

Estate Eyes, Predicting Your Dream Home's Value: A Comprehensive Survey

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Abstract - This comprehensive study explores advanced applications in Artificial neural networks by integrating memristor-based technology into sophisticated multi-variable regression models for house price prediction. Simultaneously, a novel deep learning model employs public facilities, satellite maps, and attention mechanisms, surpassing traditional methods. In the real estate domain, Google Trends emerges as a tool for predictive analysis, enhancing decision-making. Lasso regression proves crucial in machine learning for adaptable housing price prediction models. The utilization of Linear Regression aids predictions based on bedrooms and amenities, enabling informed customer decisions. Concluding the exploration, a research effort combines regression analysis and particle swarm optimization to predict house prices, achieving a minimal error of IDR 14,186 and providing valuable insights for precise predictions in real estate across diverse locations.

Indexed Terms- House Price Prediction, Machine Learning Algorithm, Real Estate, Heterogeneous Data, Big Data Utilization, Deep Learning, Regression.

I. INTRODUCTION

House price prediction involves evaluating property values through diverse methodologies and techniques. The article emphasizes the pivotal role of housing in global economic, financial, and political structures. It advocates for the utilization of machine learning models to predict house prices, considering various influencing factors. The comprehensive literature analysis provided in the later sections delves into

attributes affecting house prices and the application of machine learning models in predicting them.[1]

This work explores the implementation of a multi-layer feed-forward neural network using memristors as electronic synapses, enabling automatic online training. Unlike traditional models using CPUs and GPUs, this novel approach aims to design a customized integrated circuit that consumes less power and operates at high speed. The application of this technology involves predicting house prices in Boston towns, demonstrating promising results that closely align with target data.[2]

The study addresses the contemporary significance of house price prediction, serving as a crucial basis for transactions between buyers and sellers. With a focus on real estate transaction data, the research explores factors affecting house prices, categorizing them into house conditions and environmental factors. Leveraging machine learning, deep learning, and the Google Maps API, the study introduces a novel approach that incorporates satellite maps and public facility data, employing a spatial transformer network for feature extraction. The ultimate goal is to enhance prediction accuracy, understand influential features, and offer insights into the diverse factors influencing house prices, leading to the development of an attention-based model.[3]

According to [6], The increasing demand for housing, fueled by population growth and urban migration, highlights the need for precise house price prediction. This project employs various techniques, including Linear Regression, to forecast house prices. The research integrates methods such as variance influence

factor analysis, dimensionality reduction, and data transformation techniques like outlier treatment, missing value handling, and box-cox transformation. These endeavors underscore house price prediction as an essential area within regression-based machine learning research.

According to [7], recent progress in predictive modeling allows for a new way of predicting housing values. The research explores different regression methods, focusing on the effectiveness of XG Boost in the prediction process. Using established techniques like gradient boosting, the model aims to provide users with more realistic future value predictions. While meeting initial requirements, the study recognizes room for improvement, especially in addressing concerns about prolonged processing times. Exploring parallel computations and adding functionalities, like regional heat maps, could refine the existing predictive framework.

According to [9], Navigating the real estate landscape in a city like Mumbai, known for its exorbitant living costs, poses significant challenges for prospective homeowners. This paper addresses the complexities of property pricing in Mumbai, influenced by factors such as location, amenities, and proximity to essential services. The objective is to develop a predictive model, utilizing the linear regression algorithm, to accurately estimate real estate prices. Leveraging the Housing Prices in Mumbai dataset from Kaggle, the study involves training and testing the model to assess its accuracy, aiming to provide a valuable tool for property buyers and mitigate the risk of misinformation in this challenging market.

