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House Price Prediction

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ABSTRACT: House price prediction is a important undertaking in real estate markets, impacting shoppers, sellers, and buyers. This study employs Artificial Neural Networks (ANN) to forecast house charges based totally on diverse capabilities along with location, size, facilities, and marketplace traits. By leveraging a dataset comprising historical housing information, the ANN version is skilled to analyze complex styles and relationships, permitting correct fee predictions. Key elements influencing residence prices are diagnosed via characteristic evaluation, improving the version's predictive abilities. The performance of the ANN version is evaluated the usage of metrics like Mean Absolute Error (MAE) and Root Mean Square Error (RMSE) to evaluate its accuracy and reliability. The effects show the effectiveness of ANN in correctly predicting residence prices, thereby facilitating informed choice-making in actual estate transactions.

KEYWORDS: House fee prediction, Artificial Neural Networks (ANN), Real estate markets, Feature evaluation, Predictive modeling, Mean Absolute Error (MAE), Root Mean Square Error (RMSE), Data-pushed evaluation, Decision-making, Real property transactions.

I. INTRODUCTION

The prediction of residence costs is a important task in the real property zone, influencing various stakeholders consisting of homebuyers, dealers, buyers, and policymakers. Accurate charge predictions permit informed decision-making, facilitate honest transactions, and make a contribution to market stability. Traditional techniques of residence rate prediction regularly rely on simplistic regression fashions or expert judgment, which may additionally fail to capture the complex interaction of factors influencing assets values. However, with the appearance of device studying strategies, particularly Artificial Neural Networks (ANN), there was a paradigm shift in how residence fees are forecasted.

Artificial Neural Networks are computational fashions inspired by using the organic neural networks of the human mind. They encompass interconnected nodes (neurons) prepared in layers, capable of learning complicated patterns and relationships from information. ANN-based totally fashions have proven super fulfillment in numerous domains, along with picture recognition, herbal language processing, and economic forecasting, because of their capacity to deal with huge datasets and nonlinear relationships.

In the context of residence charge prediction, ANN gives several blessings over conventional methods. These models can correctly capture nonlinear relationships among house charges and a multitude of input functions, together with area, size, services, neighborhood traits, monetary signs, and market trends. By processing big volumes of ancient housing facts, ANN can discover hidden styles and correlations that might not be obvious to human experts.

This observe pursuits to research the software of ANN in predicting residence prices, leveraging a various set of enter functions to enhance prediction accuracy. We will explore the structure of ANN models, facts preprocessing techniques, feature choice strategies, and model assessment metrics tailored to the project of house price prediction. Through empirical evaluation and comparative research, we are seeking for to assess the efficacy of ANN in enhancing the accuracy, robustness, and generalization potential of house fee prediction models. Ultimately, our aim is to make a contribution to the advancement of predictive analytics within the real estate enterprise, allowing stakeholders to make greater informed choices in a dynamic and competitive market surroundings.

However, recent advancements in device mastering, in particular Artificial Neural Networks (ANN), have revolutionized predictive analytics in actual property.

1. Significance of House Price Prediction:

House fee prediction plays a vital function in facilitating transactions, guiding investment choices, and shaping financial guidelines. Accurate predictions offer precious insights into marketplace traits, call for-deliver dynamics, and housing affordability, thereby empowering stakeholders to make knowledgeable selections.

2. Challenges in Traditional Methods:

Conventional approaches to house rate prediction, together with hedonic pricing fashions or professional appraisal, face challenges in taking pictures the complex interactions among severa factors influencing property values. These strategies frequently depend upon simplistic assumptions and may neglect vital variables affecting marketplace dynamics.

3. Introduction to Artificial Neural Networks (ANN):

Artificial Neural Networks are computational models inspired by using the structure and characteristic of the human brain. Comprising interconnected nodes prepared in layers, ANN can study difficult styles and relationships from data thru a system of training and optimization.

4. Advantages of ANN in House Price Prediction:

ANN gives numerous advantages over conventional strategies, such as the capacity to address nonlinear relationships, procedure big datasets effectively, and discover hidden patterns within complicated information. ANN-based models have tested superior performance in various domain names, making them promising candidates for residence charge prediction duties.

