

Time Series Prediction Grounded on Neural Prophet- Temperature Forecasting

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Abstract—Temperature determining is a moderate and time series investigation cycle to estimate the condition of the temperature for a specific area in coming time. These days, agribusiness and assembling areas are for the most part reliant upon temperature so determining is essential to be exact in light of the fact that temperature admonitions can save life and property. In this work, the Prophet Forecasting Model is utilized for Myitkyina's yearly temperature estimating utilizing authentic (2010 to 2017) time series information. Myitkyina is the capital city of the northernmost state (Kachin) in Myanmar, found 1480 kilometres from Yangon. Prophet is a particular relapse model for time series forecasts with high precision by utilizing basic interpretable boundaries that think about the impact of custom irregularity and occasions. In this review, the temperature estimating model is proposed by utilizing climate dataset given by an International foundation, National Oceanic and Atmospheric Administration (NOAA). This work executes the multi-step univariate time series expectation model and analyses the anticipated worth against the real information. Such discoveries check that the proposed anticipating model gives an effective and exact expectation for temperature in Myitkyina.

Keywords — National Oceanic and Atmospheric Administration; Forecasting Model; Time Series; Myitkyina; Neural Prophet Model.

1. Introduction

A period series is an assortment of information focuses fixed on schedule. Time series examination is applied to investigate these time series information by consolidating various techniques to get significant data. The estimating of the time series information is a system which can assist the model with anticipating future qualities utilizing recently noticed notable qualities [1]. These days, there are significant time series issue to be addressed, for example, how much stock to keep up with, the number of individuals will go by a plane, how high the temperature will be in the following month, how much the cost of a tradable monetary resource will be close to tomorrow. For these issues, each datum researcher should know the methods for time series foreseeing. In this way, time based examples information is vital for any areas. For an association, Forecasting is a significant information science task expected for some exercises to be completed. For weather conditions determining, there are numerous different strategies accessible and numerous specialists are keen on this due to its effect on living things [2]. Subsequently, this paper expects to apply time series examination for temperature gauging of a city.

In such examination of time series determining, two central matters have been seen in anticipating: (1) Complete robotized gauging strategies can be testing and too unbendable to even consider carrying out valuable suspicions. (2) Due to the prerequisite of huge involvement with information science ability, investigators can't in any

case gauge in great. There exists very much a wide range of ways of determining future patterns, for example, ARCH, ARIMA, counterfeit neural organizations, backward models,. Among them, the Prophet gauging model is utilized in this work to anticipate the temperature of Myitkyina, Myanmar by managing the normal highlights of the climate information. For gauging time series information, a publicly released Prophet is a model delivered by Facebook on 23 February 2017 [3]. In this work, the proposed temperature forecast framework is assembled and it will give the future temperature worth to a city. In this way, it might give meteorologists in anticipating the future temperature esteem rapidly and honestly. The excess piece of this paper is coordinated in the accompanying manner. Segment 2 tends to prior temperature forecast frameworks with different learning calculations recently acted in writing. The main segment 3 blueprints the proposed work of utilizing Facebook Prophet to fabricate a compelling temperature determining strategy, clarifies the particulars of the time series based temperature anticipating method and shows the outcomes for tests by plotting the presentation of the proposed framework, then, at that point, the paper wraps up in Section 4.

2. Literature Review

2.1 Time Series Prediction

Fundamentally, the prediction objective of a time series is to estimate the value at time i , y_i based on its previous historic data y_{i-1}, y_{i-2}, \dots . If the interested data is x

$= \{ y_{i-k}, y_{i-k+1}, \dots, y_{i-1} \}$, $i = \{ k, \dots, n \}$, the goal aims at finding a function $f(x)$ so that $\hat{y} = f(x)$ is as close to the ground truth y_i as possible. Some methods are one-step univariate forecasting, multi-step or sequence forecasting and multivariate forecasting, among them, the multi-step univariate is applied in the proposed system. Multivariate forecasting observes various measurements and predicts one or more of them. Time series forecasting is acceptable considering the nature of weather data, since temperature forecasting is temporary and time series operation.

