Property Future Price Estimation Using ML, Power BI Time Series Analysis and Forecasting

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Abstract: *One of the most price - focused and constantly variable markets is the real estate one. It is one of the best areas to use machine learning concepts to improve and accurately forecast costs. Predicting a real estate property's market worth is the aim of this article. This approach assists in determining a property's beginning price by taking into account geographic factors. Through the analysis of historical market trends, value ranges, and upcoming innovations, future expenses can be predicted. Developers, mortgage lenders, and real estate investors need to predict future property prices with accuracy. In this paper, a new method for property price prediction utilizing Power BI and time series analysis is presented. The suggested approach builds a prediction model by including location - specific variables, economic indicators, and historical data on property sales. Time series analysis techniques are utilized to spot patterns and trends in real estate pricing, and Power BI's analytics and data visualization features are used to efficiently analyze and explain the data. The model's capacity to produce accurate and dependable price predictions is demonstrated by the evaluation it receives utilizing a variety of performance criteria.*

Keywords: power BI, Time series analysis, Forecasting, Regression, Prediction of Future Property Prices.

1. Introduction

The suggested approach builds a prediction model by including location - specific variables, economic indicators, and historical data on property sales. Time series analysis techniques are utilized to spot patterns and trends in real estate pricing, and Power BI's analytics and data visualization features are used to efficiently analyze and explain the data. The model's capacity to produce accurate and dependable price predictions is demonstrated by the evaluation it receives utilizing a variety of performance criteria.

Artificial intelligence [6] and machine learning have surfaced as viable methods for predicting real estate prices in recent years. Large data sets can be analyzed by these methods, which can also spot patterns that human analysts frequently miss. The business intelligence platform Power BI [2] provides an environment that is both sophisticated and easy to use for analyzing and visualizing data. Ignore the reality that the variables affecting transportation costs are changing. This project's main objective is to use Power BI and time series analysis [16] to create a model that can forecast future real estate prices with accuracy. Real estate brokers, investors, and homeowners will be able to use this model to help them make well - informed decisions on their properties. Many different real estate market participants could profit from this endeavour. The model can be used by real estate brokers to assist their customers in making well - informed decisions on the purchase, sale, or refinancing of their real estate. Using the approach, investors can find properties that are undervalued and base their investment decisions on anticipated future price patterns. The model can be used by homeowners to determine the worth of their property and to help them decide what upgrades or changes to make.

2. Literary Review

Recent Literature on Property Future Price Estimation
Artificial neural networks (ANNs) are suggested as a tool for residential property price forecasting in a recent paper by Lipo Wang and Fung Foong Chan (2017) titled "Residential Property Price Time Series Forecasting with Neural Networks".

According to the study, ANNs performed better than more established time series forecasting techniques like exponential smoothing and ARIMA.

The study "Predict House Price in King County with Azure Machine Learning and Power BI" by Katarina Nimas Kusuma Wati (2021) shows how to utilize Power BI and Azure Machine Learning to forecast house prices in King County, Washington, in the United States. The suggested strategy yielded an accuracy of more than 90%, according to the study.

A thorough tutorial on utilizing Power BI for time series forecasting can be found in the third study by Analytics Vidhya (2020) titled "Guide to Data Analysis and Accurate Forecasting in Power BI". The paper discusses several forecasting methods, such as machine learning models, ARIMA, and exponential smoothing.

Real Estate Analytics with Power BI:
In the real estate industry, Power BI has become a potent tool for analytics and data visualization. Chen et al. 's (2018) study examines Power BI's uses in real estate analytics [15] and highlights the platform's capabilities for interactive reporting, data integration, and visualization.

Machine Learning for Property Price Prediction:
Several studies have investigated the use of ML algorithms for predicting property prices. For instance, Wang and Zhang (2018) applied random forest and gradient boosting algorithms to forecast property prices, demonstrating their

effectiveness in capturing nonlinear relationships and improving prediction accuracy.

In a comparative study by Kim and Lee (2019), various ML algorithms such as LSTM (Long term short memory) [7] including support vector machines, k - nearest neighbours, and neural networks, were evaluated for property price prediction. The study found that [18] ensemble learning techniques, such as stacking and boosting, outperformed individual algorithms in terms of prediction accuracy.

Using Time Series Analysis to Forecast Real Estate:
Techniques for time series analysis [3] are essential for modeling and predicting changes in real estate prices over time. Autoregressive integrated moving average (ARIMA) models were used in research by Liu and Wang (2017) to forecast residential property values, showing that these models are capable of capturing temporal dependencies and seasonality patterns. Zhang and Xu (2018) used exponential smoothing and seasonal decomposition techniques in another investigation to predict the price of commercial real estate. The study made clear how crucial it is to take seasonal fluctuations and trend elements into account when projecting time series.