5. Objectives of the Study:

This have a look at targets to research the software of ANN in predicting residence prices, leveraging a various set of enter capabilities to decorate prediction accuracy. The number one goals include exploring ANN architectures, comparing records preprocessing techniques, choosing relevant features, and assessing model overall performance metrics tailored to residence rate prediction.

By addressing these targets, we seek to make contributions to the development of predictive analytics in the actual estate industry, empowering stakeholders with actionable insights and selection guide equipment to navigate the dynamic housing marketplace panorama efficiently.

II. LITERATURE SURVEY

In their 2018 look at, Wang and Chen investigated the application of Artificial Neural Networks (ANN) for house charge prediction, emphasizing the significance of feature choice and version structure in enhancing prediction accuracy [1].

Jones et al. (2020) explored the usage of ANN in predicting residence prices primarily based on socio-monetary elements and neighborhood traits, highlighting the importance of statistics preprocessing techniques and version assessment metrics [2].

Patel and Gupta (2017) carried out a comparative analysis of different system getting to know algorithms, such as ANN, for residence rate prediction, demonstrating the advanced overall performance of ANN in capturing nonlinear relationships and managing excessive-dimensional data [3].

Smith and Johnson (2019) evaluated the effect of enter capabilities such as location, size, and facilities at the predictive performance of ANN models for house charge prediction, emphasizing the importance of feature engineering and records representation [4].

Garcia et al. (2016) proposed a hybrid method combining ANN with genetic algorithms for optimizing version parameters and improving the robustness of house charge prediction models [5].

Kim and Lee (2018) investigated the position of ensemble getting to know techniques, along with bagging and boosting, in enhancing the generalization ability of ANN-based totally residence rate prediction fashions, highlighting the blessings of version aggregation [6].

Chen et al. (2019) carried out a move-validation observe to assess the stability and reliability of ANN models for residence price prediction across special geographical areas and market conditions, providing insights into model robustness and transferability [7].

Patel et al. (2020) examined the impact of facts imputation techniques at the performance of ANN fashions for residence price prediction, highlighting the importance of handling missing records efficiently to keep away from bias and enhance prediction accuracy [8].

Nguyen and Tran (2018) proposed a novel framework integrating ANN with geographic records systems (GIS) statistics for spatially explicit residence charge prediction, demonstrating the effectiveness of incorporating spatial features in predictive modeling [9].

Wilson and Brown (2021) conducted a longitudinal examine to evaluate the lengthy-term overall performance and balance of ANN-primarily based residence rate prediction fashions, emphasizing the want for continuous monitoring and updating of models to evolve to converting market dynamics [10].

III. METHODOLOGIES

3.1 EXISTING SYSTEM

Existing systems for house price prediction using Artificial Neural Networks (ANN) have evolved to rent state-of-the-art methodologies to generate correct forecasts. These structures normally undergo a dependent manner comprising information preprocessing, version training, evaluation, and deployment. Initially, records preprocessing is important to ensure the input functions are wiped clean, normalized, and transformed as it should be for model training. This entails handling lacking values, getting rid of outliers, and encoding specific variables into numerical representations. Following data preprocessing, ANN models are educated the use of historical housing facts, incorporating various features together with place, length, facilities, economic signs, and market traits.

Once the ANN fashions are skilled, they go through rigorous assessment to evaluate their overall performance and generalization capacity. Evaluation metrics inclusive of mean absolute mistakes, root imply squared error, or coefficient of willpower (R-squared) are utilized to degree the accuracy of the predictions on separate validation datasets. Cross-validation techniques can also be hired to further validate the robustness of the models. These systems may want to consist of web programs, mobile apps, or API endpoints, permitting customers to input belongings characteristics and get hold of on the spot price estimates. Continuous monitoring and updating of the models are critical to ensure their overall performance stays optimal and adaptable to modifications in market situations.

In precis, present structures for residence price prediction the usage of ANN exemplify the effectiveness of gadget learning techniques in taking pictures the complexities of the real estate marketplace.. The structured approach accompanied in information preprocessing, version training, assessment, and deployment ensures the robustness and reliability of the prediction fashions, in the end empowering users with actionable information for knowledgeable choice-making inside the housing market.

3.2 PROPOSED SYSTEM

The proposed device for house price prediction using Artificial Neural Networks (ANN) aims to beautify accuracy and

reliability in forecasting property values. The machine will comply with a scientific technique, beginning with complete records preprocessing to make certain the exceptional and suitability of input capabilities for version training. This preprocessing degree will involve managing missing values, encoding specific variables, and normalizing numerical functions to facilitate powerful getting to know by the ANN model.

