https://doi.org/10.46335/IJIES.2024.9.7.10 **e-ISSN: 2456-3463**
Vol. 9, No. 7, 2024, PP. 45-50

International Journal of Innovations in Engineering and Science, www.ijies.net

Assets Estimation of Domestic and Scalable Edifice using Machine Learning Approach

Mohini Barapatre[1], Akshata Bettawar[2], Ishita Dharmik[3], Barnabas Johnson[4], Ansar Sheikh[5]

[1, 2, 3, 4]UG Engineering Students, [5]Associate Professor Department of Computer Engineering, St. Vincent Pallotti College of Engineering and Technology, Nagpur, Maharashtra, India

mohinibarapatre31@gmail.com

***Received on**: 5 May,2024* ***Revised on**: 30 June,2024* ***Published on**: 03 July ,2024*

Abstract— Property valuation is a crucial aspect of real estate investment and decision-making processes, encompassing both residential and commercial sectors. Traditional methods of property valuation often rely on subjective assessments, leading to potential inaccuracies and inconsistencies. This research paper investigates the efficacy of regression analysis as a quantitative tool for property valuation, focusing on residential and commercial buildings. Through a comparative study, various regression models are employed to analyze the relationship between property characteristics and market values, utilizing datasets encompassing a diverse range of properties. The findings of this research is to provide valuable insights into the applicability and accuracy of regression analysis in property valuation for both residential and commercial buildings. Moreover, the study contributes to the existing body of knowledge by highlighting the nuances and complexities involved in valuing properties across different segments of the real estate market. Ultimately, the outcomes of this research can inform stakeholders, including investors, developers, appraisers, and policymakers, in making informed decisions regarding property investments and market assessments.

Keywords— Assets, Estimation, Domestic, Scalable, Edifice, Machine Learning

I. INTRODUCTION

Property valuation is a critical aspect of real estate investment, providing an estimation of the monetary worth of generate robust valuation models [4] [5]. By analyzing historical sales data and relevant market variables, regression models can provide insights into the underlying drivers of property value fluctuations, empowering stakeholders to make informed decisions [6].

Furthermore, advancements in data analytics and computing technology have enhanced the efficacy of regression analysis in property valuation [5] [4]. With access to vast datasets and sophisticated statistical tools, researchers and practitioners can develop more sophisticated models capable of capturing complex relationships within the real estate market [7]. These models offer improved accuracy and reliability compared to traditional valuation methods, thereby reducing the risk of overvaluation or undervaluation of properties [4].

Despite its widespread adoption, challenges remain in implementing regression analysis for property valuation [3]. Ensuring the quality and integrity of data inputs, selecting appropriate variables, addressing multi colinearity issues, and validating model assumptions are among the key considerations for researchers and analysts. Moreover, the dynamic nature of real estate markets necessitates continuous refinement and updating of regression models to reflect changing conditions and trends [2].

In this research paper, we aim to explore the application of regression analysis in property valuation for both residential and commercial buildings. We will examine the theoretical foundations of regression modeling, review relevant literature, discuss methodological considerations, and present empirical findings from case studies or analyses. By critically evaluating the strengths and limitations of regression-based valuation approaches, we seek to contribute to a deeper understanding of their utility and effectiveness in the real estate industry.

