IBM Hack Challenge 2020

Wind Turbine Active Power Forecasting

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Project Id: SPS_PRO_870
Application Id: SPS_CH_APL_20200002376

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Problem Statement

- To Produce Accurate predictions of energy output from a wind farm based on the wind conditions at its surrounding .
- Next 72 hrs Prediction at time interval of 1 hr.
- Build an application to recommend the Power Grid to suggest the best time to utilize the energy from wind farm

Introduction

About The Project

- Wind power generation is the next big thing. To make it a reality we have to establish the reliability
- We have developed an application which can forecast the wind power of the future leveraging AI tools and powerful visualizations.
- This will enable the government and concerned parties to cut down on costs and collaborate on different energy sources efficiently,

Technology Stack

Tools & Frameworks

Python 3.8
FLASK
Plotly, Dash
Bootstrap
HTML
CSS

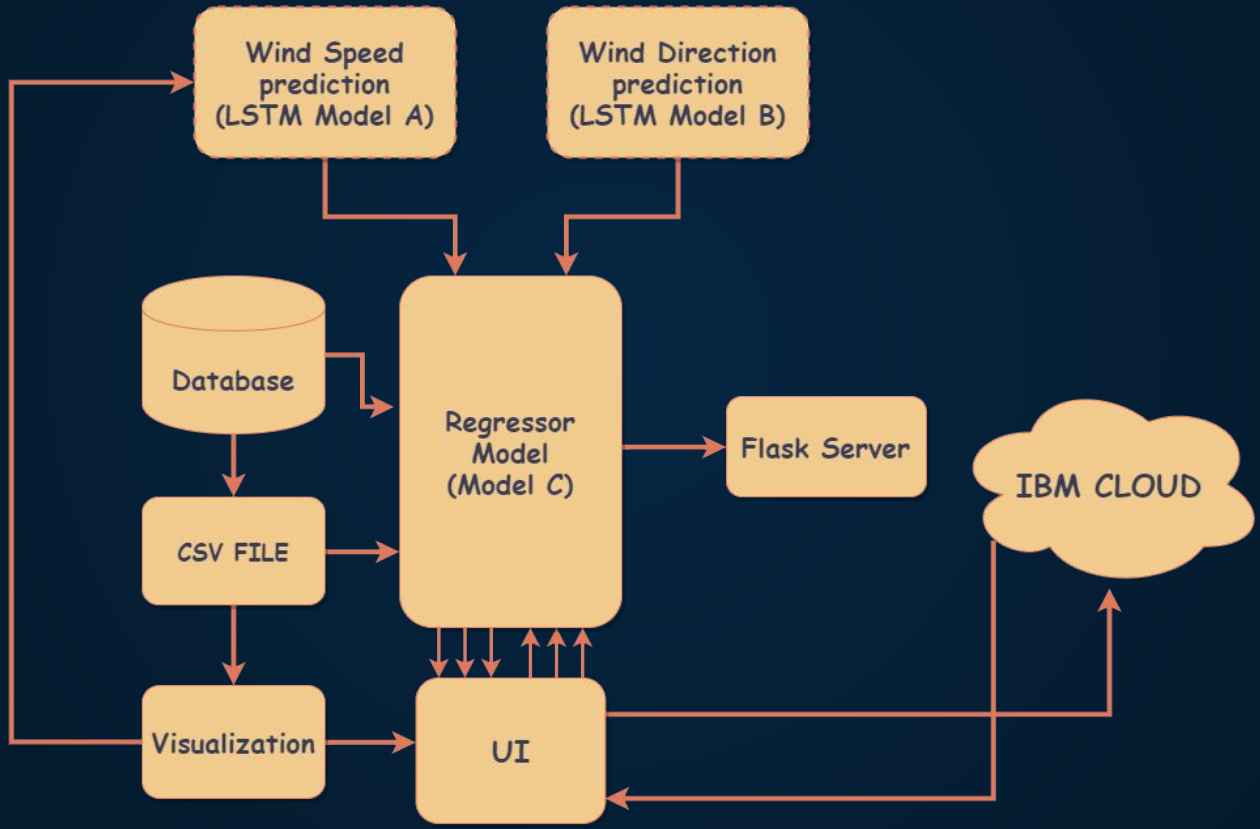
Algos for Model Building

