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Estate Eyes, Predicting Your Dream Homes Value

Prof. Dipali Mane[1], Akash Vishwakarma[2], Rohan Ghorpade[3], Vaishnavi Patil[4], Varad Pawale[5]
[1]*Professor, Dept. of Computer Engineering, Alard College of Engineering and Management Pune, Maharashtra*
[2, 3, 4, 5]*Student, Dept. of Computer Engineering, Alard College of Engineering and Management Pune, Maharashtra*

Abstract: ***Real estate transactions are known for their complexity and uncertainty, which can make it challenging for both buyers and sellers to make informed decisions. Addressing this issue, a machine learning initiative called 'Estate Eyes: Predicting Your Dream Home's Value' has been developed. This project utilizes a user-friendly web interface to collect essential property details and predict the approximate value of a user's ideal home. By integrating user-driven filters and a machine learning model, the platform simplifies the real estate process, reduces the information gap in the housing sector, and empowers users to confidently make informed decisions. The primary objective of this project is to enhance transparency, reduce uncertainty, and improve efficiency in real estate transactions.***

Keywords: Real Estate, Big Data Utilization, Heterogeneous Data, Machine Learning Algorithm, Deep Learning, Regression, House Price Prediction.

I. INTRODUCTION

The real estate market is a dynamic and multifaceted environment that demands informed decision-making for successful transactions. 'Estate Eyes: Predicting Your Dream Home's Value' represents an innovative machine learning (ML) project aimed at simplifying the process of valuing one's dream home. This initiative is centered around a user-friendly web interface that gathers essential property details, including location, size, and the number of bedrooms. Through the application of advanced ML techniques, the system provides precise predictions regarding the property's value, thereby enhancing transparency and operational efficiency within real estate transactions. The transformative potential of this system within the real estate industry stems from its emphasis on promoting transparency, equipping users with data-driven insights, and cultivating a community of knowledgeable homebuyers and sellers. By embracing a contemporary approach that leverages data for informed decision-making in property dealings, 'Estate Eyes' signals a paradigm shift in real estate towards a landscape where transparency and informed choices are not the exception but the standard practice.

A. Scope of the Project

1) Assist investors in making informed decisions by predicting future property values based on various factors.
2) Provide homeowners and real estate agents with estimates of property values for buying, selling, or refinancing purposes.
3) Support city planners in understanding housing demand and guiding infrastructure development and zoning decisions.
4) Evaluate the risk associated with mortgage lending or insurance underwriting by predicting property values.

II. RELATED WORK

The real estate market is vast and complex, with numerous factors influencing property prices. To simplify the process of predicting house prices, researchers have developed various models using machine learning and artificial intelligence techniques. One such model, proposed by Pei-Ying Wang et al. in [3], uses a deep learning model and heterogeneous data analysis with a joint self-attention mechanism to predict house prices accurately. This model considers factors such as public facilities and the surrounding environment to provide better prediction accuracy. Another study by Choujun Zhan et al. in [5] proposes using deep learning methods to predict housing prices in Taiwan. The authors found that a deep learning algorithm called CNN performed the best in predicting housing prices. This study can help inform interventions in the housing market. In addition, researchers have also explored the use of Google search data to predict housing price changes. A study by Nina Rizun and Anna Baj-rogowska in [4] found that analyzing Google search data can provide valuable insights into the real estate market and help predict housing price changes. On the other hand, some researchers have focused on using machine learning algorithms to predict house prices. For instance, a study by J. J. Wang et al. in [2] 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.

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III. METHODOLOGY

A. Random Forest

Random Forest is an ensemble learning method that operates by constructing a multitude of decision trees during training and outputting the mode of the classes (classification) or mean prediction (regression) of the individual trees. It builds multiple decision trees and merges them together to get a more accurate and stable prediction. Each tree in the Random Forest is trained on a random subset of the training data and a random subset of features. This randomness helps to reduce overfitting and improve generalization performance. Random Forests are versatile and widely used in various applications due to their robustness and ability to handle high-dimensional data with complex relationships.