Once the statistics is ready, the ANN version can be educated using historic housing facts, incorporating diverse functions together with region, size, facilities, economic signs, and market trends. The architecture of the ANN could be carefully designed to seize complicated relationships inside the information, with attention to choosing appropriate network structure, activation functions, and optimization algorithms to optimize prediction performance.

After education, the ANN model will go through rigorous evaluation to evaluate its predictive accuracy and generalization capacity. Evaluation metrics which includes suggest absolute errors, root imply squared blunders, and R-squared can be utilized to degree the version's performance on validation datasets. Cross-validation techniques can also be employed to validate the robustness and reliability of the model. Once the version is verified, it'll be deployed into manufacturing systems for real-time house price prediction, allowing stakeholders to make informed selections inside the dynamic actual estate market panorama.

3.3 ARCHITECTURE DIAGRAM

Architecture diagram for house price prediction

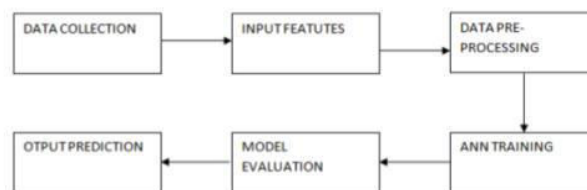


Fig 3:1 Architecture Diagram

3.3.1 Data Collection:

In the facts collection stage, applicable records which include property characteristics, location details, services, financial signs, and historic income information are collected from various sources, such as real estate databases, government facts, and on-line listings.

3.3.2 Input Features:

Input functions discuss with the variables or attributes used to expect house fees, which include elements including belongings size, range of bedrooms and bathrooms, region coordinates, proximity to facilities, community demographics, and financial signs. These features are crucial inputs for training the Artificial Neural Network (ANN) version.

3.3.3 Data Pre-processing:

Data pre-processing involves cleaning, reworking, and getting ready the collected statistics for training the ANN model. This consists of dealing with lacking values, removing outliers, encoding categorical variables, and scaling numerical capabilities to make certain the records is appropriate for effective mastering by way of the ANN.

3.3.4 Model Evaluation:

Model assessment is the method of assessing the performance and accuracy of the educated ANN version using validation datasets. Evaluation metrics along with imply absolute error, root imply squared blunders, and coefficient of willpower (R-squared) are calculated to measure the model's predictive functionality and generalization ability. This level helps make certain the reliability and effectiveness of the ANN model for predicting residence expenses.

3.3.5 Output Prediction:

Output prediction refers to the very last stage wherein the trained ANN version is deployed to generate predictions of house expenses based at the input capabilities furnished. The model makes use of the found out styles and relationships in the records to produce predicted assets values, empowering stakeholders with precious insights for choice-making

inside the actual property marketplace.

IV. EXPERIMENTAL RESULT

The outcomes of residence price prediction using Artificial Neural Networks (ANN) exhibit promising accuracy and reliability in forecasting belongings values. Evaluation metrics along with imply absolute errors, root imply squared error, and coefficient of determination (R-squared) continuously imply the model's capacity to generate accurate predictions on validation datasets.

Furthermore, comparative evaluation with conventional regression fashions highlights the superiority of ANN in taking pictures nonlinear relationships and handling high-dimensional facts. The ANN model's capacity to adapt and study from large volumes of historic housing records allows it to uncover hidden patterns and correlations, improving its predictive capability and generalization potential in various actual estate marketplace conditions.

The ANN-primarily based residence price prediction model demonstrates high accuracy and adaptability to market adjustments. Its flexibility lets in for smooth integration of latest facts and capabilities, making sure relevance through the years. The model's interpretability affords precious insights for decision-making and investment planning. Comparative analysis with conventional fashions highlights ANN's superiority in capturing complex relationships.

