IBM-Recommendation-Model-To-Utilize-Energy-From-Wind-Farm

- By Horoscopers

SCOPE

- OUR ULIMATE AIM IS TO COMPETITIVE REAL TIME,REDUCE ENERGY WASTEAGE AND LOSSES IN POWER GRID.
- BY USING OUR MODEL,WE CAN PREDICT THE VALUABLE TIME OF POWER PRODUCTION.
- REST OF PLANT CAN BE PROVIDED FREQUENTLY BY PREDICTING THE UNWORTHY TIME.
- BY FORECATSING ENERGY, WE CAN SOLVE THE FUTURE ENERGY NEEDS.
- AS WELL AVAILBIALITY OF ENERGY CAN BE DETERMINED.

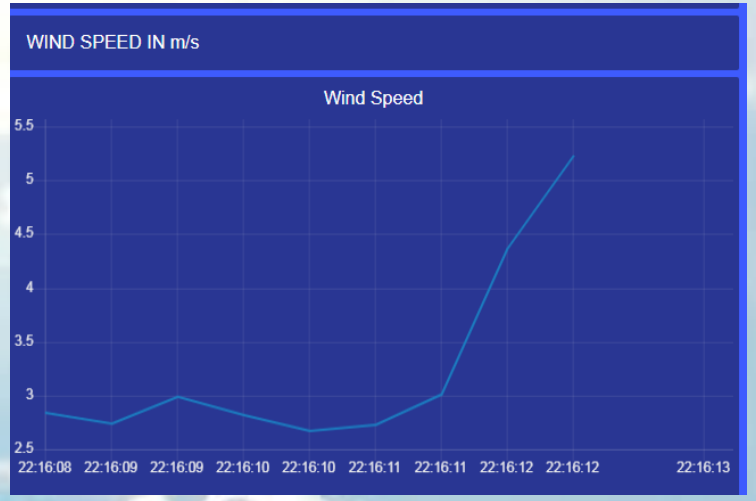
LITERATUER REVIEW:-

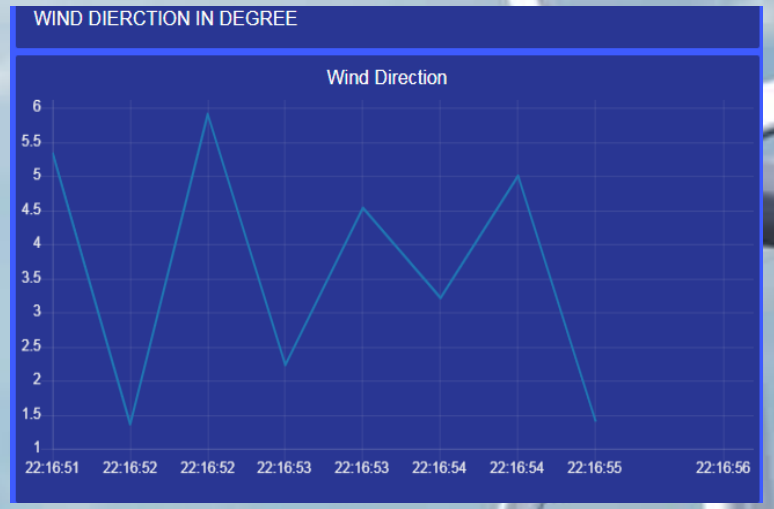
Article A New Hybrid Approach to Forecast Wind Power for Large Scale Wind Turbine Data Using Deep Learning with TensorFlow Framework and Principal Component Analysis.

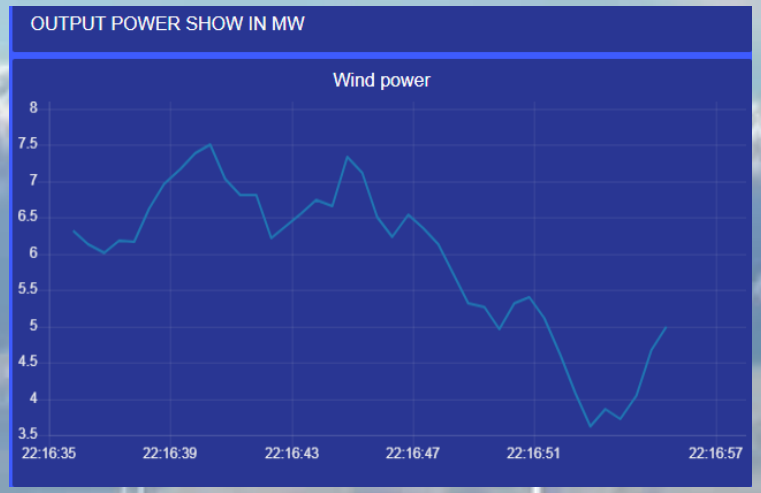
- Mansoor Khan , Tianqi Liu ,* and Farhan Ullah