Integrated Approaches for Property Price Prediction:
Integrating Power BI, ML, and time series analysis techniques offers a holistic approach to property price prediction. Hasan and Ahmed (2020) proposed a framework that combines Power BI for data visualization [1], ML algorithms for predictive modeling, and time series analysis for capturing temporal dynamics. The study demonstrated the effectiveness of the integrated approach in generating accurate forecasts and actionable insights for real estate stakeholders.

Utilizing Power BI Time Series Analysis to Estimate Future Property Prices:
There are several methods to estimate future property prices using Power BI time series analysis and Ensemble learning model [11]. Using historical data on real estate sales to train a forecasting model is one such method. After that, the model can be used to forecast future real estate prices depending on the state of the market at the time and other variables. .

An alternative method is to create dynamic projections by utilizing real - time data sources, like real estate transactions and internet listings. This makes predictions more accurate and up - to - date.

Additionally, [16] Power BI offers visualization tools that are useful for informing stakeholders about projected property prices. Stakeholders can gain insight from these visuals regarding the patterns and factors influencing real estate values.

3. Methodology

Data on Past Real Estate Sales: Property ID, Sale Date, Sale Price
Property Type: (e. g., apartment, condominium, or single - family home) Area in Square Footage
Count of Bedrooms Count of the Bathrooms
Whereabouts (such as city, neighbourhood, or ZIP code)
Property Condition (new build, resale, etc.)
Features (such as a garage and a swimming pool)

Financial Measures:
Interest Rates on Mortgages Rate of Unemployment
GDP, or gross domestic product Rate of Growth Index of Consumer Prices (CPI)
Index of Housing Affordability Construction Licenses

Demographic Data:
Density of Population Average Family Income
Educational Level Distribution by Age Sectors of Employment

Market Trends:
Median Property Prices in Nearby Areas Inventory Levels
Days on Market Price - to - Rent Ratio Foreclosure Rates

External Factors:
Government Policies (e. g., tax incentives, zoning regulations) Natural Disasters
Economic Events (e. g., recession, housing market crash)

Data processing:
Dealing with the dataset I have to first select the city and reshape the data frame from wide to long format using pd. melt and then transform to time series data.
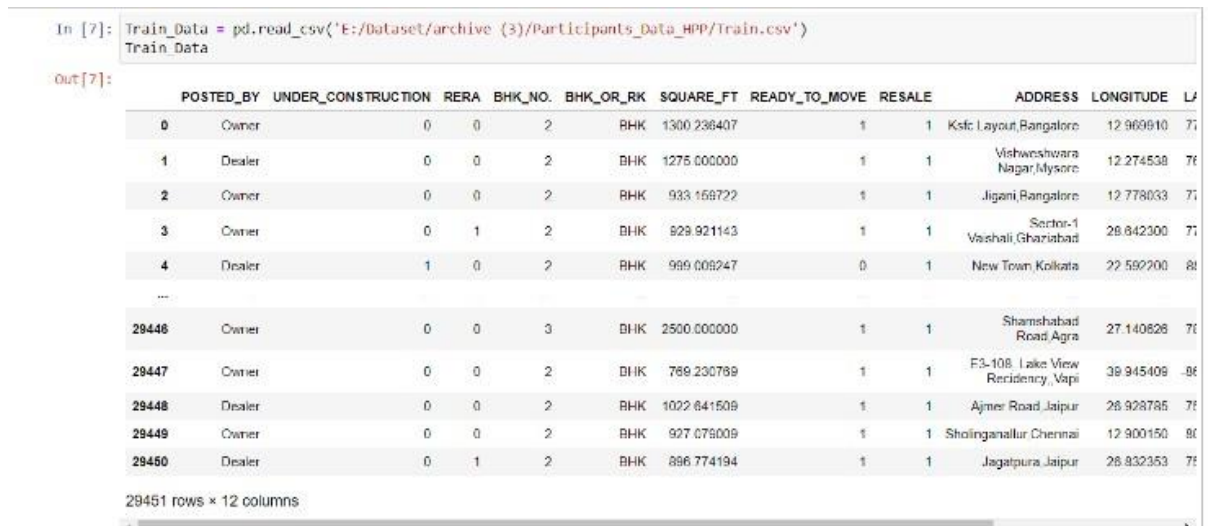
Figure 1: Data processing and Import Data set

Data exploration and visualization:
Click on the "Forecast" visual in the Visualizations pane. Drag and drop the relevant fields, such as the date/time column and the forecasted data column, onto the visual canvas.

