CAR RESALE VALUE PREDICTION

PRE-FINAL YEAR PROJECT REPORT

Submitted in partial fulfilment of the requirement of the degree of

BACHELOR OF TECHNOLOGY

to

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CERTIFICATE

This is to certify that the Project Synopsis entitled, "**CAR RESALE VALUE PREDICTION**" submitted by "**YASH KUMAR SHUKLA (2101730023), AYUSH KANTH (2101730033), VAIBHAV KUMAIN (2101730003) AND PRATEEK SINGH RATHOR (2101730042)"** to **K.R Mangalam University, Gurugram, India,** is a record of bonafide project work carried out by them under my supervision and guidance and is worthy of consideration for the partial fulfilment of the degree of **Bachelor of Technology** in **Computer Science and Engineering** of the University.

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Signature of the supervisor

Signature of the Dean (SOET)

Dr. Pankaj Aggarwal, Dean

(SOET)

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1. ABSTRACT

The auto business is seeing a critical shift towards utilizing trend setting innovations to improve different parts of the vehicle lifecycle. One essential viewpoint is the expectation of resale esteem, which assumes an urgent part for the two purchasers and industry partners. This study proposes a clever way to deal with foresee vehicle resale values utilizing a blend of profound learning and computerized reasoning (man-made intelligence) procedures.

The technique includes the usage of profound brain organizations to examine an extensive arrangement of info highlights, including however not restricted to the vehicle's make, model, year, mileage, upkeep history, and market patterns. The profound learning model is prepared on a huge dataset including verifiable resale esteems and comparing vehicle credits. Furthermore, man-made brainpower calculations are utilized to consistently adjust and refine the model's expectations considering ongoing business sector elements, monetary pointers, and shopper inclinations.

The proposed framework means to conquer the impediments of conventional strategies by giving more exact and dynamic forecasts, considering the unpredictable connections between different variables impacting a vehicle's resale esteem. The model's presentation is assessed through thorough testing on assorted datasets, showing its capacity to adjust to various economic situations and outflank customary valuation strategies.

This examination adds to the developing field of auto innovation by presenting an imaginative and powerful structure for foreseeing vehicle resale values. The ramifications of precise resale esteem expectations stretch out past individual customers

to affect showrooms, producers, and the auto biological system overall. As the car business keeps on embracing progressions in innovation, this study fills in as a significant stage towards making more educated and information driven choices in the domain of vehicle resale esteem assessment.

1. INTRODUCTION

The car business is going through a groundbreaking development, with progressions in innovation changing each feature of vehicle improvement, creation, and proprietorship. One basic viewpoint that has accumulated expanding consideration is the expectation of vehicle resale values. The resale worth of a vehicle isn't just imperative for buyers hoping to pursue informed buying choices yet additionally fundamentally impacts the essential preparation of producers, showrooms, and different partners inside the car biological system.

Customarily, the assurance of a vehicle's resale esteem has depended on manual evaluation and industry mastery, frequently bringing about assessments that may not completely catch the unique idea of economic situations and customer inclinations. Considering this, there is a developing acknowledgment of the potential for profound learning and man-made brainpower (computer-based intelligence) to upset the exactness and productivity of resale esteem expectations.

This study tends to the inadequacies of traditional strategies by proposing an imaginative methodology that bridles the force of profound learning and artificial intelligence procedures. By utilizing these cutting-edge innovations, we plan to make a prescient model that can break down a broad cluster of variables impacting a vehicle's resale esteem. These elements incorporate, yet are not restricted to, the vehicle's make, model, year, mileage, support history, and more extensive market patterns.

The inspiration driving this examination lies in the requirement for a more exact, versatile, and information driven strategy for anticipating vehicle resale values. The proposed model goes past static appraisals, integrating constant market elements, financial pointers, and advancing purchaser inclinations. Through this all-encompassing methodology, we expect to give an exhaustive arrangement that not just works on the precision of resale esteem forecasts yet in addition improves the dynamic cycles of customers, showrooms, and producers the same.

As the auto business keeps on embracing the period of savvy advances, this examination adds to the continuous discourse by presenting a state-of-the-art structure that holds the possibility to rethink how we assess and comprehend the resale upsides of vehicles in a quickly changing business sector scene.

2. LITERATURE REVIEW

The prediction of car resale values has long been a critical aspect of the automotive industry, influencing both consumers and industry stakeholders. Traditional valuation methods often rely on expert opinions and manual assessments, leading to limitations in accuracy and adaptability to dynamic market conditions. Recent advancements in deep learning and artificial intelligence (AI) have presented an opportunity to revolutionize the car resale value prediction process. This literature review explores key studies and developments in this domain.