- The principal components are then used as input data to **deep learning** based on the **TensorFlow framework.** PCA provides feature extraction and selection.
- Here, acc, val_loss, val_acc represents **accuracy, validation loss** and **validation accuracy**, respectively. The loss, accuracy and loss, and validation loss are calculated for wind power forecasting.
- The proposed deep learning algorithm is applied to PCs **to forecast wind** power. The **Keras** API is used with TensorFlow to configure a more reliable **neural network.**

Forecasting output







Work Process

- IBM Account Creation.
  - Smart Internz assigning template.
  - Assigning team.
- Fetching Input.
- Selection of algorithm.
- Date preparation.
- Deploying Model.
- GUI creation.

Fetching Input:-

- Collecting of data from various website.
  - **Kaggle-**https://www.kaggle.com/berkerisen/wind-turbine-scada-dataset
  - **Github-**https://github.com/ShashwatArghode/Wind-Energy-Prediction-using-LSTM/blob/master/AL_WIND_07_12.xlsx
- Importing data in watson studion in a click.

```
In [10]: import types
import pandas as pd
from botocore.client import Config
import ibm_boto3

def __iter__(self): return 0

# @hidden_cell
# The following code accesses a file in your IBM Cloud Object Storage. It includes your credentials.
# You might want to remove those credentials before you share the notebook.
client_64c85547f35d43b5b41b68c871da81d6 = ibm_boto3.client(service_name='s3',
    ibm_api_key_id='HcWLNSvsllJ6yiZ0P9bQiEHBvJ5Ty-JY0OoShzpA1Fll',
    ibm_auth_endpoint="https://iam.cloud.ibm.com/oidc/token",
    config=Config(signature_version='oauth'),
    endpoint_url='https://s3.eu-geo.objectstorage.service.networklayer.com')

body = client_64c85547f35d43b5b41b68c871da81d6.get_object(Bucket='hanif-donotdelete-pr-nx1leyc1obvpqp',Key='winddirtime.csv')['Body']
# add missing __iter__ method, so pandas accepts body as file-like object
if not hasattr(body, "__iter__"): body.__iter__ = types.MethodType( __iter__, body )

series = pd.read_csv(body,index_col='Date/Time')
series.head()
```

Out[10]:

	Wind Direction (°)
Date/Time	
01 01 2018 00:00	259.994904
01 01 2018 00:10	268.641113
01 01 2018 00:20	272.564789
01 01 2018 00:30	271.258087
01 01 2018 00:40	265.674286

Selection Of Algorithm

- Choosing Best algo . is the main process ever in forecasting.
- Normally algo. Like **SVM, Arima, Auto arima** are used for time series prediction .
- But in this recommendation model we tried **LSTM algo** ,which is one of library of **keras**.
- We have done this forecasting in **three segment**, Wind Speed , Direction, Power.
- Wind Speed and Wind Direction using **lstm** model.
- Power Forescating using **AutoAi**, The facility provied by **our IBM Watson studio**.