In the ever-evolving real estate market, predicting house prices accurately is a formidable challenge. Leveraging the power of machine learning, this project endeavors to create a user-friendly web-based tool for predicting house prices. Tailored for real estate agents, homebuyers, and sellers, the tool allows users to input property details, utilizing a trained machine learning model to generate accurate price predictions. By integrating advanced algorithms into an accessible interface, this project aims to empower users with valuable insights, facilitating more informed decisions in the dynamic realm of real estate.[10]

1.1 Introduction to Machine Learning

Machine Learning (ML) is a field of scientific inquiry focused on the development of algorithms and statistical models utilized by computer systems to execute specific tasks without explicit programming instructions. The fundamental goal of machine learning is to enable systems to learn and improve their performance based on data inputs. Numerous studies have delved into empowering machines to learn autonomously, without the need for explicit programming. Mathematicians and programmers employ diverse approaches to address this challenge, particularly when dealing with vast datasets. The emphasis is on enhancing machine autonomy and efficiency in tasks by leveraging the inherent patterns and insights within extensive data repositories.[1][14][7]

II. RELATED WORKS

A comprehensive review and evaluation encompassed a total of 15 articles to capture all attributes influencing house prices. The system aims to determine house prices based on user-provided features, utilizing a Machine Learning (ML) model for accurate predictions. To achieve this, an appropriate dataset will be selected, undergo data cleaning to eliminate unnecessary information, and be transformed into a .csv file. The data will then undergo preprocessing, handling missing values, and, if necessary, label encoding. Subsequently, the dataset will be transformed into a NumPy array for model training.[14]

During training, various ML algorithms will be employed, and their error rates will be assessed to select the most accurate model. Users and companies can log in, fill a form with property attributes, and submit it for prediction. The entered data will be processed by the model, providing users with quick and accurate predictions. The entire process emphasizes simplicity and user-friendliness, ensuring an effective tool for predicting house prices.

2.1 House Price Prediction

According to [6], In the domain of machine learning, house rate prediction entails deploying algorithms trained on historical datasets to foresee outcomes

when applied to new data. These machine learning models enable accurate estimations of potential house rates by recognizing patterns within past data. A variety of algorithms, including linear regression, multiple linear regression, random forest, regression tree, neural networks, and others, can be employed for house rate prediction purposes. These algorithms play a crucial role in enhancing the precision and dependability of forecasting house rates, facilitating well-informed decision-making across various applications.[14]

III. METHODOLOGY

3.1 Linear Regression

Simple linear regression is a statistical technique employed to analyze and elucidate the connection between two continuous quantitative variables. In this method, one variable, labeled as x , assumes the role of the predictor, explanatory, or independent variable, while the other variable, denoted as y , serves as the response, outcome, or dependent variable.[7]

IV. LITERATURE SURVEY

Pei-Ying Wang, Chiao-Ting Chen, Jain-Wun Su, Ting-Yun Wang, And Szu-Hao Huang, “Deep Learning Model for House Price Prediction Using Heterogeneous Data Analysis Along With Joint Self-Attention Mechanism”, The paper proposes a new model for predicting house prices by incorporating factors such as public facilities and the surrounding environment. It uses attention mechanisms to identify important features and achieves better prediction accuracy than other models. The model imports heterogeneous data to supplement house information and proposes an attention mechanism to automatically assign weights according to different features or samples. The model is constructed using STN techniques and extends the concept of self-attention mechanism to propose a joint-self attention mechanism.[3]

Choujun Zhan et al, “Housing prices prediction with deep learning: an application for the real estate market in Taiwan”, The paper proposes using deep learning methods to predict housing prices, as traditional models struggle to capture the non-linear relationship between housing prices and factors. The authors

construct a dataset including housing attributes and macroeconomic data in Taiwan and find that a deep learning algorithm called CNN performs the best in predicting housing prices. This study can help inform interventions in the housing market.[5]

Nina Rizun and Anna Baj-rogowska, “Can Web Search Queries Predict Prices Change on the Real Estate Market?”, This study examines whether the intensity of Google searches can predict changes in real estate prices. The researchers found that analyzing Google search data can provide valuable insights into the real estate market and help predict housing price changes. The study also demonstrates the significance of using Google Trends data in the housing market and extends the understanding of using Google search engine queries to predict real estate price changes, considering users' interests in both 'real estate' and 'credit to buy real estate.'[4]