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II. Literature Review

Property valuation is a multifaceted endeavor that has garnered significant attention from researchers, practitioners, and policymakers alike. Traditional valuation methods have often relied on subjective assessments or simplistic metrics, leading to potential inaccuracies and inconsistencies. In recent years, however, there has been a growing interest in employing regression analysis as a quantitative tool for property valuation, particularly for residential and commercial buildings. A comprehensive review of the literature reveals a plethora of studies that have explored the application of regression analysis in property valuation across various contexts. The study is grounded in the recognition of the importance of proper valuation techniques in assessing the worth of intellectual property assets. Through the AHP methodology, the author aims to offer a structured approach for choosing the most appropriate valuation method. This approach involves considering various factors and criteria to weigh the advantages and disadvantages of different valuation methods effectively [8]. Similarly, in the commercial real estate sector, the paper by Kossecki et al [9] discusses the valuation of intellectual property, particularly focusing on software in the early stages of implementation. It employs the income approach and scenario analysis to assess the value of intellectual property. This study contributes to the field by providing insights into the evaluation of intellectual property assets, aiding companies in strategic decision-making and investment [9]. Alsahan, Ibraheem, and Alzaidan (2024) explores the potential of artificial intelligence (AI) in revolutionizing real estate valuation practices. It delves into the opportunities AI offers in enhancing accuracy, efficiency, and objectivity in valuation processes. The authors discuss various AI techniques such as machine learning and deep learning and their application in real estate valuation. Furthermore, they address the challenges associated with the integration of AI in this domain, highlighting the need for data quality, regulatory compliance, and human expertise to harness the full potential of AI in real estate valuation [10]. The study by Tajani, Murano, Salvo, and Ruggiero (2019) introduces a novel approach to property valuation, focusing on the optimization of the market approach through a weighted appraisal model. The authors propose a method that incorporates various factors impacting property value, assigning weights to each factor based on their relative importance. By integrating these weighted factors into the appraisal model, the study aims to improve the accuracy and reliability of property valuations [11].

The research by Lorenz and Lützkendorf (2008) examines the integration of sustainability considerations into property valuation theory and practice. The study explores the evolving concept of sustainability within the real estate sector and its implications for valuation methodologies. Through a comprehensive analysis, the authors highlight the challenges and opportunities associated with incorporating sustainability criteria into property valuation, emphasizing the need for standardized frameworks and metrics to ensure consistency and accuracy in valuation outcomes. This research contributes to advancing the understanding of sustainability's role in property valuation and provides insights for practitioners and policymakers seeking to integrate environmental and social factors into valuation processes [12].

Furthermore, the literature highlights the importance of considering specific factors and variables relevant to residential and commercial property valuations. Residential properties may be influenced by factors such as location, property size, amenities, and neighborhood characteristics, whereas commercial properties may be impacted by variables such as rental income potential, zoning regulations, and economic indicators.

III. Existing System

Traditional methods of property valuation for residential and commercial buildings often rely on subjective assessments, simplistic metrics, or established valuation approaches such as the sales comparison approach or income capitalization approach. These methods may lack the ability to comprehensively capture the intricacies of real estate markets and the diverse range of factors influencing property values.

In the residential sector, valuation often involves assessing comparable sales, considering factors such as location, property size, amenities, and neighborhood characteristics. While this approach provides valuable insights, it is susceptible to biases and may overlook important variables that could impact property values.

Similarly, in the commercial real estate sector, valuation typically involves analyzing income-producing properties based on their potential rental income, operating expenses, and capitalization rates. While income capitalization provides a standardized approach to valuing commercial properties, it may not fully account for variations in market conditions, tenant profiles, or property-specific attributes.

Moreover, both residential and commercial property valuations may be subject to market fluctuations, regulatory changes, and other external factors that can affect property values. Traditional valuation methods may struggle to adapt to these dynamics and may not provide timely or accurate assessments of property values.

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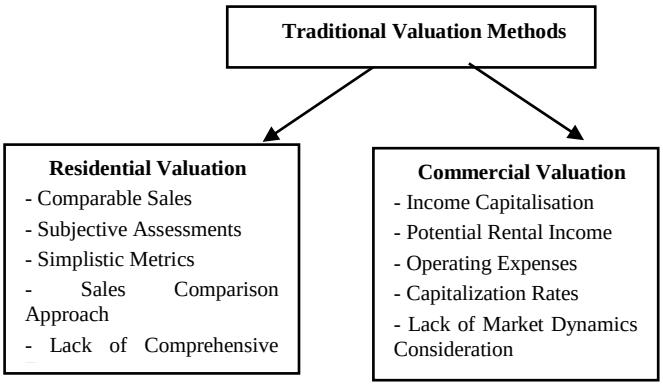