B. Gradient Boosting

Gradient Boosting is another ensemble learning technique that builds a strong model by sequentially adding weak learners (typically decision trees) to the ensemble. Unlike Random Forest, where trees are built independently, Gradient Boosting builds trees in a serial manner, where each new tree corrects errors made by the previous ones. It works by minimizing a loss function (e.g., mean squared error for regression problems) using gradient descent. Gradient Boosting is known for its high predictive accuracy and is particularly effective in handling structured/tabular data, making it popular in machine learning competitions and real-world applications.

C. Linear Regression

Linear Regression is a simple yet powerful supervised learning algorithm used for regression tasks. It models the relationship between a dependent variable (target) and one or more independent variables (features) by fitting a linear equation to observed data points. The goal is to find the best-fitting line (or hyperplane in higher dimensions) that minimizes the sum of the squared differences between the observed and predicted values. Linear Regression assumes a linear relationship between the input features and the target variable, making it interpretable and easy to implement. However, it may not capture complex nonlinear relationships present in the data, which can limit its effectiveness in certain scenarios.

D. Meta Model

The meta-model in this context refers to an ensemble learning technique known as stacking. Stacking combines multiple base models' predictions to build a more robust and accurate final prediction. In this setup, the base models are the Random Forest, Gradient Boosting, and Linear Regression models. The meta-model takes the predictions made by these base models as input features and learns how to combine them to make the final prediction. Stacking leverages the strengths of different models and can often outperform any individual base model by learning to correct their weaknesses. It is a powerful technique in machine learning competitions and has been shown to achieve state-of-the-art performance in various prediction tasks.

E. Stacked Algorithm Performance

Upon employing the stacking method to combine predictions from various algorithms, the resulting model demonstrates promising performance. Stacking merges the strengths of multiple individual models to enhance predictive capabilities. In this case, the stacked regression model achieves a Root Mean Squared Error (RMSE) of about 14.91, indicating a relatively small average deviation between predicted and actual values. Furthermore, the stacking model achieves a high coefficient of determination (R-squared) of approximately 0.957, indicating that around 95.7% of the variance in the dependent variable is explained by the ensemble of algorithms. This result underscores the effectiveness of stacking in improving predictive accuracy by leveraging the diverse perspectives offered by different models.

Algorithm	R-Squared Score	RMSE
Random Forest	0.939486	17.6804
Gradient Boosting	0.886054	24.2615
Linear Regression	0.932607	18.6584
Stacking Algorithm	0.956984	14.9066

Table 1: Summary of performance of Algorithms.

