

Predictive Insights for Monthly Property Sales Forecasting: An End-to-End Time Series Forecasting

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Abstract: *In the realm of real estate and urban economics, accurate predictions of property sales can play a pivotal role in informed decision-making and strategic planning. Time series forecasting has emerged as a crucial technique for understanding and predicting temporal trends in various domains. This paper presents an end-to-end data science workflow focused on time series forecasting using the Facebook Prophet framework, with a specific application to predicting total monthly property sales in New York City (NYC) based on historical sales data. The objective of this study is to provide a comprehensive demonstration of how time series forecasting techniques can be employed to gain predictive insights into NYC's dynamic property market. The dataset under investigation encompasses NYC property sales spanning a 13-year period from 2003 to 2015. Each record in the dataset represents a building sold, with attributes encompassing property characteristics, location, transaction details, and sale dates. Leveraging this rich dataset, the proposed workflow follows a systematic approach: Firstly, the data is loaded and processed, ensuring its suitability for time series analysis. Exploratory data analysis (EDA) is then conducted to gain a deeper understanding of the data's temporal characteristics and identify potential patterns or anomalies. Following EDA, the study delves into the heart of the analysis by employing the Facebook Prophet framework for time series forecasting. Prophet's capability to handle missing values, outliers, and various seasonal patterns makes it a compelling choice. The model's architecture consists of three key components: trend, seasonality, and holidays. In the case of property sales forecasting, the focus is on capturing trends and seasonality, with the model's adaptive change point selection providing flexibility to account for shifts in growth rates. For the sake of forecasting accuracy, the data is aggregated on a monthly level. By adopting a piece-wise constant growth rate for the trend and employing Fourier series to model weekly and yearly seasonality, the Prophet framework yields forecasts that capture the underlying dynamics of NYC's property sales market. The results of the time series forecasting experiments are thoroughly analyzed and evaluated. Performance metrics such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and Mean Absolute Percentage Error (MAPE) are used to quantify the accuracy of the predictions. This assessment serves as a critical checkpoint for assessing the model's capability to provide actionable insights for property sales forecasts. In conclusion, this paper demonstrates the efficacy of an end-to-end data science workflow for time series forecasting using Facebook Prophet, applied to the context of predicting monthly property sales in NYC. The methodology outlined herein provides valuable insights for stakeholders in the real estate and urban planning sectors, enabling them to make informed decisions based on accurate predictive models. Moreover, the presented framework offers a foundation for tackling similar forecasting tasks in various domains, such as capacity planning and price forecasting, by leveraging the power of time series analysis and robust forecasting techniques.*

Keywords: Time Series Forecasting, Property Sales Prediction, Facebook Prophet, Data Analysis

REFERENCES

- [1]. Abhishek Varma G V S, Akshay Varma G V N."Dynamic User Routing for Paid and Free Users in Web Applications using Content Delivery Network (CDN)", Volume 11, Issue VII, International Journal for Research in Applied Science and Engineering Technology (IJRASET) Page No: 409-414, ISSN : 2321-9653, www.ijraset.com
- [2]. <https://github.com/varma59/timeseries>
- [3]. PER, ORIGINALRESEARCH PA. "Bat optimization algorithm for wrapper-based feature selection and performance improvement of android malware detection." (2021)..
- [4]. Ramesh, Mr P., and Mr T. Narayan Rao. "The Sensitivity of Service Quality on Customers towards Overall Satisfaction."
- [5]. Delamaire, Linda, Hussein Abdou, and John Pointon. "Credit card fraud and detection techniques: a review." Banks and Bank systems 4.2 (2009): 57-68..