Future Engineering

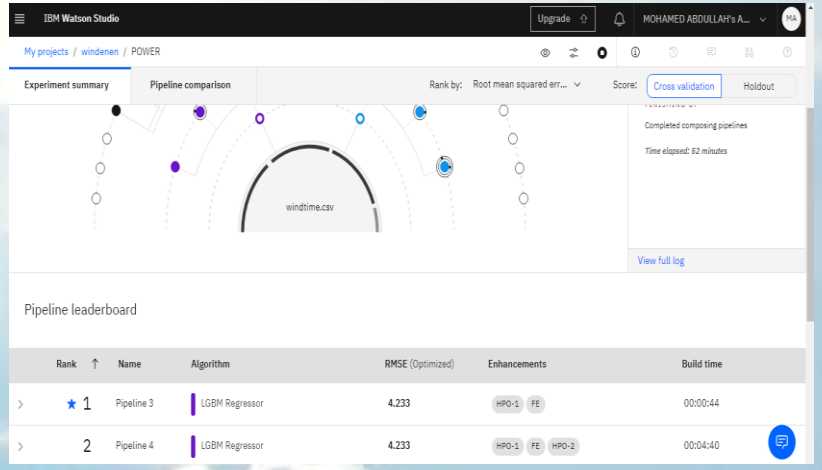
FOR WIND SPEED AND DIRECTION:-

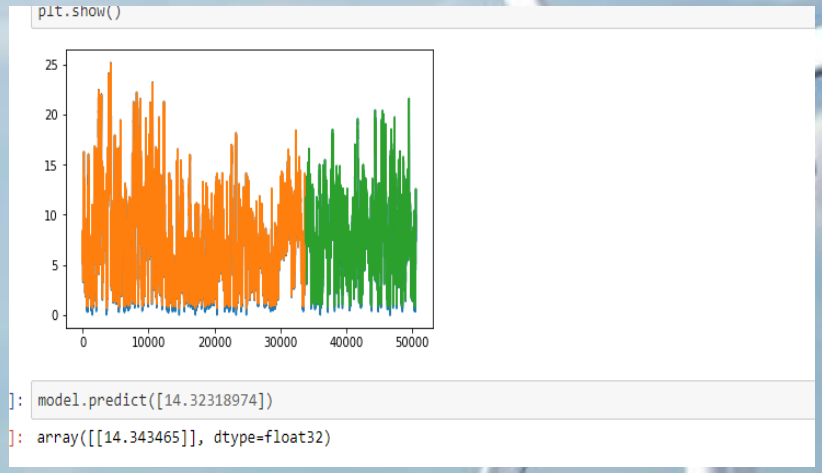
- To fit our model we done some **preprocessing .**
- Split up data into **train** and **test .**
- Converting the data into scalar form , then take difference of past data.
- Setting the epoch ,finding study rate, fix the batch size, selection of neurons and validate.

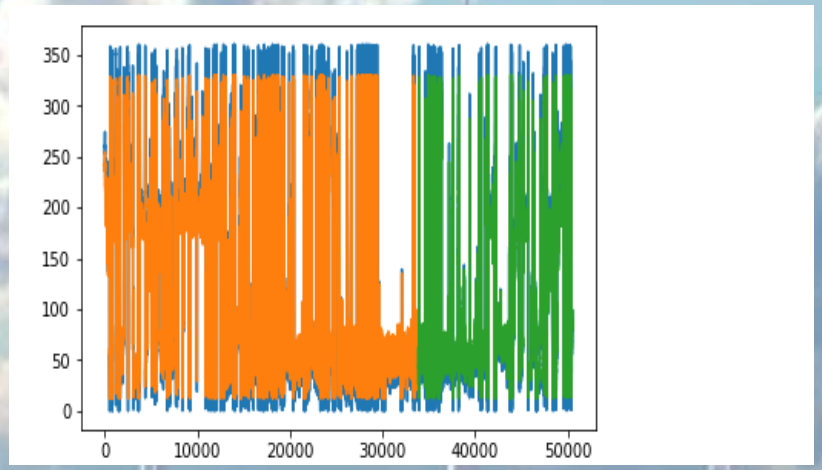
FOR POWER:-

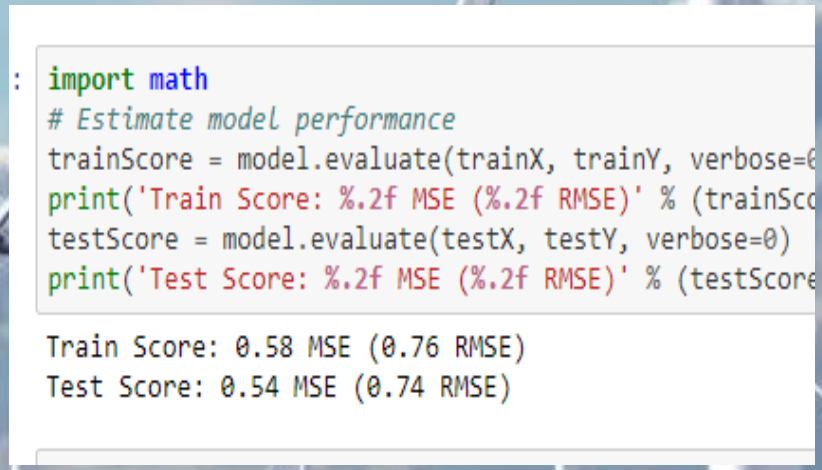
- We done it in **auto AI.**
- For power prediction we give the **input from the ouput** of former prediction.