2.2 Related Work

In nowadays, numerous past examinations have been performed on foreseeing temperature. A portion of those are portrayed underneath. Shaminder Singh, Pankaj Bhambri and Jasmeen Gill [4] carried out a period series subordinate temperature expectation model by consolidating back spread with the hereditary calculation that takes different populace sizes. A sliding window of size 5 is utilized to get the moving normal from the full dataset. From that point forward, the reliant boundaries are obtained and taken care of into the framework as a contribution for the organization preparing. An underlying populace of chromosomes is additionally produced haphazardly in network preparing, and the loads are separated from every chromosome. Dr. S. Santhosh Baboo and I.Kadar Shereef [5] depicted Back Propagation Neural organization based calculation for foreseeing the temperature. That proposed model can catch the complicated connections between numerous reliant variables that proposal to guaranteed temperature. It is affirmed with the ongoing dataset and contrasted and really working of meteorological division.

Kuldeep Goswami and Arnab N. Patowary [6] fostered a Seasonal Autoregressive Integrated Moving Average (SARIMA) model to gauge temperature on month to month and occasional time scale. The examination utilized long haul temperature information of Dibrugarh, Assam for the time of fifty years (1966-2015). In the investigation, an occasional ARIMA model for month to month least temperature information and an occasional ARIMA model for month to month most extreme temperature information are created. To break down the month to month records of outright surface temperature, an important natural boundary, a summed up, underlying, time series demonstrating framework was created utilizing a deterministic consolidated stochastic (DSC) strategy by YE Liming and YANG Guixia [7]. In spite of the fact that their framework improvement was centered on describing the variety examples of a worldwide dataset, the approach could be applied to any outright month to month temperature record. Y.Radhika and M.Shashi apply Support Vector Machines (SVMs) to anticipate the following day's greatest

temperature for a given area in light of time series information [8].

3. Prediction Model

The proposed temperature expectation framework is to assist meteorologist with bettering appraisal climate in future for a particular area. Despite the fact that such countless various types of time-series exist, Facebook prophet is utilized for this work. This is a Facebook library which works amazing on the grounds that more measurements expanding the exactness of the models are incorporated.

3.1 Multi-step Forecasting Model

The fundamental reason for the genuine determining issues is to anticipate an intrigued information esteem ahead on schedule and a few information values in a specific time figure skyline k . The gauge skyline k is the area of time later on and expected qualities for that ought to be ready. This strategy for anticipating is called multi-step determining, which can be applied utilizing two unique methods, except if the estimate skyline is one:

- The immediate system: the model is prepared unequivocally to anticipate around a few strides ahead
- The iterative technique: emphasizes expectations up to the ideal skyline by doing rehashed one-venture forecasts

In this work, the immediate procedure is utilized for the multistep univariate anticipating model.

3.2 Multi-step Forecasting Model

As a classical time series, the next following set of data members are expected to draw only on a certain number of their immediate predecessors. Univariate forecasting problem is the forecasting problem which is comprised of one single series. When the historical data for some time series is presented as $x_0, x_1, x_2, \dots, x_{n-1}, x_n$. As there is some functional dependency between historical and future time series data points, the required forecasted value $x_{n,+1}, x_{n,+2}, \dots, x_{n,+k-1}, x_{n,+k}$ for the k forecast horizon is a function of the previous n data points. Therefore, this dependency can be described in the following: $x_{n,+1}, x_{n,+2}, \dots, x_{n,+k-1}, x_{n,+k} = f(x_0, x_1, x_2, \dots, x_{n-1}, x_n)$ might be a machine learning method. And, as a prediction model, Facebook Prophet Model is used for this work.

3.3 Neural Prophet Model

Prophet has key components: trends $g(t)$, seasonality $s(t)$, holidays $h(t)$. They are composed as

$y(t)=g(t)+s(t)+h(t)+\epsilon(t)$, where $\epsilon(t)$ is error term. There are a variety of functional benefits of this approach. Due to weekly and annual seasonality, the seasonal component $s(t)$ provides a flexible model of periodic changes. The $h(t)$ portion reflects predictable annual abnormal days including those on irregular schedules. The error term, $\epsilon(t)$ reflects information not expressed in the model. It is typically modelled as normally distributed noise [2].