Fig. 1. Traditional Valuation Methods

IV. Research Methodology

Property valuation is a critical aspect of the real estate industry, influencing various stakeholders such as buyers, sellers, investors, and lenders. Traditionally, property valuation has been conducted using manual methods, involving extensive data collection, analysis, and expert judgment. However, with the advancements in technology, particularly in the field of machine learning, there has been a paradigm shift in how property valuation is approached.

Machine learning is concept to learn the computer from the day today's example and past experiences and does not required to program machine [13]. Machine learning techniques, particularly regression analysis, have gained prominence in the realm of property valuation due to their ability to analyze vast amounts of data and derive meaningful insights. Regression analysis, a statistical method, allows us to model the relationship between a dependent variable (e.g., property value) and one or more independent variables (e.g., location, size, amenities, market trends). By leveraging historical sales data and various property attributes, machine learning algorithms can predict property values with a high degree of accuracy.

A. Advantages over Traditional Methods:

1) *Efficiency:* Machine learning algorithms can process large datasets much faster than manual methods, reducing the time and effort required for property valuation.
2) *Accuracy:* By analyzing numerous factors simultaneously, machine learning models can generate more accurate property valuations, taking into account subtle nuances and market dynamics that may be overlooked by human appraisers.
3) *Scalability:* Machine learning models can be easily scaled to handle large portfolios of properties, making them suitable for real estate investors and organizations managing extensive property assets.
4) *Automation:* Automated valuation models (AVMs) powered by machine learning can streamline the valuation process, allowing for quick and consistent assessments without human intervention.

In the context of commercial buildings, where property valuation is often complex due to factors such as location, zoning regulations, tenant profiles, and income potential, machine learning holds particular promise. By incorporating diverse datasets encompassing both property-specific attributes and broader market trends, machine learning models can provide more robust and nuanced valuations for commercial properties.

B. Steps for Valuation

1) *Data Collection:* The first step in the research methodology involves gathering comprehensive datasets comprising information on residential and commercial properties. This data will include attributes such as location, size, amenities, property characteristics, sales prices or rental incomes, economic indicators, and other relevant factors influencing property values. The datasets will be sourced from reliable sources such as real estate databases, government records, property listings, and industry reports.
2) *Data Preprocessing:* Once the datasets are collected, they will undergo preprocessing to ensure quality and consistency. This preprocessing step may involve cleaning the data to remove outliers, missing values, or inconsistencies. Additionally, data normalization or transformation techniques may be applied to standardize the variables and improve the performance of regression models.
3) *Variable Selection:* Next, appropriate variables will be selected for inclusion in the regression analysis. This step will involve identifying key determinants of property values based on existing literature and domain knowledge. Variables such as location factors, property characteristics, amenities, economic indicators, and

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market trends will be considered for inclusion in the regression models.

4) *Regression Modeling:* Regression analysis will be employed to develop predictive models for property valuation. Various regression techniques, including linear regression, multiple linear regression, and possibly advanced methods like ridge regression or decision trees, will be explored. The regression models will be built using the selected variables as predictors and property values (sales prices or rental incomes) as the target variable.
5) *Model Evaluation:* The performance of the regression models will be evaluated using appropriate metrics such as R-squared, root mean square error (RMSE), mean absolute error (MAE), or other relevant measures of model accuracy and goodness-of-fit. Cross-validation techniques may also be employed to assess the robustness and generalization capabilities of the models.
6) *Comparative Analysis:* The predictive capabilities of regression analysis will be compared between residential and commercial property valuations. This comparative analysis will highlight any differences in the factors influencing property values and the effectiveness of regression models in capturing these differences across the two sectors.
7) *Sensitivity Analysis:* Sensitivity analysis will be conducted to examine the impact of changes in key variables or model specifications on property valuations. This analysis will help identify the most influential factors driving property values and assess the robustness of the regression models to variations in input parameters.
8) *Interpretation and Discussion:* The findings of the regression analysis will be interpreted and discussed in the context of existing literature and theoretical frameworks. The implications of the results for property valuation practices, investment decisions, and policy formulation will be examined, highlighting practical insights and recommendations for stakeholders.
9) *Limitations and Future Research:* Finally, the limitations of the research methodology will be acknowledged, and avenues for future research will be discussed. Suggestions for enhancing the accuracy and applicability of regression analysis in property valuation for residential and commercial buildings will be provided, paving the way for further advancements in the field.