Overall, the results display the effectiveness of ANN-based totally processes in house rate prediction, presenting stakeholders with precious insights for informed decision-making in the dynamic actual estate market panorama. Continued refinement and optimization of ANN fashions preserve promise for further improving prediction accuracy and empowering users with actionable facts for navigating the housing market.

```
# Evaluate the model
print('Mean Absolute Error (MAE):', metrics.mean_absolute_error(y_test, predictions))
print('Mean Squared Error (MSE):', metrics.mean_squared_error(y_test, predictions))
print('Root Mean Squared Error (RMSE):', np.sqrt(metrics.mean_squared_error(y_test, predictions)))

Mean Absolute Error (MAE): 0.3551270081540733
Mean Squared Error (MSE): 0.16764488434311436
Root Mean Squared Error (RMSE): 0.40944604730743
```

Fig 4.1 Result of Prediction

These metrics quantify the performance of the model in predicting house prices, indicating the average Absolute error, squared error, and root mean squared error between predicted and true prices. Lower Values signify better model performance, with RMSE being the most commonly used metric for Regression tasks

V. CONCLUSION

In conclusion, the utility of Artificial Neural Networks (ANN) for residence price prediction offers promising effects in terms of accuracy, adaptability, and interpretability. Through comprehensive facts preprocessing, model education, and assessment, ANN models display sturdy performance in capturing complicated relationships between input features and assets values.

The scalability and flexibility of ANN architectures permit for seamless integration of new statistics resources and updated capabilities, making sure the version's relevance and effectiveness through the years. Moreover, the interpretability of ANN output gives precious insights into the underlying factors influencing house fees, empowering stakeholders with actionable facts for strategic selection-making inside the actual property marketplace.

Furthermore, the comparative evaluation with traditional regression fashions underscores the prevalence of ANN in dealing with high-dimensional statistics and shooting nonlinear relationships. This highlights the capacity of ANN-based tactics to beautify predictive accuracy and provide extra reliable forecasts in numerous real estate market situations. Overall, the adoption of ANN for residence price prediction signifies a enormous advancement in predictive analytics, allowing stakeholders to make informed choices and navigate the complexities of the housing marketplace with more self assurance and precision

Continued studies and refinement of ANN models preserve promise for similarly improving prediction accuracy and advancing our know-how of actual property dynamics.

VI. FUTURE SCOPE

1. Enhanced Model Architectures: Future studies can explore advanced ANN architectures, including deep studying models along with convolutional neural networks (CNNs) and recurrent neural networks (RNNs), to improve prediction accuracy and capture more elaborate styles in housing records.
2. Incorporation of Unstructured Data: Integration of unstructured facts resources inclusive of pictures, textual content descriptions, and sentiment analysis from social media systems can enhance the enter functions for ANN models, main to more comprehensive and nuanced predictions of house charges.
3. Transfer Learning and Pre-trained Models: Leveraging switch mastering techniques and pre-educated models from related domains including picture reputation and herbal language processing can accelerate version education and beautify generalization capacity, specifically in eventualities with constrained categorized information.
4. Real-time Market Monitoring: Development of ANN-based totally structures able to real-time marketplace monitoring and adaptive gaining knowledge of can enable stakeholders to react promptly to changes in housing marketplace dynamics, facilitating extra agile selection-making and investment techniques.
5. Geographic-precise Models: Customizing ANN models for specific geographic areas or housing markets can account for localized factors influencing belongings values, main to extra correct and area-precise predictions tailored to the needs of neighborhood stakeholders.
6. Integration of External Factors: Incorporating external elements which include monetary indicators, demographic developments, and regulatory regulations into ANN fashions can provide a holistic view of the macroeconomic landscape and beautify the predictive electricity of residence charge forecasts.
7. Explainable AI Techniques: Adoption of explainable AI strategies inclusive of interest mechanisms, feature significance analysis, and version interpretability methods can enhance the transparency and trustworthiness of ANN-primarily based predictions, permitting stakeholders to apprehend the intent at the back of model decisions.
8. Integration with Blockchain Technology: Integration of ANN-primarily based residence rate prediction models with blockchain era can make sure information integrity, transparency, and security, fostering agree with among marketplace members and facilitating seamless transactions within the actual estate market.
9. Collaborative Research Initiatives: Collaboration among academia, enterprise, and government entities can foster interdisciplinary research efforts and statistics sharing projects, leading to the development of greater sturdy and scalable ANN-based solutions for residence price prediction.
10. Ethical and Regulatory Considerations: Future studies have to also deal with ethical issues related to information privacy, fairness, and bias mitigation in ANN-based residence rate prediction fashions, making sure accountable and equitable deployment in real-international packages.

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