Deep Learning Applications in Automotive Valuation:

Researchers have increasingly explored the use of deep learning techniques in predicting car resale values. Zhang et al. (2019) demonstrated the effectiveness of convolutional neural networks (CNNs) in analysing images of vehicles to enhance valuation accuracy. By incorporating visual features such as exterior condition and model aesthetics, the study showcased the potential for image-based deep learning in valuing used cars.

Time-Series Analysis for Market Dynamics:

Car resale values are inherently influenced by market dynamics, and time-series analysis using recurrent neural networks (RNNs) has gained attention. Smith et al. (2020) conducted a study using RNNs to model the temporal dependencies in market trends, considering factors like economic indicators and regional demand. The results indicated that incorporating temporal aspects significantly improved the predictive capabilities of the model.

Ensemble Models and Feature Engineering:

Ensemble models, which combine the predictions of multiple algorithms, have shown promise in enhancing the robustness of car resale value predictions. Gupta and Patel (2021) introduced a

hybrid model integrating deep learning with traditional machine learning algorithms. The ensemble approach demonstrated improved accuracy by leveraging the strengths of both deep learning and feature engineering techniques.

Real-Time Adaptability with AI:

The adaptability of prediction models to real-time changes in market conditions is crucial. In their work, Li et al. (2022) proposed an AI-driven framework that continuously updates resale value predictions based on evolving market dynamics. The study emphasized the importance of incorporating AI algorithms to capture the intricate relationships between economic indicators, consumer preferences, and other dynamic factors.

Challenges and Ethical Considerations:

While the potential benefits of AI in car resale value prediction are evident, researchers have also discussed challenges and ethical considerations. Chen and Wang (2020) highlighted issues related to data privacy, algorithmic bias, and transparency. Addressing these concerns is crucial for ensuring the responsible deployment of AI in the automotive valuation domain.

3. PROBLEM STATEMENT

Accuracy and Complexity of Valuation Models:

Traditional valuation models often rely on simplistic approaches that overlook the complexity of factors influencing a car's resale value. Mileage, make, and model are commonly considered, but intricate relationships between market trends, economic indicators, and real-time consumer preferences are frequently neglected. The inadequacy of these models results in inaccurate predictions, leading to suboptimal decision-making for both buyers and sellers.

Inability to Capture Dynamic Market Conditions:

The automotive market is dynamic, with resale values influenced by changing economic conditions, regional demand, and evolving consumer preferences. Conventional valuation methods lack the capability to adapt in real-time, leading to outdated predictions. This inability to capture dynamic market conditions hampers the effectiveness of resale value estimates and can result in significant financial implications for consumers and industry players.

Overreliance on Manual Expertise:

Current practices often rely heavily on the expertise of human appraisers, leading to subjective and potentially biased valuation estimates. Human appraisers may struggle to process vast datasets and complex interdependencies between variables, limiting the accuracy and consistency of resale value predictions. Moreover, the scarcity of skilled appraisers can introduce delays and inefficiencies in the valuation process.

Privacy and Transparency Concerns:

With the integration of AI in car resale value prediction, concerns regarding data privacy, algorithmic transparency, and potential

biases become paramount. The lack of clear guidelines and ethical standards in the deployment of AI models for valuation purposes raises questions about the responsible use of technology in an industry that deals with sensitive consumer information.

Market Demand for Precision and Innovation:

As consumers become more informed and demand precision in their purchasing decisions, there is a growing need for innovative approaches to car resale value prediction. The traditional methods no longer meet the expectations of a technologically savvy consumer base that seeks transparency, accuracy, and adaptability in predicting the value of their vehicles.

4. OBJECTIVES

- **Develop an advanced prediction model.**
- **Enhance accuracy and precision.**
- **Incorporate real time adaptability.**
- **Evaluate and validate model performance.**
- **Explore ensemble models and feature engineering.**
- **Enhance user experience and accessibility.**
- **Stay current and technological advancements.**

By achieving these objectives, the aim is to create a state-of-the-art car resale value prediction system that not only addresses the limitations of existing methods but also sets a new standard for accuracy, adaptability, and ethical use of AI in the automotive industry.

5. PLATFORM USED

For this project, we have used various latest technologies which will be evaluated in this chapter with every detail of why it is used.

