Univariate
Time Series Analysis for
Weather Prediction using
Prophet library

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1. INTRODUCTION

1.1 OVERVIEW

Weather forecasting is the application of science and technology to predict the conditions of the atmosphere for a given location and time. People have attempted to predict the weather informally for millennia and formally since the 19th century.
Once calculated by hand based mainly upon changes in barometric pressure, current weather conditions, and sky condition or cloud cover, weather forecasting now relies on computer-based models that take many atmospheric factors into account. Human input is still required to pick the best possible forecast model to base the forecast upon, which involves pattern recognition skills, teleconnections, knowledge of model performance, and knowledge of model biases. The inaccuracy of forecasting is due to the chaotic nature of the atmosphere, the massive computational power required to solve the equations that describe the atmosphere, the error involved in measuring the initial conditions, and an incomplete understanding of atmospheric processes.

1.2 PURPOSE

The main idea of this project is to create an application for forecasting the weather by using the fbprophet library. The Prophet library is an open-source library designed for making forecasts for univariate time series datasets. It is easy to use and designed to automatically find a good set of hyperparameters for the model in an effort to make skillful forecasts for data with trends and seasonal structure by default.

2. LITERARY SURVEY ABOUT PROPHET LIBRARY

Prophet or "Facebook Prophet," is an open-source library for univariate (one variable) time series forecasting developed by Facebook. Prophet implements what they refer to as an additive time series forecasting model, and the implementation supports trends, seasonality, and holidays. It implements a procedure for forecasting time series data based on an additive model where non-linear trends are fit with yearly, weekly, and daily seasonality, plus holiday effects. It is designed to be easy and completely automatic, e.g. point it at a time series and get a forecast. As such, it is intended for internal company use, such as forecasting sales, capacity, etc.

3. THEORETICAL ANALYSIS

3.1 BLOCK DIAGRAM
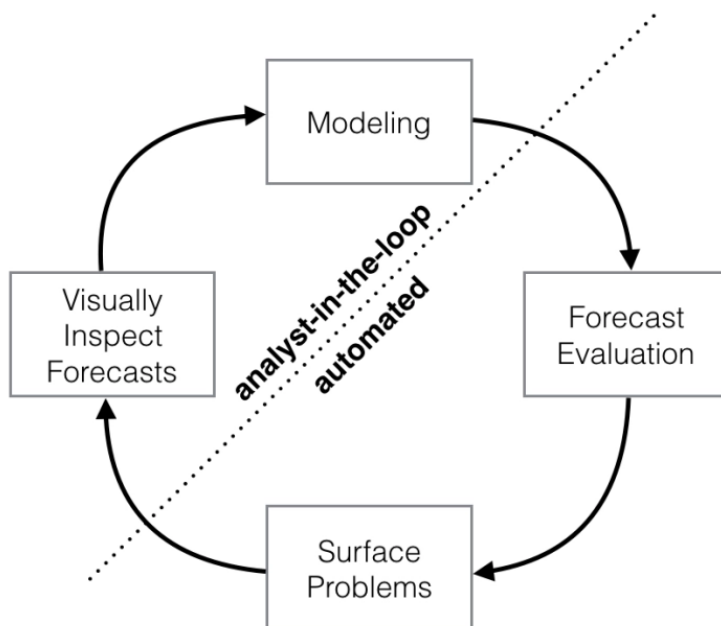
3.2 HARDWARE/ SOFTWARE DESIGNING

The model is designed using jupyter notebook in Anaconda which is a open source distribution of Python and R programming languages for scientific computing, that aims to simplify package management and deployment.The application building is done using flask which is a web framework that provides tools, libraries and technologies that allow the developer to build a web application. This web application can be some web pages, a blog, a wiki or go as big as a web-based calendar application or a commercial website. The library provides two interfaces, including R and Python. We will focus on the Python interface for this project.