Validation of our Prediction









Deployment

- **IBM Watson Studio** made Deployment easy in few steps.
- For deployment purpose ,we created a service credentials in **Watson machine learning service.**
- After creating credentials load the model in service provider , We get the guid .

```
from watson_machine_learning_client import WatsonMachineLearningAPIClient
```

```
wml_credentials = {
  "apikey": "mMtFox3bgn8ZwUo8OxuT_7uegZO6HNwmdj55cde-x4Tg",
  "iam_apikey_description": "Auto-generated for key 22942c5d-09db-432c-aaa8-3769965759b9",
  "iam_apikey_name": "Service credentials-2",
  "iam_role_crn": "crn:v1:bluemix:public:iam::::serviceRole:Writer",
  "iam_serviceid_crn": "crn:v1:bluemix:public:iam-identity::a/1af47d91ccdc47489f9955bf340a1583::serviceid:ServiceId-a1a64fbd-7e6c-4f1b-9e
25-799208ee5c1a",
  "instance_id": "fdc0cfe6-e3a5-4958-af00-d1453d727e98",
  "url": "https://eu-gb.ml.cloud.ibm.com"
}
```

```
client = WatsonMachineLearningAPIClient(wml_credentials)
```

```
metadata = {
        client.repository.ModelMetaNames.AUTHOR_NAME: 'Mohamed Abdullah',
        client.repository.ModelMetaNames.AUTHOR_EMAIL: 'abdullahmohamed2540@gmail.com',
        client.repository.ModelMetaNames.NAME: 'Prediction of Wind Direction',
        client.repository.ModelMetaNames.FRAMEWORK_NAME: 'tensorflow',
        client.repository.ModelMetaNames.FRAMEWORK_VERSION: '1.15',
        client.repository.ModelMetaNames.FRAMEWORK_LIBRARIES:[{'name':'keras', 'version':'2.2.4'}]
}
```

```
model_result_path = 'direction_prediction.h5'
lstm_model.save(model_result_path)
```

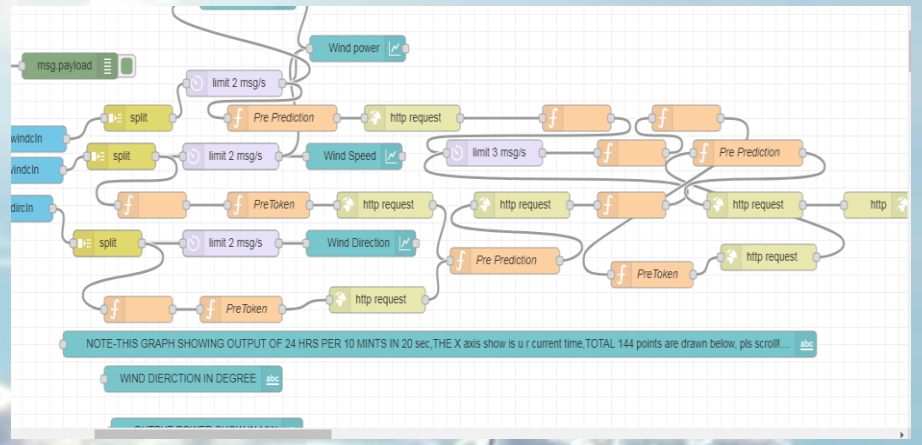
```
!tar -zcvf direction_prediction.tgz direction_prediction.h5
```

```
direction_prediction.h5
```

```
stored_data = client.repository.store_model(model='direction_prediction.tgz' ,meta_props=metadata, training_data =X, training_target=y)
```

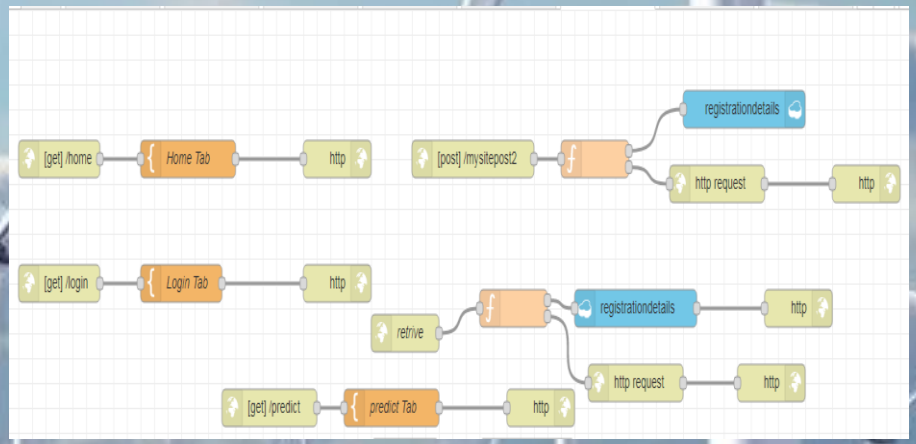
GUI Creation

For Creating **GUI** We used **Node-red** ,available in Our **IBM** .