F. System Architecture

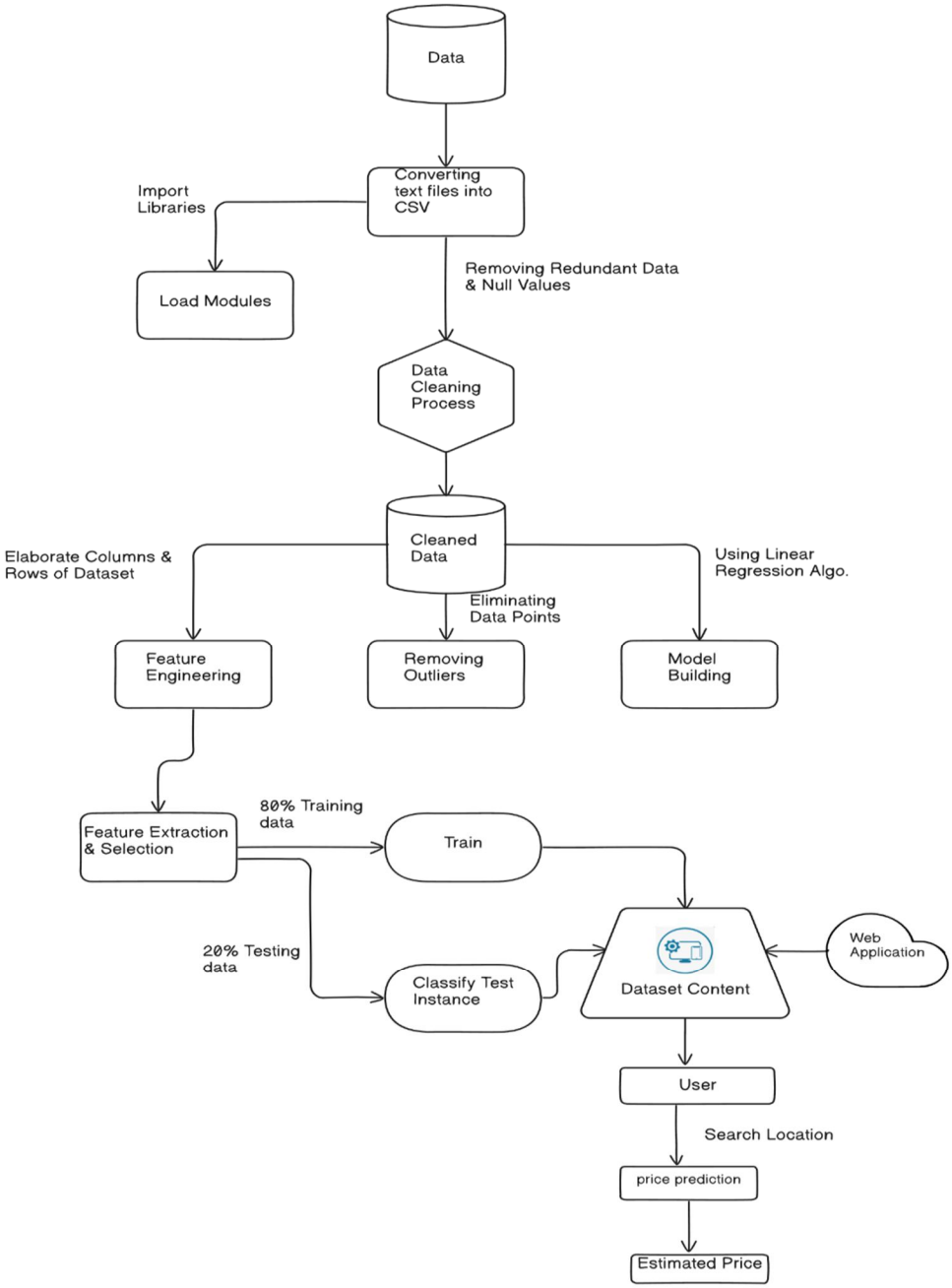


Fig. 1: System Architecture

IV. FUTURE SCOPE

Looking ahead, the future scope of this project extends into several exciting avenues for exploration and enhancement. Firstly, integrating additional features and datasets could augment the predictive power of our chosen algorithm, allowing for a more comprehensive understanding of factors influencing house prices. Additionally, incorporating geospatial analysis and considering neighborhood-level variables could provide deeper insights into localized housing market dynamics. Collaborating with domain experts, policymakers, and stakeholders could also enrich the project by aligning predictive models with actionable insights to inform policy decisions and support strategic planning in the housing sector. Overall, the future scope of this project offers an expansive landscape for innovation, collaboration, and impact, with opportunities to continually refine and adapt predictive models to address evolving challenges in the realm of housing price prediction.

V. RESULT

Our system utilizes ensemble learning models to predict house rates accurately. These models analyze various factors such as location and size to provide reliable predictions. The interface is designed to be user-friendly, offering a simple and clear presentation of the predicted house rates. This aids users in making informed decisions based on data-driven insights. By leveraging ensemble learning, we ensure a robust and effective approach to house rate prediction.
(In the form of Screenshots).