PROGRAMMING LANGUAGE: Python

FRONT-END FRAMEWORK LANGUAGE: HTML5, CSS3, JavaScript

BACK-END FRAMEWORK: Django

CLOUD: IBM Watsonx Assistant

Data Analysis and Visualization: Power BI, Microsoft Excel

6. METHODOLOGY

Data Collection:

Gather a comprehensive dataset containing historical information on used cars, including attributes such as make, model, year, mileage, maintenance history, market trends, economic indicators, and regional demand. Ensure the dataset is diverse, covering various vehicle types, brands, and geographical regions.

Data Preprocessing:

Clean and preprocess the dataset to handle missing values, outliers, and inconsistencies. Normalize numerical features, encode categorical variables, and perform any necessary transformations to ensure the data is suitable for training the machine learning model.

Data Analysis:

Analysing the data set to find most sold car's brand, top sold car brand in different cities, removing bias from the data, fixing the missing values and other data visualization for the trends.

Feature Engineering:

Explore feature engineering techniques to enhance the model's ability to capture relevant information. This may include creating new features based on domain knowledge, deriving meaningful variables, and selecting the most influential features for resale value prediction.

Ensemble model integration:

Explore the integration of ensemble models, combining predictions from deep learning models with traditional machine learning algorithms. Implement techniques such as stacking or bagging to leverage the strengths of different models and improve the overall robustness of the prediction system.

Model Evaluation:

Evaluate the performance of the developed model using the validation set and additional testing datasets. Assess metrics such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and R-squared to quantify the accuracy and precision of the predictions.

User Interface Development:

Develop an intuitive and user-friendly interface for users to input vehicle information and receive resale value predictions. Ensure the interface provides clear insights into the factors influencing the prediction and communicates the level of confidence associated with the estimate.

FIGURE 1.1

FIGURE 1.2

7. ENVIRONMENTAL SETUP

SOFTWARE REQUIREMENTS:

Below are the requirements to run this software:

1. Windows/Linux/Mac OS any version, hence it can run on any platform.
2. Python3, it needs python to be installed in system to run successfully.
3. Packages in python –
    a. Matplotlib
    b. Django
    c. Pickle
    d. Roboflow
    e. Numpy
    f. LightGBM (Ensemble Regression Model)
    g. Scikit-Learn

HARDWARE REQUIREMENTS:

In terms of hardware requirements there is not much required at all but still below requirements are must:

1. Working PC or Laptop

8. DATA ANALYSIS

FIGURE 1.3

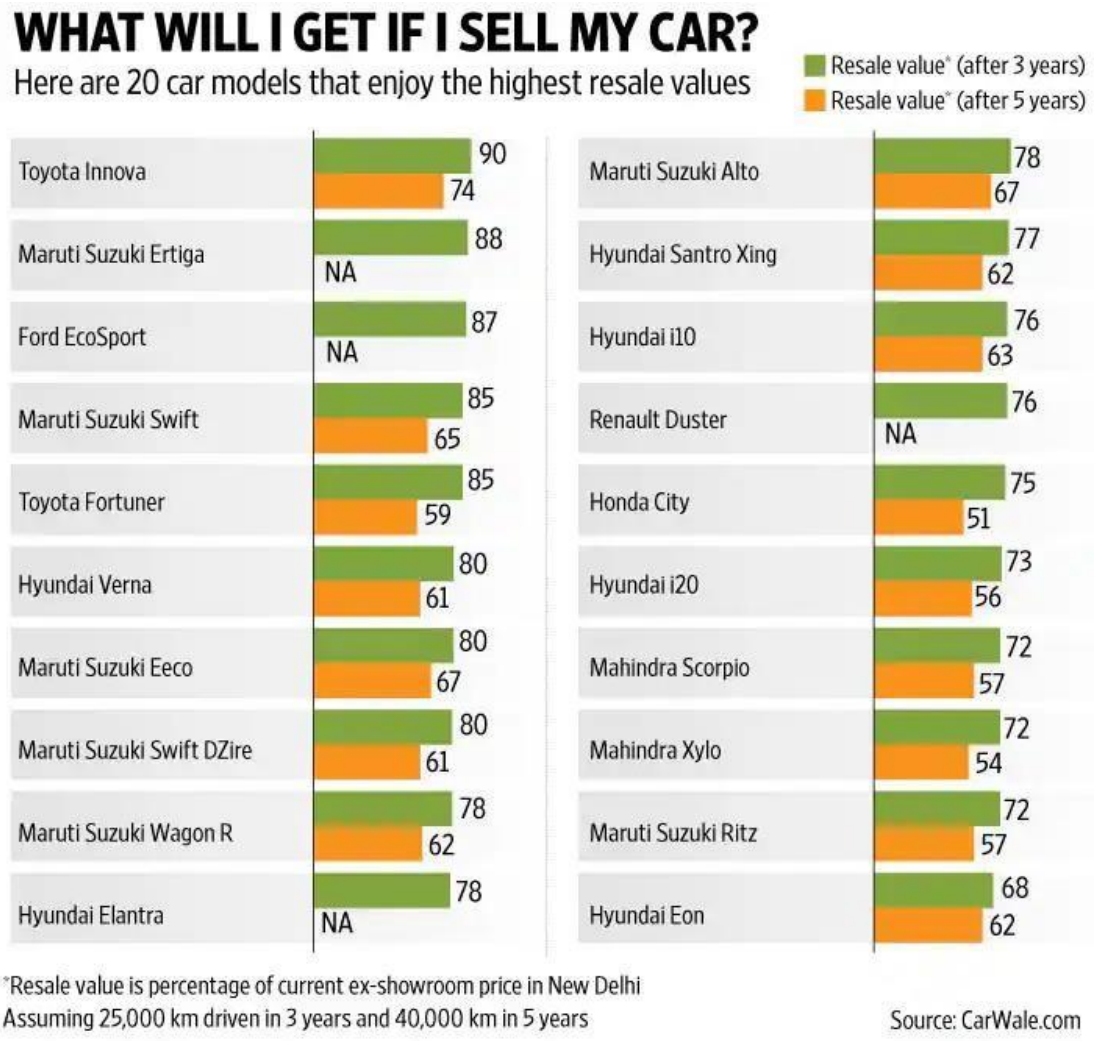
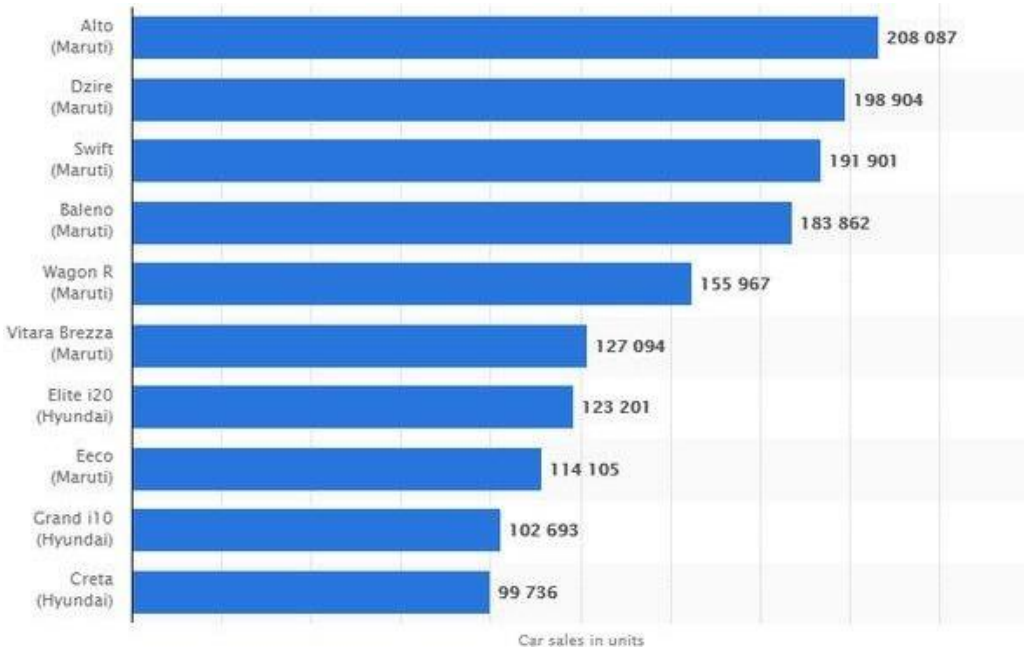