LSTM
ARIMA
SARIMAX
XG Boost
Random Forest

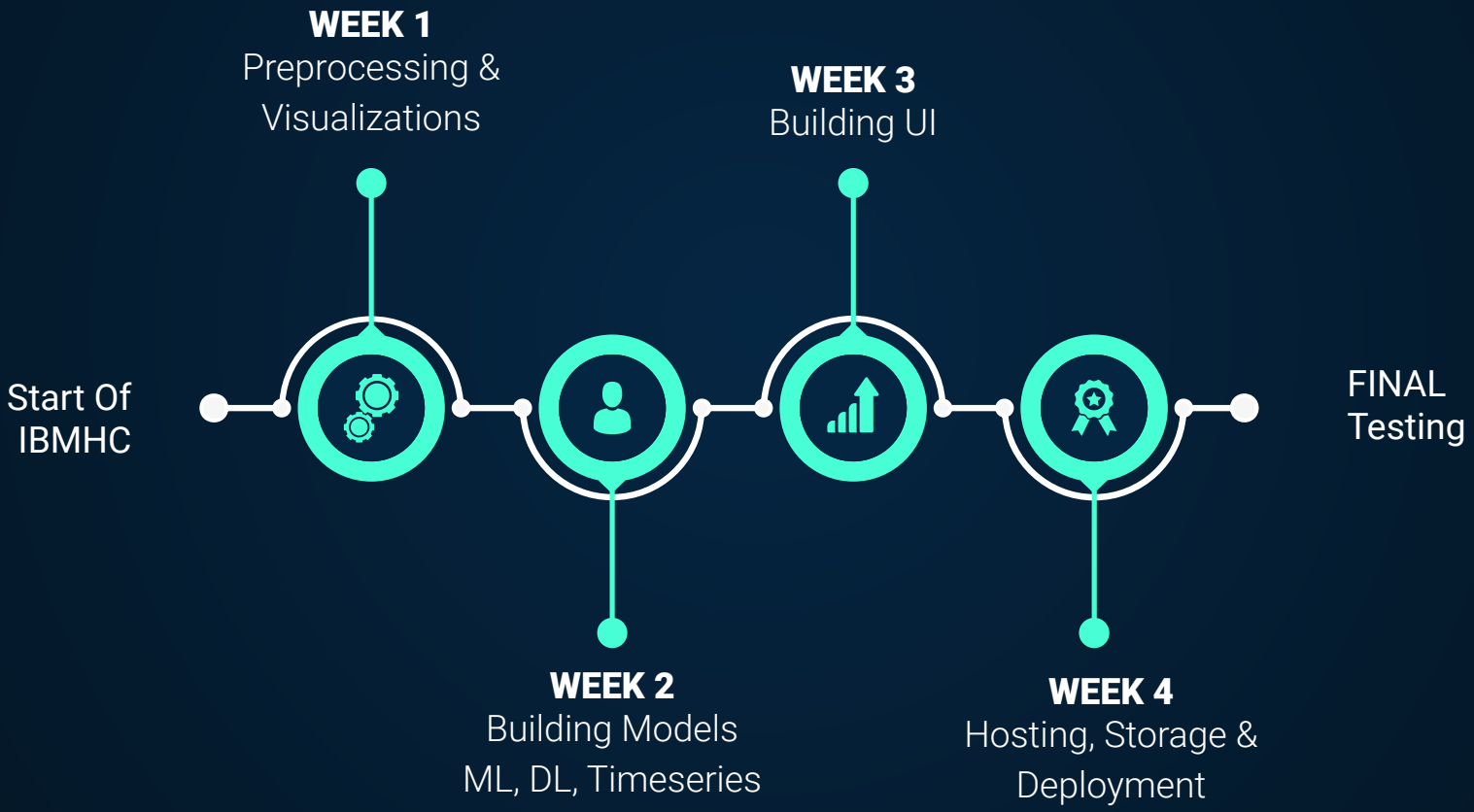
Hosting & Deployment

IBM Cloud
BlueMix
Heroku

Flow Chart


Wind Speed prediction (LSTM Model A)
Wind Direction prediction (LSTM Model B)
Database
CSV FILE
Regressor Model (Model C)
Flask Server
IBM CLOUD
Visualization
UI

OUR TIMELINE



Exploratory data analysis - EDA

- Found that our Primary Dataset from Kaggle had 3 Independent variables Wind Speed, Wind Direction, Theoretical Power
- Theoretical power was the least important logically, Wind Speed the most affecting as it seems it is directly proportional.
- There were 3 data ranges missing from the data set

  2018-01-26 06:20:00 to 2018-01-30 14:40:00, 2018-09-28 21:20:00 to 2018-10-02 16:30:00, 2018-11-10 21:10:00 to 2018-11-14 12:00:00
- Training had to be done on the hourly based data points.

Forecasting Power Output (ARIMA)

- ARMA
- ARIMA
- SARIMAX

Forecasting Models

- Basic ML models are used in Regression & Classification Problems but it can't predict future values so We use forecasting models for such scenarios.