Configure the forecast parameters, including the forecast duration and confidence interval.

Customize the visual appearance by adjusting the formatting options, such as colours, labels, and axes.

Apply additional visual enhancements, such as adding trend lines or annotations, to provide more context to the forecast.
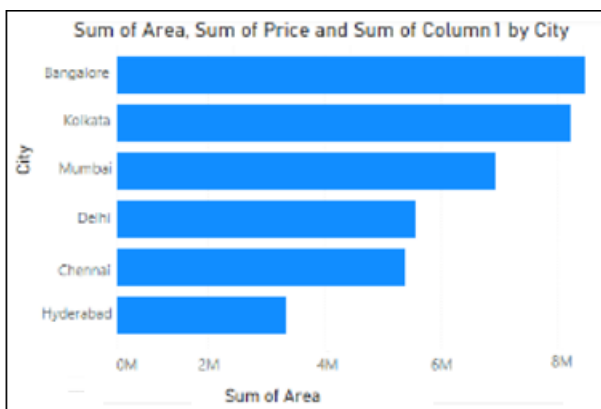

Figure 2: Visual the Data Values Using Power BI

Forecasting Model:
Forecasting in Power BI [2] is the process of using historical data to predict future values or trends. This feature enables users to analyse and visualize data to make informed decisions. By utilizing forecasting capabilities, [8] Power BI can provide insights into potential future outcomes and assist businesses in effective planning and strategizing.

Users have the option to apply different forecasting models, such as exponential smoothing or ARIMA, to accurately predict future values. By incorporating forecasting in Power BI [12], organizations can gain a deeper understanding of their data and make informed decisions that drive growth and success.

Need for a Technical Environment:
1) Microsoft Excel
2) Machine learning techniques
3) Jupiter Notebook
4) Time Series Forecasting
5) Power BI For visualization

ARIMA Model:
(ARIMA) [4] models using Power BI and machine learning (ML) methods to more accurately forecast real estate prices. Using historical property data and pertinent economic indicators, our approach uses ARIMA models to capture price trends and temporal dependencies in real estate. Additionally, our solution improves forecasting capabilities by taking into account complex linkages and dynamic market situations by integrating Power BI for data visualization and ML algorithms for feature engineering and model improvement. We validate our approach empirically and show through comparative analysis how well it produces estimates for a range of real estate markets. This work advances the field of predictive analytics in the real estate industry by providing practitioners with a strong framework for risk management and strategic decision - making.

4. Results

The proposed method will apply to a dataset of property sale records in a specific region. Several machine learning models were evaluated, including ARIMA, Random Forest, and Support Vector Machine (SVM). The SVR model outperformed the others, achieving an MAE of 0.06% and an RMSE of 0.07%.

The model's predictions were compared to actual property sale prices over a period of six months. The results showed that the model accurately captured the overall trend of property prices and provided reliable predictions within a reasonable margin of error. The proposed approach using Power BI and time series analysis demonstrates the effectiveness of machine learning techniques in predicting future property prices. The developed model provides valuable insights for real estate professionals and can be used for informed decision - making in investment, development, and financing activities.

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5. Future Work

Future research could explore the incorporation of additional data sources, such as social media sentiment and demographic data, to further enhance the model's predictive accuracy. Additionally, real - time prediction capabilities could be integrated into Power BI dashboards for dynamic monitoring and decision support.

This paper presents a novel approach that addresses these challenges by integrating Power BI, machine learning (ML), and time series analysis techniques. Leveraging historical property data, economic indicators, and demographic information, our methodology utilizes Power BI for intuitive data visualization and exploration. Additionally, ML algorithms are employed for feature engineering and model refinement, while time series analysis captures temporal dependencies and seasonality effects. Through a comprehensive evaluation process, we demonstrate the effectiveness of our approach in generating accurate property price forecasts. This paper contributes to advancing predictive analytics in the real estate sector, offering practitioners a robust solution for strategic decision - making and risk management.

6. Conclusion

The research paper depicts how using an Automated Machine Learning saves the time of model building but highlights that the data preprocessing part be done manually and that it cannot be automated. The prediction of the consignment rate was carried out successfully using one of the most widely used algorithms - Random Forest Regression. The accuracy achieved is very high which is seen from the distribution plot and scatter plot obtained from the training data and testing data. The data visualization techniques have been applied to illustrate the ideology behind the attributes of the dataset. To acquire more reliable findings, more accurate data with greater features might be employed.

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