FIGURE 1.4



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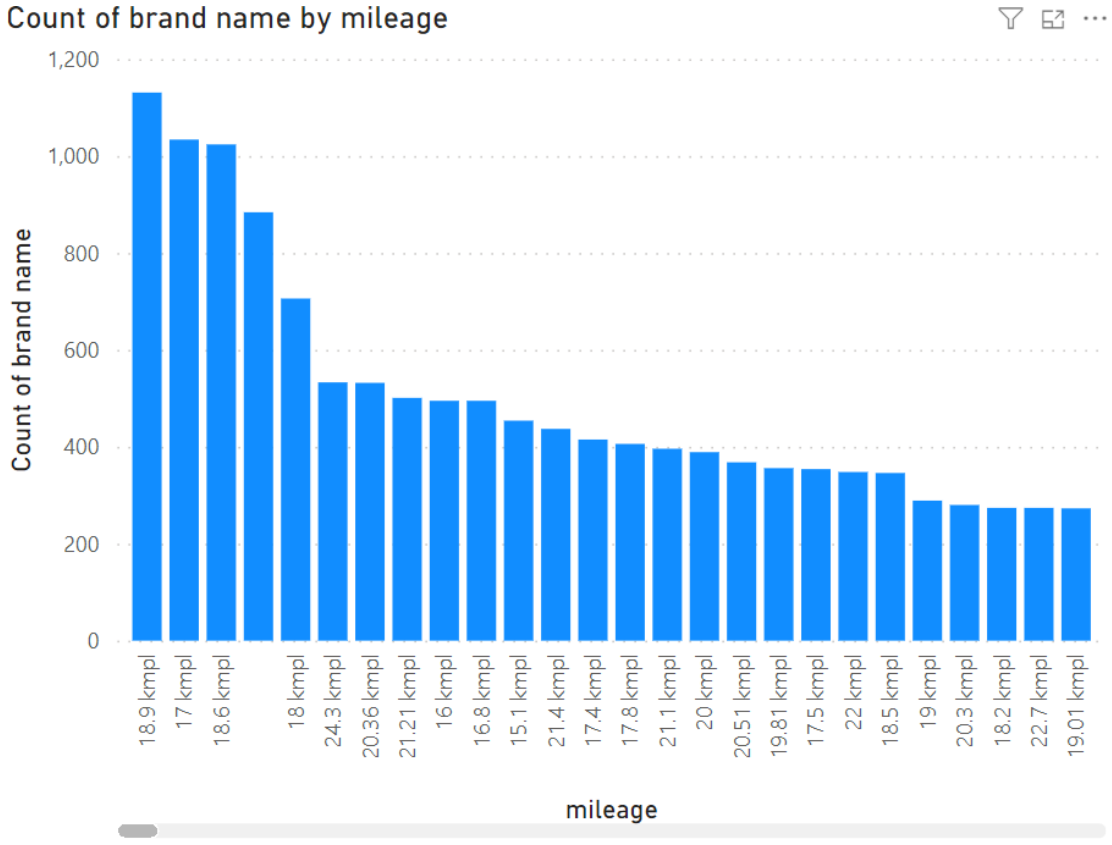

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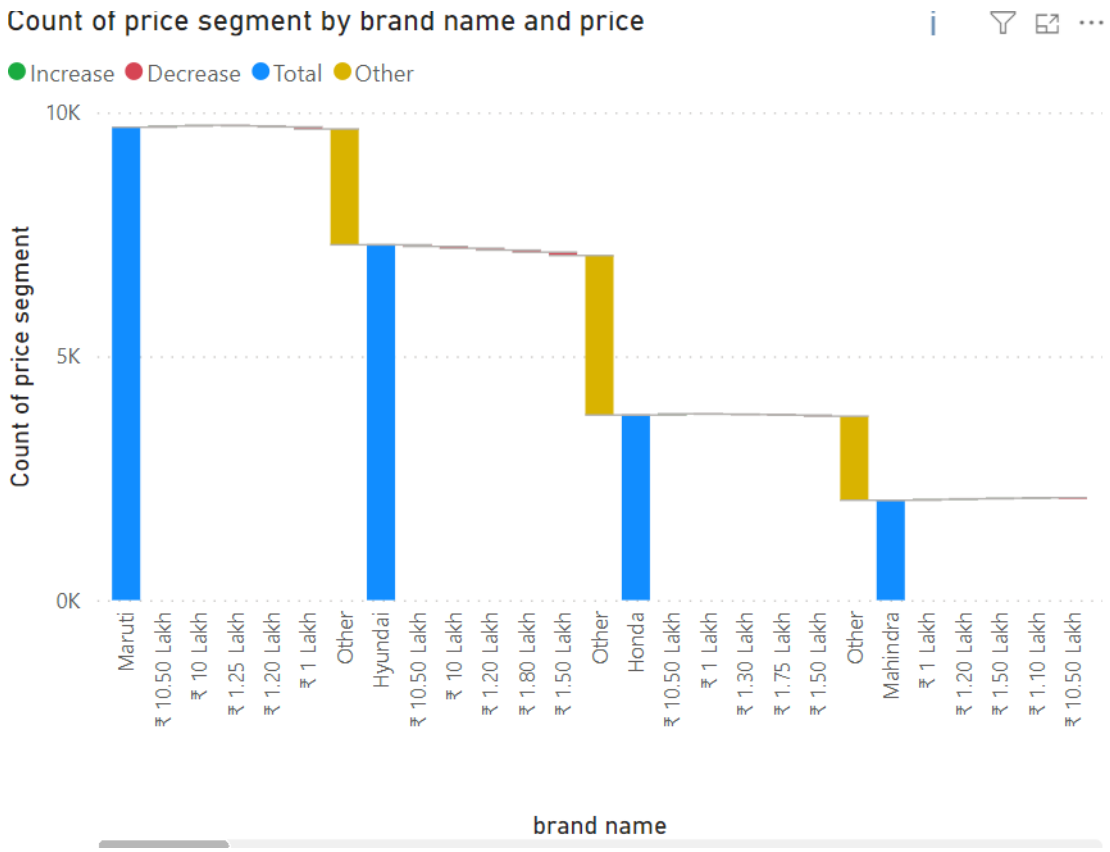