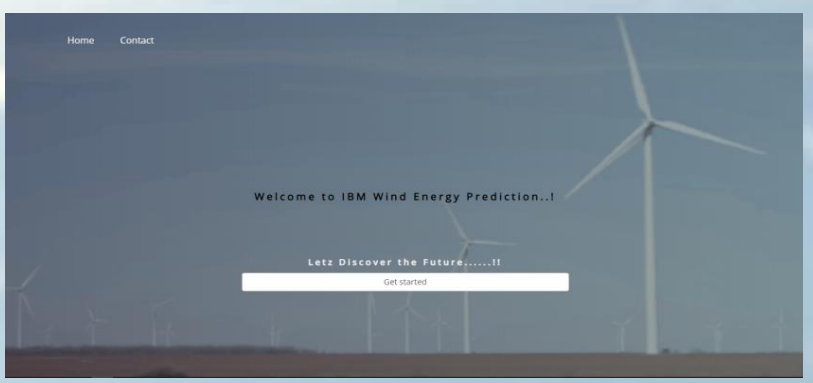


Prediction Flow

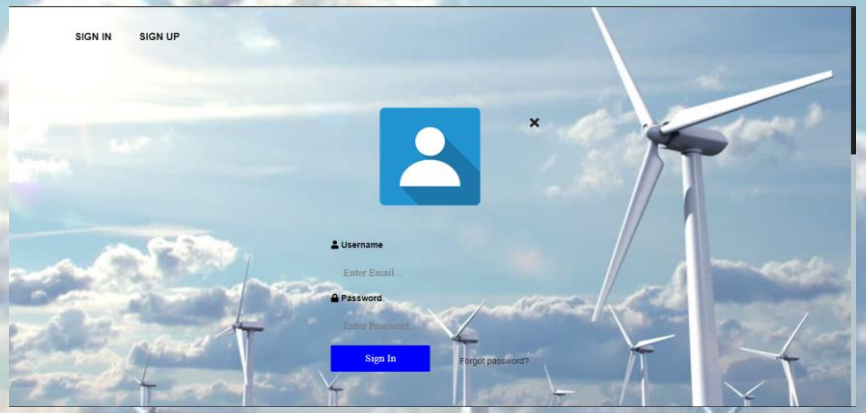
Main Flow



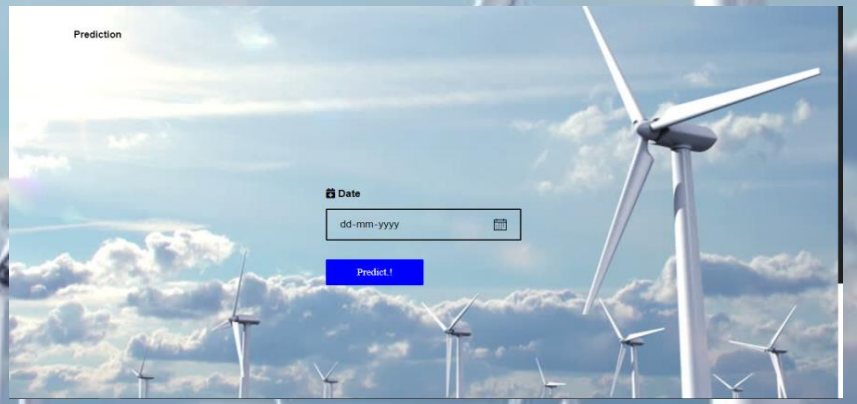
Our GUI With IBM



Home Tab



Log-In Tab



Prediction Tab

HIGHLIGHT'S

- We Predicting **Wind Speed , Wind Direction** In **separate algo.**, and giving the **output of this prediction** to predict **power**, however real time scenario happens like this.
- So our model should be best to **competitive with real time.**
- It can also **recommend** the time to **Utilize Power from grid**.
- So that we can give **rest period** to grid and **Save Energy** .

SPECIAL THANKS TO:-

- IBM Platform And Crew
- SMARTINTERNZ

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