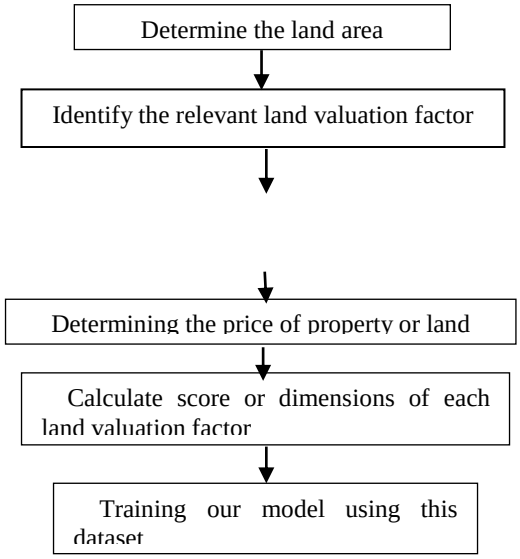

Fig. 2. Flow diagram

Obtaining residual land prices datasets from a real-estate/ agent

V. WHY SVM?

Support Vector Machine (SVM) is a powerful machine learning algorithm that is widely used for classification and regression tasks [14]. Unlike traditional regression techniques like linear regression, SVM aims to find the optimal hyperplane that best separates different classes or predicts continuous outcomes, such as property values. SVM operates by mapping input data into a high-dimensional feature space and finding the hyperplane that maximizes the margin between different classes or fits the data with the least error.

In the context of property valuation, SVM regression offers a robust and flexible approach to modeling the relationship between various property attributes and their corresponding values. By leveraging historical sales data and a multitude of property characteristics, SVM can effectively capture nonlinear relationships and intricate patterns that may exist in real estate markets. Moreover, SVM's ability to handle high-dimensional data and nonlinearities makes it particularly suitable for valuing commercial buildings, which often exhibit complex relationships between attributes such as location, size, amenities, and market trends.

A. Advantages of SVM

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1) *Flexibility:* SVM regression can accommodate different types of data and model complex relationships between property attributes and values, allowing for more accurate valuations.

2) *Robustness:* SVM is less sensitive to outliers and noise in the data compared to traditional regression techniques, resulting in more reliable valuation estimates.

3) *Nonlinearity:* SVM can capture nonlinear relationships between property attributes and values, providing a more realistic representation of real estate markets.

4) *Generalization:* SVM regression models can generalize well to unseen data, making them suitable for predicting property values in diverse market conditions and geographic regions.

In the context of commercial buildings, where property valuation is influenced by a wide range of factors such as location, zoning regulations, tenant profiles, and economic indicators, SVM regression can provide valuable insights into the value drivers of these properties.

VI. Objectives

1. To assess the efficacy of regression analysis as a quantitative tool for property valuation in the residential and commercial real estate sectors.
2. To identify the key determinants of property values in both residential and commercial buildings through regression modeling, considering factors such as location, property characteristics, amenities, economic indicators, and market trends.
3. To compare and contrast the predictive capabilities of regression analysis between residential and commercial property valuations, highlighting the unique factors influencing each sector.
4. To investigate the accuracy and reliability of regression-based property valuations in capturing the nuances of real estate markets, including spatial variations, temporal trends, and heterogeneity across property types.
5. To provide practical insights and recommendations for stakeholders, including investors, developers, appraisers, and policymakers, regarding the application of regression analysis in property valuation and decision-making processes.