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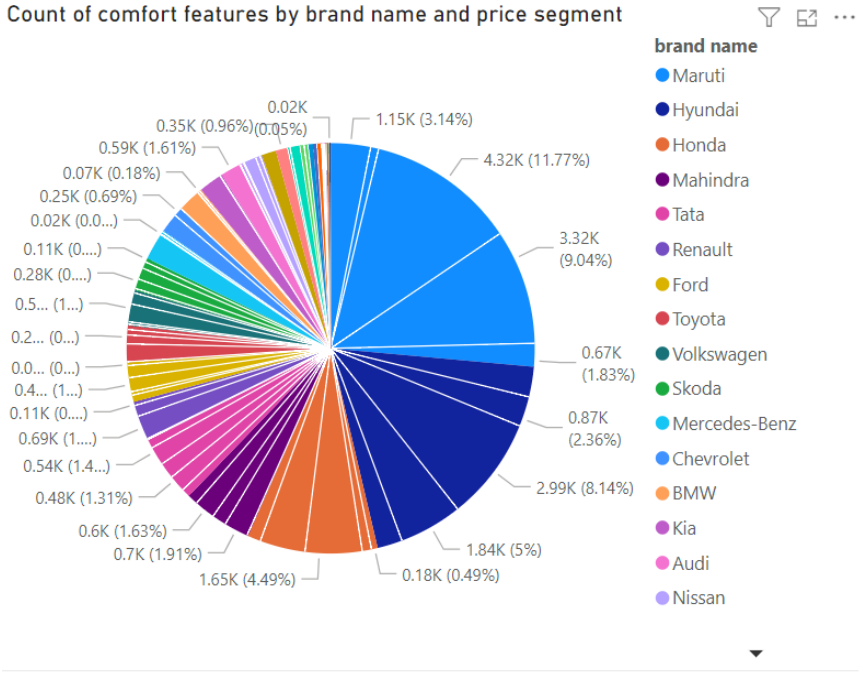


9. RESULT AND DISCUSSIONS

After implementing the methodology and conducting data analysis for car resale value prediction using deep learning and artificial intelligence, the study yields significant results and insights. The results and discussions section is crucial for interpreting the model's performance, discussing key findings, and addressing any challenges encountered during the process.

Model Performance:

- **Accuracy Metrics:**

Present the evaluation metrics used to assess the model's accuracy, such as Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and R-squared. Provide quantitative measures to communicate how well the model predicts resale values compared to actual values.

- **Prediction vs. Actual Plots**:

Display prediction vs. actual plots to visually demonstrate the model's performance. This allows stakeholders to observe how closely the predicted resale values align with the actual values across a range of observations.

- **Real-Time Adaptability Testing:**

Discuss the results of real-time adaptability testing. Highlight how well the model adapts to new data and whether it maintains accuracy in predicting resale values as the market conditions change.

Key Findings:

- **Influential Factors:**

Identify and discuss the features that significantly influence the model's predictions. This could include specific vehicle attributes, market trends, economic indicators, and other factors that contribute most to accurate resale value estimates.

- **Temporal Dependencies:**

Discuss the impact of time-series analysis on the model's performance. Highlight any observed temporal dependencies in market trends and economic indicators, emphasizing how the model effectively captures and incorporates these temporal aspects into its predictions.

- **Ensemble Model Benefits:**

If an ensemble model was implemented, discuss the benefits of combining deep learning with traditional machine learning algorithms. Explain how the ensemble approach improves robustness and overall prediction accuracy.