- Important Models
  - ARMA - Auto Regressive Moving Average
  - ARIMA - Auto Regressive Integrated Moving Average
  - SARIMAX - Seasonal Autoregressive Integrated Moving Average

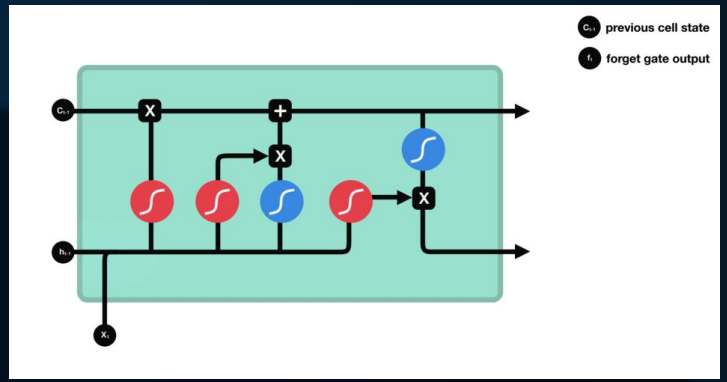
- Problems in the Statsmodels Library which was causing issues while predicting

LSTM Model

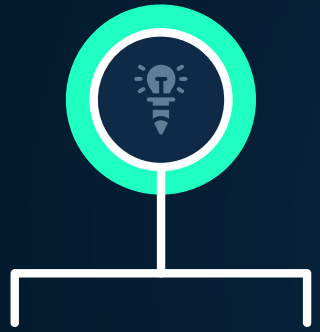
- Recurrent neural networks are networks with loops in them, allowing information to persist.

- The very same reason why we have used this model to predict the wind speed and wind direction output.

- Model A (Wind Speed) and Model B (Wind Direction) is evaluated by LSTM model.



ML Models



Support Vector Machine

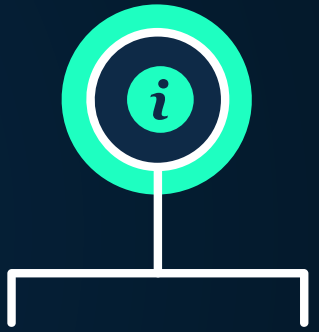
R2 Score: 88.9%

Linear Regression

R2 Score: 81.8%

Random Forest

R2 Score: 82%



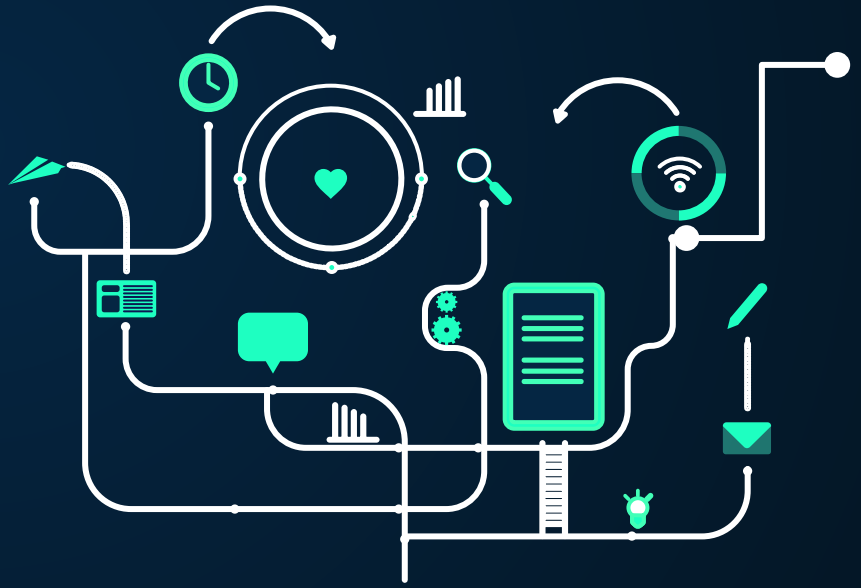
XG Boost

R2 Score: 89%

Ensemble ML Model

Voting Regressor

- A Voting Regressor is an ensemble meta-estimator.
- Improves Prediction Results Extensively.
- R2 Score of 90%



Voting Regressor

- SVM
- Random Forest
- XG Boost
- Linear Regression

User Interface (Web - App)

Predictions with proper alert system to recommend max output

Date Based

Visualizations for Specific date

Organised and Structured format

Visualizations & Predictions

Range Based

Range Based Insights

In hierarchical and with exact direction

FutureScope

ROBUST

The robustness of our model can be increased by making predictions for a longer time-period.

