NEOM نيوم

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. With the rise of wind farms, wind power forecasting would prove to be quite useful.

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.

description of the data:

data of a , windmil. The aim was to predict the wind power that could be generated from the windmill A long term wind forecasting technique is thus required.

	Date/Time	LV ActivePower (kW)	Wind Speed (m/s)	Theoretical_Power_Curve (KWh)	Wind Direction (°)
0	01 01 2018 00:00	380.047791	5.311336	416.328908	259.994904
1	01 01 2018 00:10	453.769196	5.672167	519.917511	268.641113
2	01 01 2018 00:20	306.376587	5.216037	390.900016	272.564789
3	01 01 2018 00:30	419.645905	5.659674	516.127569	271.258087
4	01 01 2018 00:40	380.650696	5.577941	491.702972	265.674286
...	...	...	...	...	...
50525	31 12 2018 23:10	2963.980957	11.404030	3397.190793	80.502724
50526	31 12 2018 23:20	1684.353027	7.332648	1173.055771	84.062599
50527	31 12 2018 23:30	2201.106934	8.435358	1788.284755	84.742500
50528	31 12 2018 23:40	2515.694092	9.421366	2418.382503	84.297913
50529	31 12 2018 23:50	2820.466064	9.979332	2779.184096	82.274620

50530 rows × 5 columns

Data preparation:

First, we check for duplicates and null data and drop

Second, add year , Month, Day, Time_Hours, Time_Minutes

Third Visualization data

Forth # Modleing & Test

Visualization

- *The heat map*

Visualization

- *The box plot*

#plotting the data distribution

results

```
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
```

True
Predicted
3500
3000
2500
2000
1500
1000
Power generated by system (kW)
0
20
40
60
80
100
Number of hours

Tools:

Technologies :
Python,

Jupyter Notebook

Libraires : Pandas, Numpy , Seaborn ,matplotlib ,scikit-learn, Keras and TensorFlow

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.

CONCLUSION

i hope this project helpful and all ideas was clear on it

Thank you