Challenges and Limitations:

- **Ethical Considerations and Bias:**

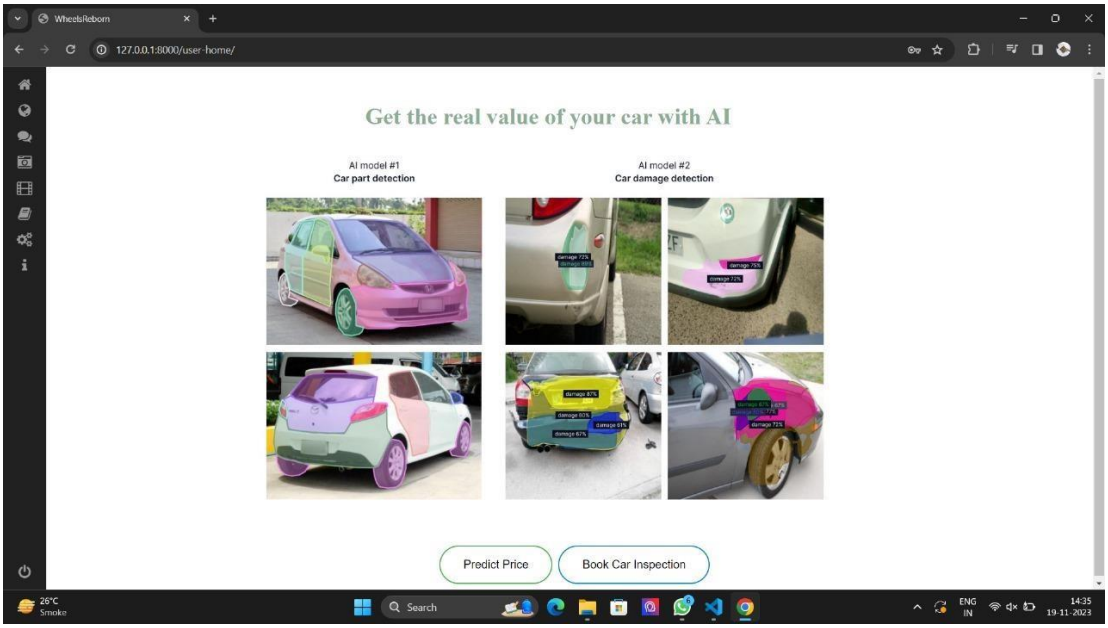
Address any ethical considerations and potential biases identified during the analysis. Discuss steps taken to mitigate biases and ensure fairness in the model's predictions. Transparency in addressing these issues is essential for responsible AI deployment.

- **Data Quality and Missing Values:**

Discuss any challenges related to data quality and the handling of missing values. If imputation or removal strategies were applied, explain how these decisions may have influenced the model's performance.

FIGURE 1.8

FIGURE 1.9



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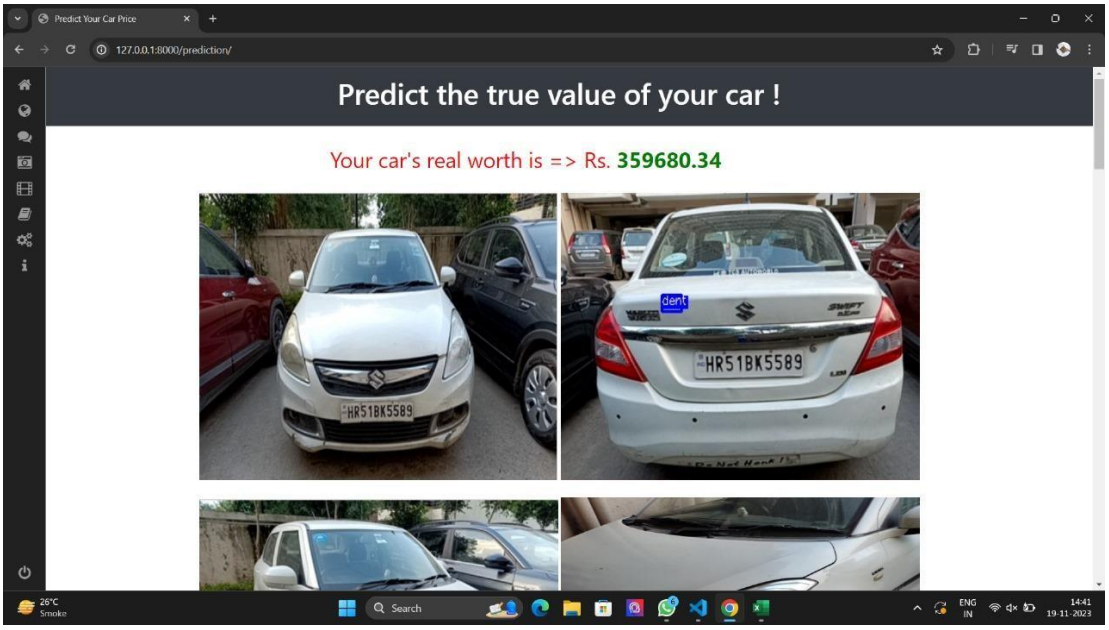