A. Backend Results

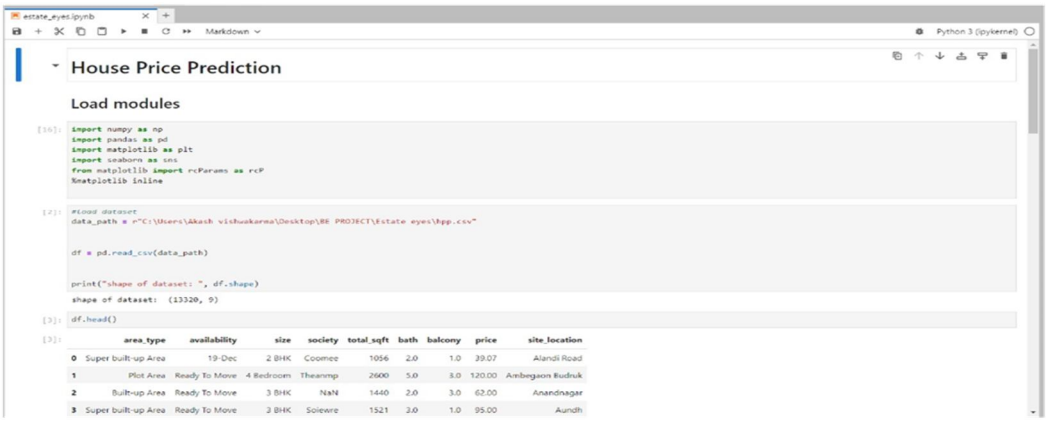


Fig. 2: House Price Prediction

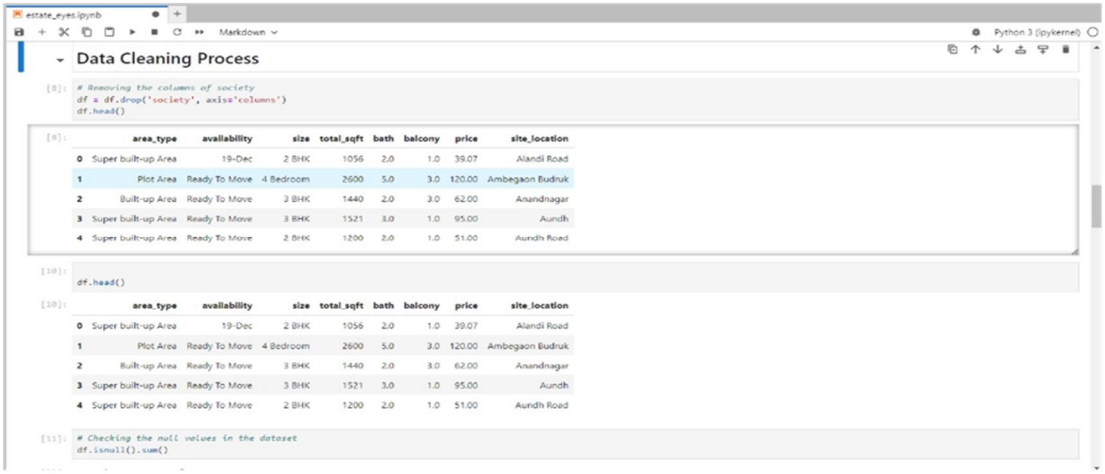


Fig. 3: Data Cleaning Process

B. Frontend Results

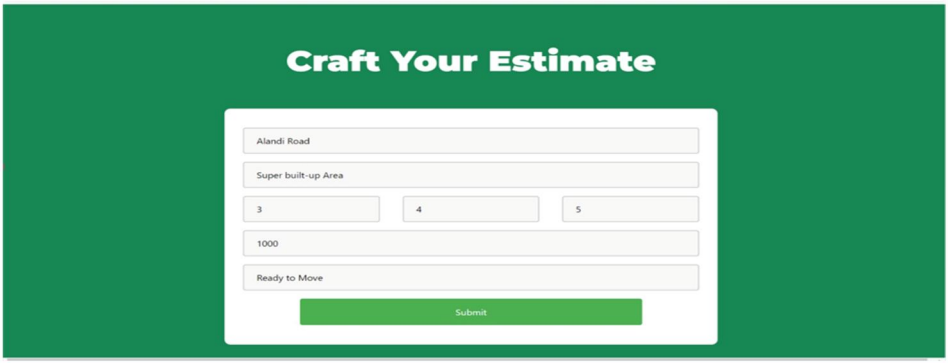


Fig. 4: House Rate Prediction

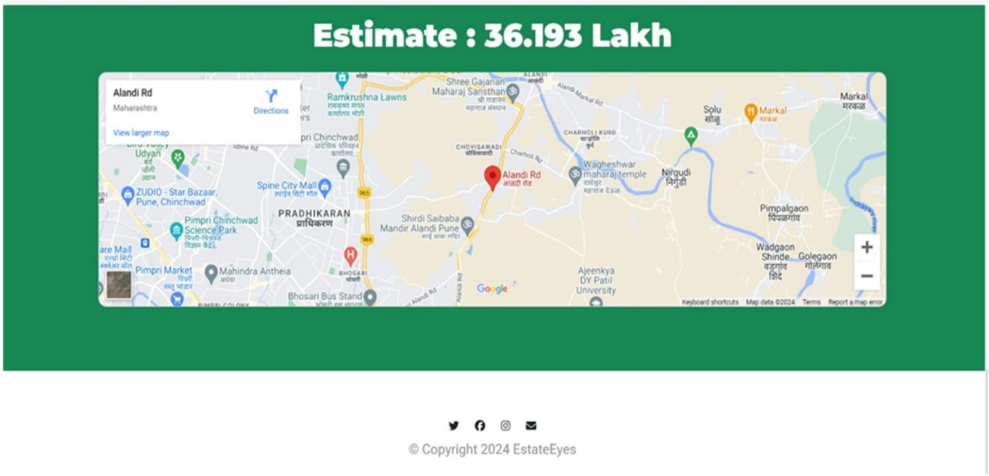


Fig. 5: Estimated Result

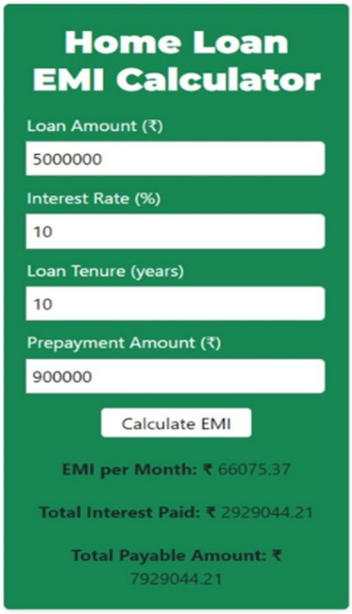


Fig. 6: EMI Calculator

V. CONCLUSION

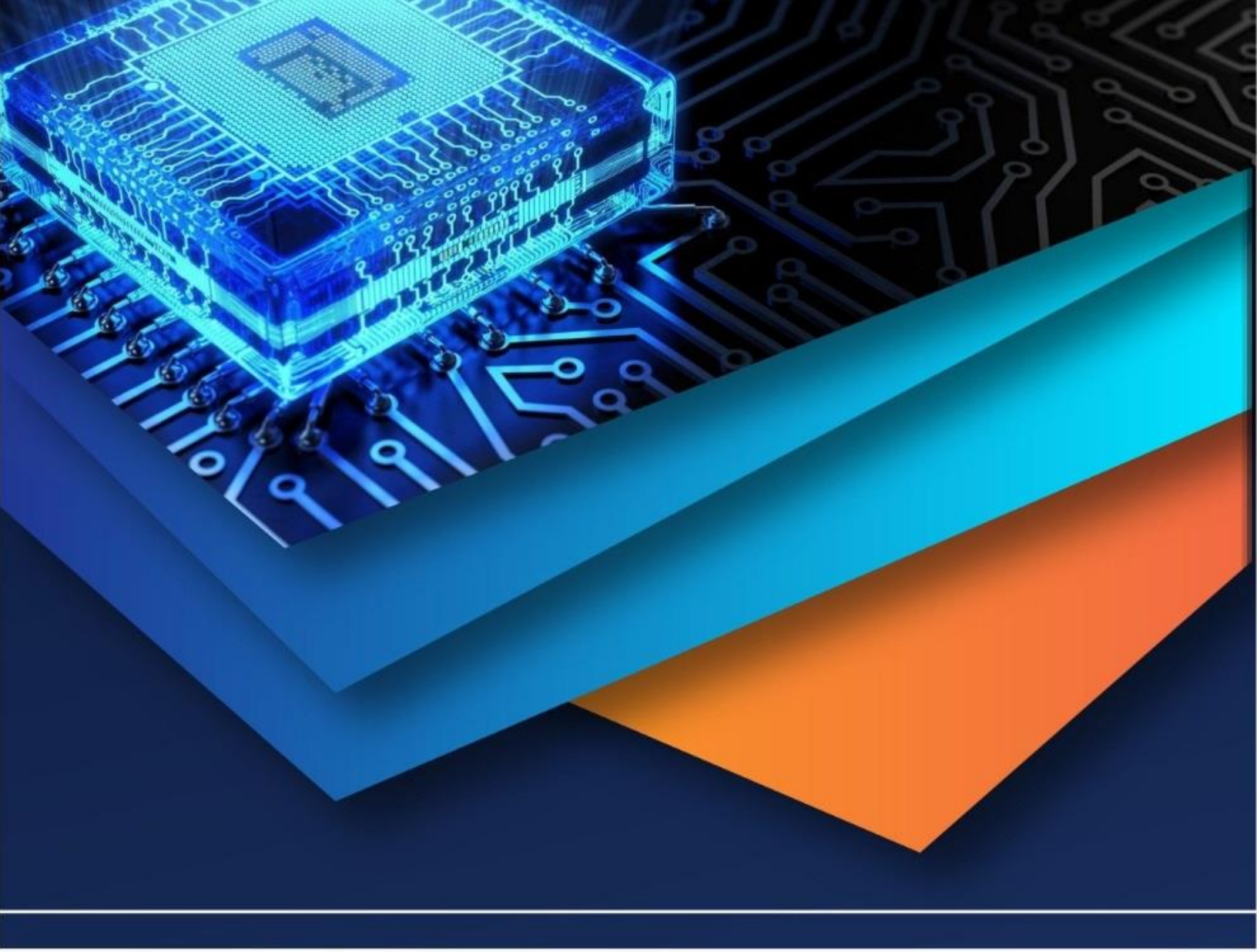
In conclusion, this project focused on the prediction of house prices using machine learning algorithms, namely Random Forest, Gradient Boosting, and Linear Regression. Through rigorous implementation and analysis, valuable insights were gained into the efficacy of these algorithms in the real estate domain. The results showcased the strengths of each model, with Random Forest exhibiting robust predictive capabilities, Gradient Boosting providing nuanced improvements through iterative learning, and Linear Regression offering a baseline understanding of linear relationships. Moreover, the utilization of ensemble techniques, such as stacking, further enhanced predictive accuracy and demonstrated the potential for model fusion in tackling complex regression tasks. This study contributes to the understanding of machine learning methodologies in real-world applications and lays the groundwork for future research endeavors aimed at refining housing price prediction models. By leveraging the diverse perspectives and strengths of various algorithms, practitioners can better navigate the complexities of the real estate market and empower informed decision-making processes.

VI. ACKNOWLEDGEMENT

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