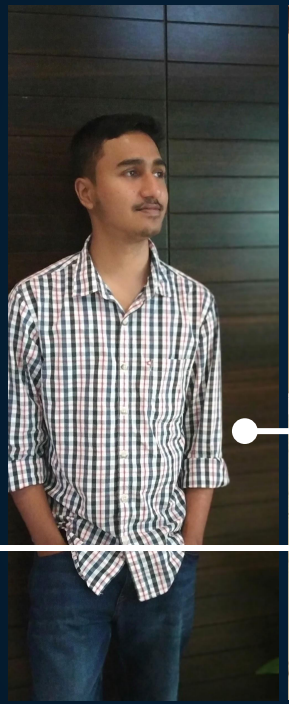
More Features

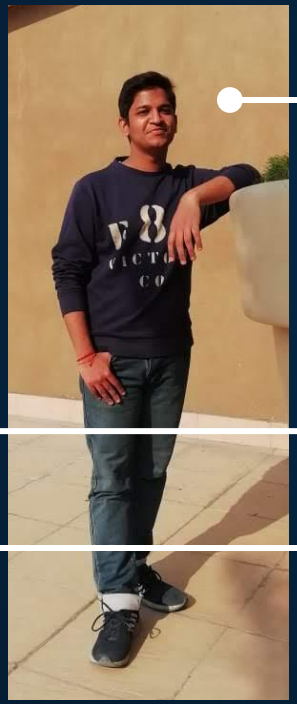
Considering other features like humidity and temperature to enhance the results.

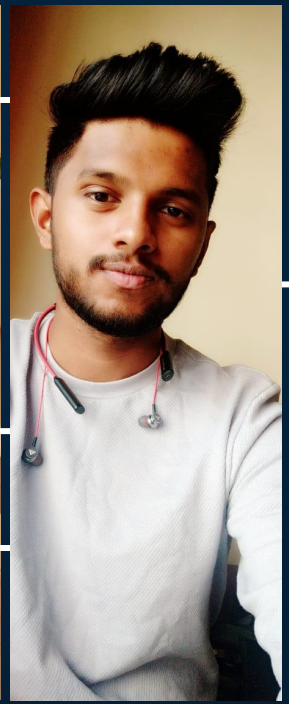
FUNCTIONALITY

Our model can be scaled to be used by governments by training our model with their data with better enhancements.

THE TEAM







Tarun Agarwal

A django developer with 3 years of experience. He is instrumental in designing the visualisation and UI for our application

Noel Jaymon

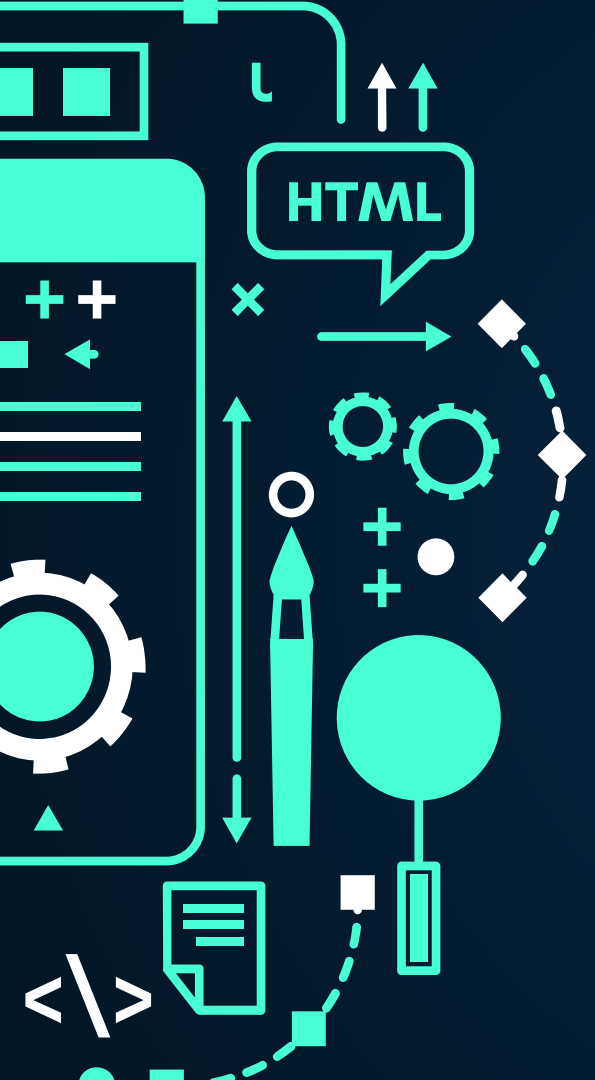
2+ years of Experience in the field of ML. His proficiency was key in the development of ML Models

Benjamin

Highly Skilled in the field of DL. Developed 2 LSTM models which is the heart of the project.

Aditya Mahajan

Full Stack developer with 3+ years of experience and 6+ projects in AI and ML



THANKS!

Does anyone have any question?

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