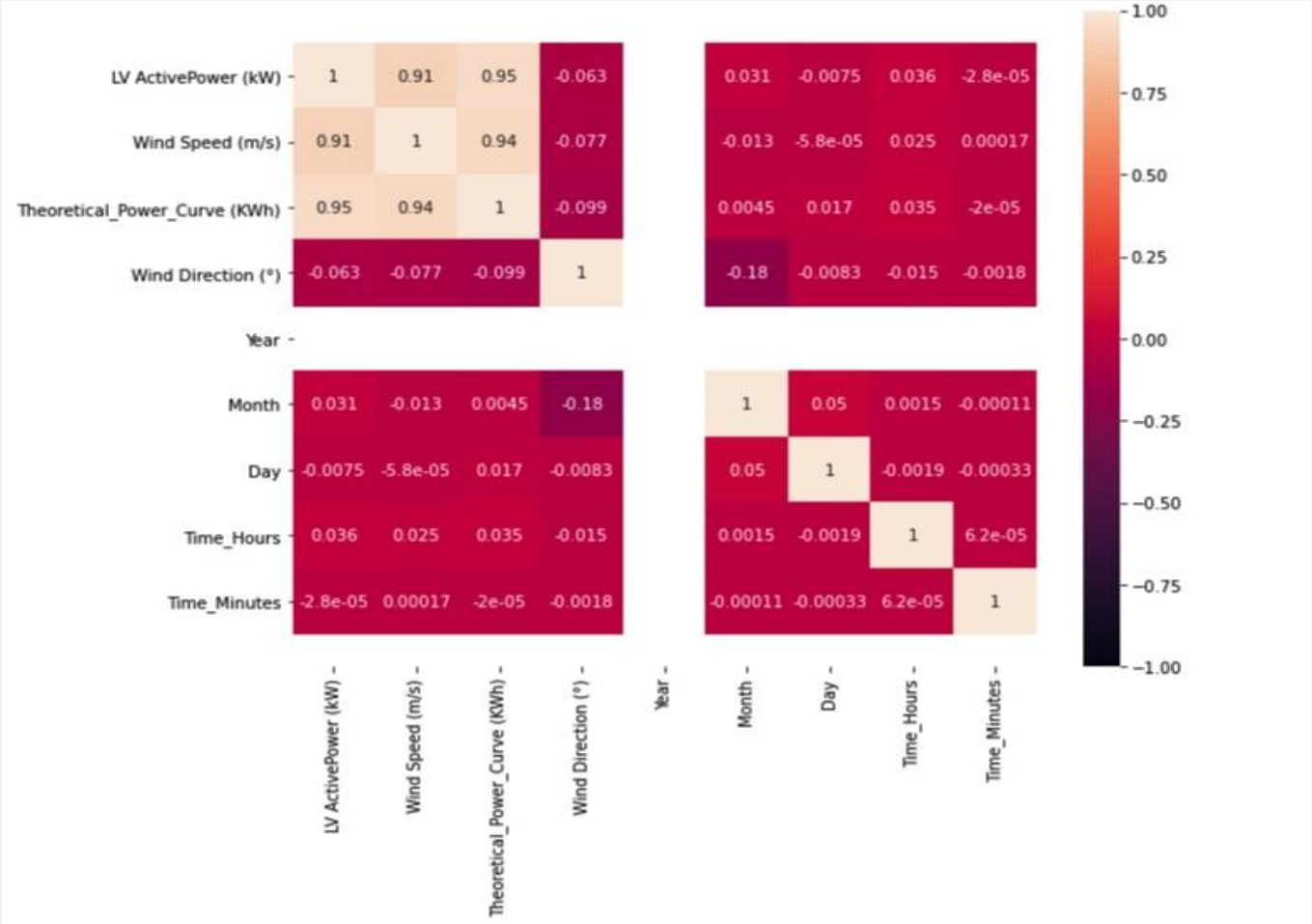
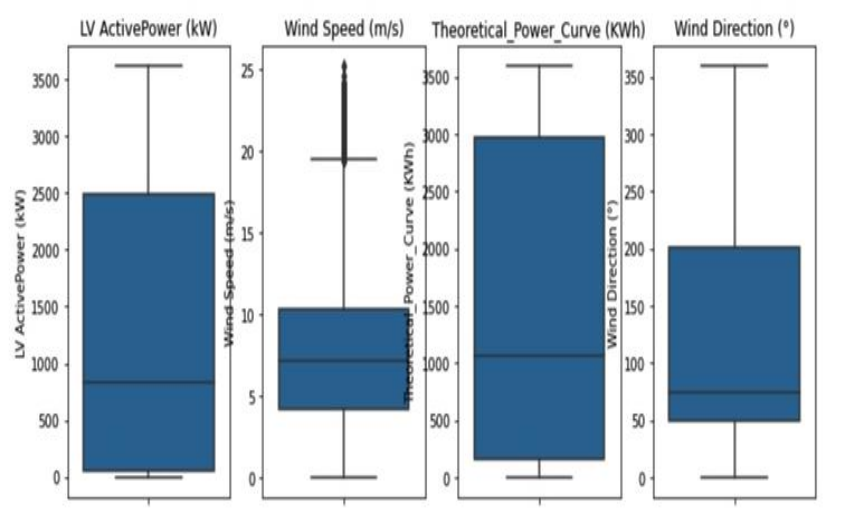
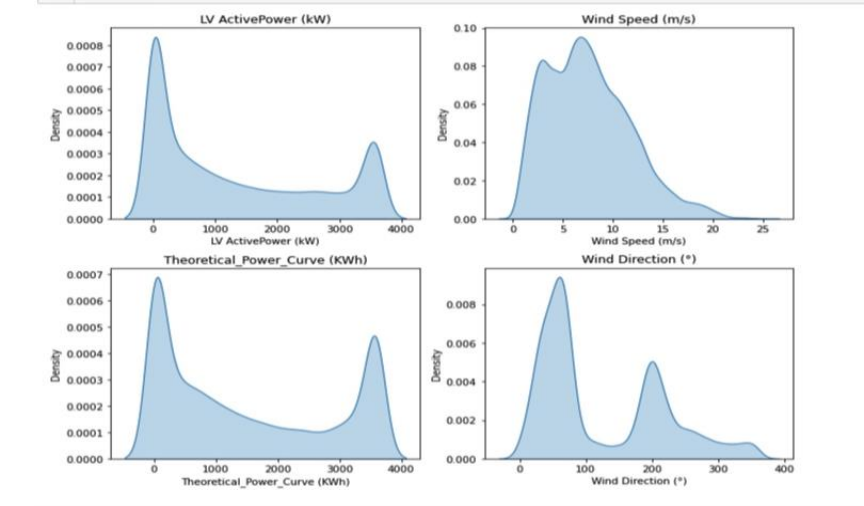
Communication:




LV ActivePower (kW)
Wind Speed (m/s)
Theoretical_Power_Curve (KWh)
Wind Direction (°)
LV ActivePower (kW)
Wind Speed (m/s)
Theoretical_Power_Curve (KWh)
Wind Direction (°)




```
lstm_model.summary()
```

```
Model: "sequential"
_________________________________________________________________
 Layer (type)                Output Shape              Param #
=================================================================
 lstm (LSTM)                 (1, 10)                   1400

 dense (Dense)               (1, 1)                    11

=================================================================
Total params: 1,411
Trainable params: 1,411
Non-trainable params: 0
```

```
In [34]: expectations = np.array(expectations)
         predictions = np.array(predictions)
         print("Mean Absolute Percent Error: ", (np.mean(np.abs((expectations - predictions) / expectations))))

         Mean Absolute Percent Error:  0.4615316174064657
```

```
        expectations.append(expected)
    print('Hour=%d, Predicted=%f, Expected=%f' % (i+1, yhat, expected))
```

```
Hour=1, Predicted=3602.623621, Expected=3600.000000
Hour=2, Predicted=3606.217023, Expected=3600.000000
Hour=3, Predicted=3607.570946, Expected=3600.000000
Hour=4, Predicted=3607.974849, Expected=2506.112948
Hour=5, Predicted=2514.191691, Expected=1954.282949
Hour=6, Predicted=1962.351654, Expected=1128.684225
Hour=7, Predicted=1136.636750, Expected=2087.002742
Hour=8, Predicted=2094.809085, Expected=1497.144149
Hour=9, Predicted=1504.743749, Expected=3143.880909
Hour=10, Predicted=3151.258527, Expected=3257.240200
Hour=11, Predicted=3264.480826, Expected=3099.589351
Hour=12, Predicted=3106.732149, Expected=2288.732261
Hour=13, Predicted=2295.830046, Expected=2851.196746
Hour=14, Predicted=2858.274821, Expected=2285.016857
Hour=15, Predicted=2292.080349, Expected=1861.757477
Hour=16, Predicted=1868.773200, Expected=2366.628323
Hour=17, Predicted=2373.522133, Expected=1708.423896
Hour=18, Predicted=1715.210367, Expected=2470.838153
Hour=19, Predicted=2477.512554, Expected=1945.646150
Hour=20, Predicted=1952.195070, Expected=3587.953946
```

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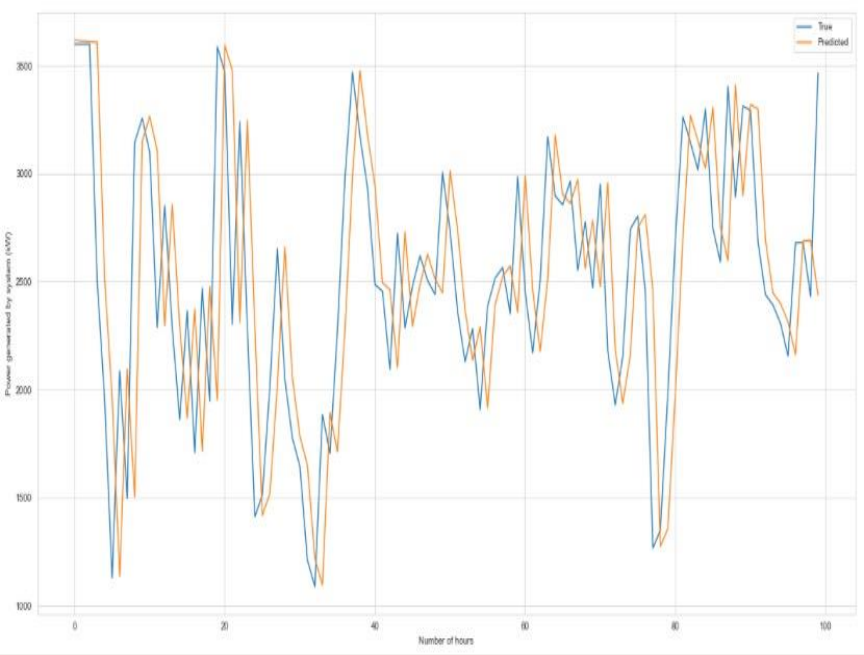

Recommedndation

- Choose open-air place for the turbine.
- Wind speed should be around 8.5 m/s.
- Do wind speed for multiple places.
- Increase wind turbine in good wind area.