J. J. Wang, S. G. Hu, X. T. Zhan, Q. Luo¹, Q. Yu , Zhen Liu , T. P. Chen , Y. Yin , Sumio Hosaka , And Y. Liu, “Predicting House Price With a Memristor-Based Artificial Neural Network”, This paper discusses using memristors in artificial neural networks to predict house prices in Boston. The researchers designed a 2-layer feed-forward neural network using memristors as synapses, and the weights of synapses can be adjusted online by the pulse voltage with the BP algorithm. The neural network can learn to predict the house price under training mode and successfully predict the house price in the predicting mode. The neural network was trained with the house price samples of several Boston towns in the US to make predictions, and the predicted results are found to be close to the target data [2]

According to [6], Bindu Sivasankar, Arun P. Ashok, Gouri Madhu, Fousiya S, "House Price Prediction," The paper explores the prediction of future housing prices by comparing different prediction methods and examining past market trends, price ranges, and upcoming developments. The system aims to fulfill the demand for forecasting future house prices in the ever-changing real estate market.

[8] Anand G. Rawool, Dattatray V. Rogy, Sainath G. Rane, Dr. Vinayk A. ,Bharadi, "House Price Prediction Using Machine Learning," The existing housing

system faces a limitation in predicting future market trends and price fluctuations, posing a challenge for budget-conscious homebuyers. The primary objective of the project is to forecast precise house prices by taking into account diverse factors and giving priority to customer budgets. The housing cost prediction model utilizes Machine Learning algorithms, including Linear Regression, Decision Tree Regression, K-Means Regression, and Random Forest Regression. This approach empowers users to make well-informed investment decisions independently, eliminating the need for reliance on brokers.

[9] Siddhant Burse, Dhriti Anjaria, Hrishikesh Balaji, "Housing Price Prediction Using Linear Regression," In the contemporary world, the real estate sector plays a crucial role, especially in cities like Mumbai, which is a desirable destination for many seeking work and settlement. This paper centers around the prediction of real-time house values in Mumbai, taking into account factors such as the number of bedrooms and available amenities. The key goal is to aid customers in discovering options that match their requirements. The utilization of the Linear Regression model for cost prediction not only eliminates the necessity for a broker but also offers additional support to customers.

[10] Manoj VN, J Yugesh, Girish NL, Madhusudhan Reddy, "House Price Prediction Using Linear Regression," The real estate market, known for its competitive pricing influenced by various factors, is a prime domain for the application of machine learning concepts. House prices, reflecting economic conditions, are of significant concern for clients and property dealers. With property prices increasing annually, there arises a need for predictive strategies to anticipate future house prices. Factors like size, location, and the number of bedrooms play pivotal roles in influencing house prices.

CONCLUSION

In conclusion, this study explores inventive strategies for predicting house prices through the integration of advanced technologies and machine learning models, incorporating memristor-based technology and deep learning techniques to significantly improve prediction accuracy.

The research underscores the contemporary significance of house price prediction in global economic structures, advocating for the adoption of machine learning models to address a variety of influencing factors. Focused on real estate transaction data, the study employs spatial transformer networks, satellite maps, and public facility data to extract influential features, contributing valuable insights for decision-making processes.

Recognizing the growing demand for housing, especially in locations like Mumbai, the project utilizes linear regression to accurately estimate real estate prices. The integration of variance influence factor analysis, dimensionality reduction, and data transformation techniques emphasizes the importance of regression-based machine learning research in house price prediction.

Aligned with the broader field of machine learning, the study employs various algorithms, including linear regression and multiple linear regression, with the aim of developing versatile models for predicting house rates. The user-friendly web-based tool targets real estate agents, homebuyers, and sellers, providing valuable insights for informed decision-making in the dynamic real estate market.

In summary, this research contributes to the evolving field of house price prediction by combining technological innovation and machine learning methodologies. The integration of linear regression, alongside advanced algorithms, reflects a commitment to delivering accurate predictions for users in the real estate market, thereby advancing the understanding of predictive modeling in this domain.

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