3.4 Methodology

The proposed model gathers time series climate information and chooses the climate boundaries to be anticipated by extricating the connection between the different climate boundaries. Missing information for certain, sections are supplanted as a zero worth. From the information, preparing informational index which contains information sources and results and test informational index with just information sources are made. To become familiar with the notable information of the city weather patterns and to foresee the future temperature esteem, the Prophet model is utilized.

Prophet model has an extraordinary dealing with power for nonexperience information researcher to conjecture in their practices. This model help information outline with just two segments which are ds for date time and year for values and should be numeric and this is the anticipating to get. Subsequent to setting up the crude information for the model, the learning model is prepared with the chronicled information. Because of the intricacy of values, it is need to simplify it utilizing log capacity and dramatic capacity to invert it to its generally expected state. Along these lines, prophet style of ds and y highlights terminology should be complied. The center piece of the model is making another information edge to save new anticipated qualities and foreseeing the objective qualities. From that point forward, this work is approved by the genuine information.

Table 1. The collected average temperature

DATE	TAVG	TMAX	TMIN
1/1/2010	69		50
1/2/2010	67		
1/3/2010	60	81	46
1/4/2010	62	81	45
1/6/2010	65		49
1/7/2010	66	85	48
1/8/2010	63		48
1/9/2010	65		47
1/10/2010	70	83	

3.4.1 Data Collection and Preprocessing

The initial stages of the prediction model are data collection and preprocessing. Since only valid data generates accurate performance, the main stage is preprocessing the data. Daily average temperature in degree Fahrenheit ranging from January, 2010 till December, 2017 is accessed from the above stated weather stations. One problem that needed to be resolved with the time series datasets was the missing data. Therefore, weather station with the least amount of missing data was selected for this work. For this work, the 8 years average temperature data of Myintkyina, Myanmar from NOAA is used. The collected weather data is noisy data with few missing values and it is essential to handle these data. In the preprocessing stage of the data, every lost value is changed with 0. After that, data is ready for learning as listed in TABLE 1 which shows some data of the weather station at Latitude 25.3946° N, 97.3841° E. The collected average temperature and time stamps are used for the prediction model.

3.4.2 Experimental Results

The forecasting model is trained using the daily weather data of the years 2010-2017 and it forecasts the average temperature of one thousand days in next three years. Figure 2 indicates the predicted temperature value. To describe the prediction accuracy of the model, two plots are compared in Figure 3. These graphs are compared the real values and predicted values. In left plot, 2010 and 2011 for next 2 years is predicted. By comparing the predicted data (left plot) and real data for 2010 to 2013 (right plot), it can be clearly seen that the proposed temperature prediction model has the high accuracy. Both the predicted value and the actual temperature value are compared on a graph in Figure 4 to see the variance value and the accuracy can be seen significantly in the last two years period. As the measurement of the prediction accuracy of the model, the Root Mean Square Error (RMSE) has been at 5.7573 for 2012 and 2013 years.

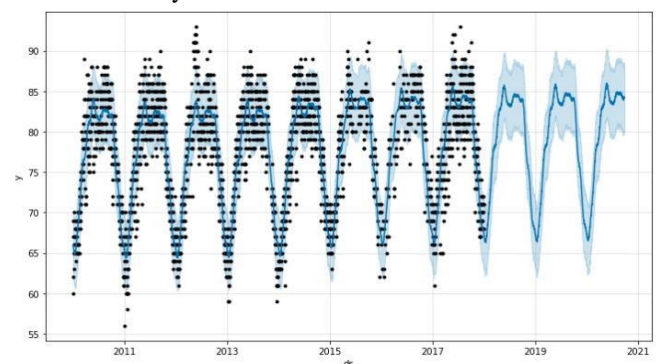


Fig. 1: The predicted average temperature value (20182020)

4. Conclusion

In this work, univariate time series expectation is made to gauge the temperature by learning the noteworthy information which is inputted to the forecast model. The outcome with the suitable RMSE has shown solid advantages for weather conditions estimating. Also, the expectation results uncovered that the model is acceptably fitted to the verifiable information. Through the creating of the proposed framework, it is demonstrated; Prophet Model can yield great outcomes for temperature forecast and can be utilized as an option in contrast to regular meteorological strategies.

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