4. FLOWCHART
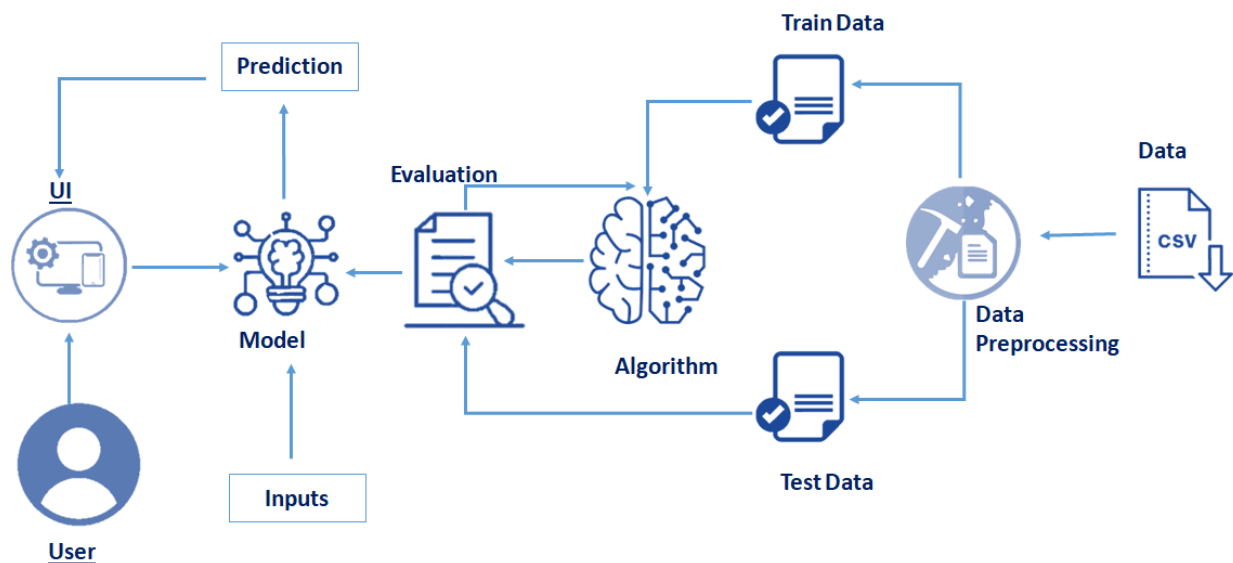
5. WHERE PROPHET SHINES

Not all forecasting problems can be solved by the same procedure. Prophet is optimized for the business forecast tasks we have encountered at Facebook, which typically have any of the following characteristics:

- hourly, daily, or weekly observations with at least a few months (preferably a year) of history
- strong multiple "human-scale" seasonalities: day of week and time of year
- important holidays that occur at irregular intervals that are known in advance (e.g. the Super Bowl)
- a reasonable number of missing observations or large outliers
- historical trend changes, for instance due to product launches or logging changes
- trends that are non-linear growth curves, where a trend hits a natural limit or saturates

6. RESULTS

The model can give us the temperature of a day in celcius from the year 1996 to 2017. User interacts with the UI (User Interface) i.e the website built using flask to give the date as input. The date is analyzed by the model which is then integrated.
Once model analyses the uploaded date, the prediction i.e the temperature in degree celcius is showcased on the UI.

7. ADVANTAGES AND DISADVANTAGES

7.1 ADVANTAGES

- Using this model we can predict the future weather conditions.
- Prophet makes it much more straightforward to create a reasonable, accurate forecast.
- Prophet forecasts are customizable in ways that are intuitive to non-experts.
- It is a simple model i.e easy to build, test and understand.
- It is useful for making analysis of the future based on the past available data.

7.2 DISADVANTAGES

- This model is not comprehenesive. A univariate model is less comprehensive than a multivariate model.
- It cannot establish relationships between different factors as only one variable can be changed at a time.

8. APPLICATIONS

- This model is used to predict the weather conditions of a day in the near future.
- Severe weather alerts and advisories
- **Air Traffic**

Because the aviation industry is especially sensitive to the weather, accurate weather forecasting is essential considering the fact that a greater number of plane crashes recorded the world over have weather related causes.

- **Marine**

Commercial and recreational use of waterways can be limited significantly by wind direction and speed, wave periodicity and heights, tides, and precipitation. T

- **Agriculture**

Farmers rely on weather forecasts to decide what work to do on any particular day.

- **Utility companies**

Electricity and gas companies rely on weather forecasts to anticipate demand, which can be strongly affected by the weather.

9. CONCLUSION

This model is one of the very interesting examples where the facebook prophet library can be used to solve a challenging real-world problem. If we are able to predict the future weather conditions, it would be of great help for air traffic control, for farmers, for marine, military,etc . It could bring a whole new dimension of in real-time.At the same time,this can also reduce the accidents in the future.

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