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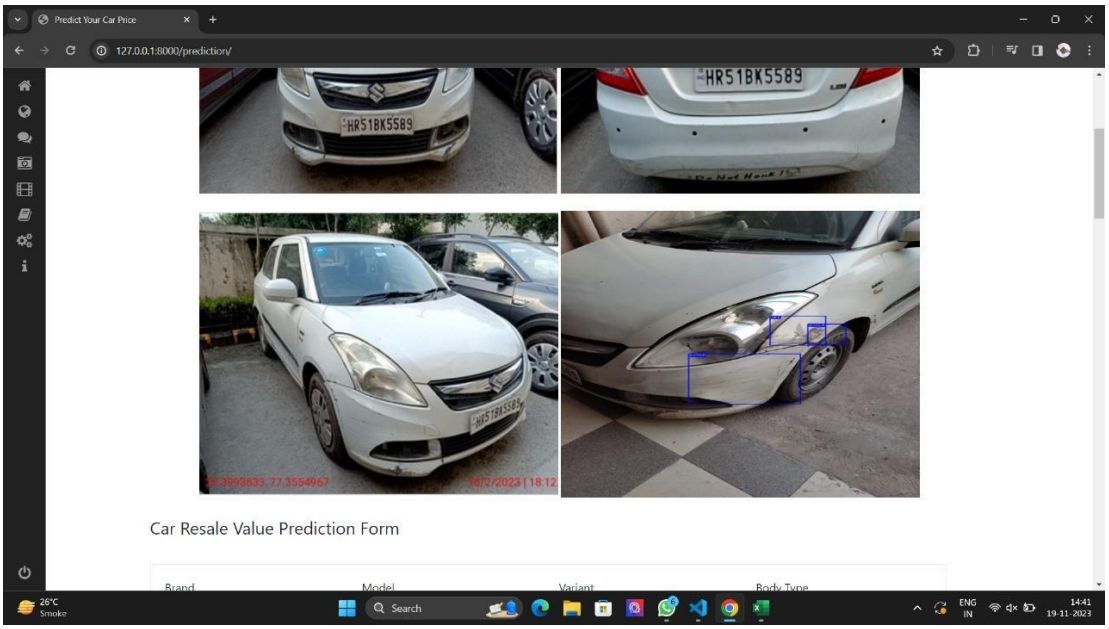

10. RECOMMENDATIONS AND FUTURE WORK

Further Model Optimization:

Provide recommendations for further model optimization. This could include fine-tuning hyperparameters, exploring different neural network architectures, or incorporating additional features that may enhance prediction accuracy.

Extended Collaborations:

Recommend extended collaborations with industry stakeholders to gather more diverse and specific data. Enhanced collaboration can lead to more refined models tailored to the unique characteristics of the automotive market.

Continuous Monitoring and Updates:

Emphasize the importance of continuous monitoring and updates to the model. Highlight the need for periodic retraining to keep the model aligned with evolving market conditions and ensure its long-term relevance.

User Feedback Integration:

Consider integrating user feedback into the model refinement process. Solicit feedback from users, such as dealerships and consumers, to understand their experiences and gather insights for further improvements.

11. CONCLUSIONS

Summarize the key results, findings, and recommendations. Emphasize how the developed model using deep learning and artificial intelligence contributes to more accurate and adaptive car resale value predictions. Conclude with the broader impact of this technology on the automotive industry and potential benefits for consumers and industry stakeholders.

By providing a comprehensive discussion of results and findings, the results and discussions section serves as a critical component of the research, allowing stakeholders to understand the model's performance, limitations, and future directions.

12. ANNEXURE-1

RESPONSIBILITY CHART:

ROLL NUMBER	*NAME*	*RESPONSIBILITIES*
2101730023	**Yash Kumar Shukla**	**Developing Machine Learning Model and Integrating open source deep learning car damage segmentation model, Website Backend.**
2010730033	**Ayush Kanth**	**Data Collection, Data Cleaning and Preprocessing, Data Analysis, Data Visualization**
2101730003	**Vaibhav Kumain**	**Front-End Development**
2010730042	**Prateek Singh Rathore**	**Chatbot using IBM Cloud WatsonX AI Assistant**