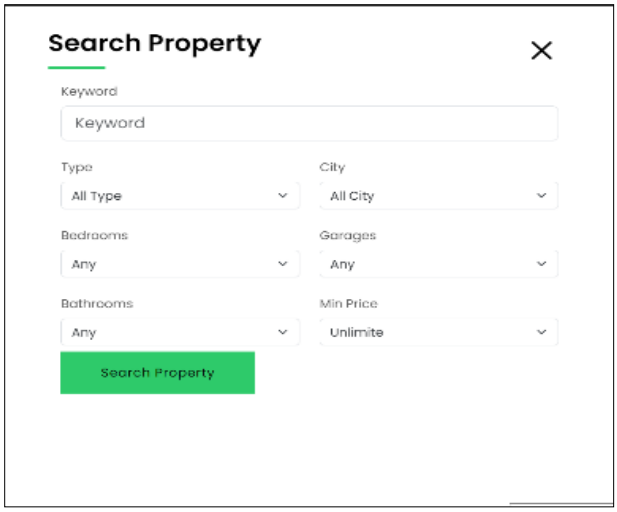

Fig. 5. Chat bot

Represents the chat bot interface where user can communicate

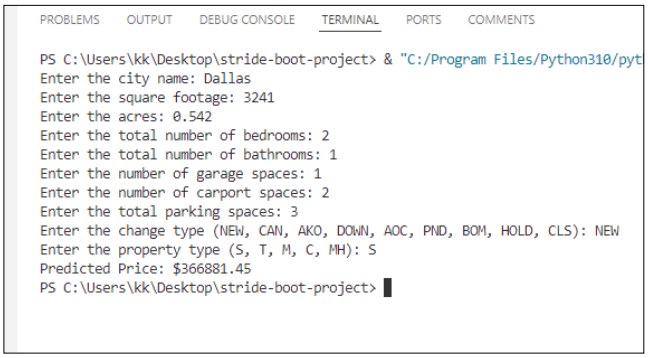

Fig. 5. Calculations

Our property valuation tool swiftly calculates property prices based on key metrics like room count, area size, parking spaces, and bathrooms. By analyzing market trends and comparable sales data, it provides instant, accurate estimates, aiding in informed decision-making for buyers, sellers, and investors.

VI. Conclusion

In conclusion, this research paper has explored the application of regression analysis as a quantitative tool for property valuation, focusing on both residential and commercial buildings. Through a comprehensive review of the literature and empirical analysis, the study has shed light on the efficacy of regression models in capturing the complexities of real estate markets and predicting property values. The findings of this research underscore the significance of regression analysis as a valuable methodology for property valuation. By leveraging empirical data and statistical techniques, regression models offer a systematic approach to assessing property values and identifying key determinants of value. In both residential and commercial sectors, regression analysis has demonstrated its ability to account for a wide range of factors, including property characteristics, location dynamics, economic indicators, and market trends, thereby enhancing the accuracy and reliability of valuations. Moreover, the comparative analysis between residential and commercial property valuations has revealed important insights into the distinctive factors influencing each sector. While residential properties may be primarily influenced by factors such as location, size, and amenities, commercial properties are often impacted by variables such as rental income potential, zoning regulations, and economic indicators. Understanding these nuances is crucial for developing robust regression models tailored to specific property types and market dynamics. Nevertheless, it is essential to acknowledge the limitations of regression analysis in property valuation. Regression models are inherently dependent on the quality and availability of data, and their effectiveness can be influenced by factors such as model specification, multi col linearity, and hetero scedasticity. Therefore, careful consideration should be given to data collection, model selection, and validation techniques to ensure the accuracy and reliability of regression-based valuations.

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