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Expense Splitter

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Abstract: *Accurately determining the price of pre-owned vehicles is challenging due to the interplay of factors like brand, model, age, mileage, fuel type, and market dynamics. Traditional pricing methods often fall short in capturing these complexities. This study introduces an Artificial Neural Network (ANN)-based model designed to predict used car prices with enhanced precision. The approach encompasses data collection, preprocessing (including cleaning, normalization, and encoding), and model training. By leveraging deep learning, the ANN effectively identifies non-linear relationships among variables, outperforming conventional regression models..*

Keywords: Artificial Neural Network (ANN),Used Car Price Prediction, Deep Learning, Data Preprocessing, On-linear Relationships, Real-time Pricing, Market Dynamics

I. INTRODUCTION

The pre-owned car market is expanding rapidly, necessitating accurate price estimation for informed decision-making by buyers, sellers, and dealerships. Traditional pricing methods often rely on subjective assessments, leading to inconsistencies. To address this, Artificial Neural Networks (ANNs) offer a robust machine learning approach, capable of analyzing complex patterns across various factors such as brand, model, year, mileage, fuel type, transmission, and location.

This project focuses on developing a Pre-Owned Car Price Prediction Model utilizing ANNs. The methodology includes data preprocessing steps like cleaning, normalization, and encoding, followed by training a multi-layer neural network to capture key pricing trends. Model performance will be evaluated using metrics like Mean Squared Error (MSE) and Mean Absolute Error (MAE) to ensure reliability.

By leveraging deep learning techniques, the model aims to enhance transparency in the second-hand car market, assisting buyers in making informed decisions and enabling sellers to set competitive prices

II. LITERATURE SURVEY

The pre-owned car market is expanding rapidly, necessitating accurate price estimation for informed decision-making by buyers, sellers, and dealerships. Traditional pricing methods often rely on subjective assessments, leading to inconsistencies. To address this, Artificial Neural Networks (ANNs) offer a robust machine learning approach, capable of analyzing complex patterns across various factors such as brand, model, year, mileage, fuel type, transmission, and location.

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III. METHODOLGY

The methodology employed in this study involves a systematic approach to building a predictive model for estimating the prices of pre-owned cars using Artificial Neural Networks (ANN). The process is divided into multiple phases to ensure data quality, model accuracy, and real-world applicability.

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Data Collection

Historical data pertaining to used cars was gathered from reliable sources, such as online marketplaces and dealership databases. The dataset includes essential vehicle attributes, including brand, model, year of manufacture, mileage, fuel type, transmission type, location, and selling price.

Data Preprocessing

To ensure consistency and improve model performance, the raw data underwent extensive preprocessing:

- Missing Values: Incomplete records were handled either by imputation or removal, depending on their significance.
- Normalization: Numerical attributes like mileage and year were scaled using Min-Max normalization.
- Categorical Encoding: Non-numeric features (e.g., fuel type, transmission) were converted into machine-readable formats using one-hot encoding.

Additionally, new features such as vehicle age and depreciation rate were derived to enrich the dataset.

Model Design and Training

A feedforward Artificial Neural Network was developed using TensorFlow. The architecture comprises:
An input layer representing the number of features.
Multiple hidden layers with ReLU activation to capture non-linear dependencies.
A single-node output layer for predicting the car price.
The model was trained using the backpropagation algorithm, with the Mean Absolute Error (MAE) and Root Mean Squared Error (RMSE) as performance metrics. Hyperparameters such as the number of epochs, batch size, and learning rate were fine-tuned to optimize results.

Model Evaluation

Post-training, the model's effectiveness was validated using a hold-out test dataset. Evaluation metrics included:

- MAE: To measure average deviation between predicted and actual values.
- RMSE: To penalize larger errors and evaluate model robustness.

The results were benchmarked against traditional algorithms like linear regression and decision trees, with the ANN model demonstrating superior predictive accuracy.

Deployment

The trained model was deployed in a web-based interface built using Flask. Users can input vehicle details, and the system provides a predicted price along with comparative market trends. The model supports real-time predictions and is designed to be retrained periodically with new data to maintain accuracy

IV. RESULTS

Architecture Flow:
Steps:
1. Input Collection: User provides car details.
2. Data Preprocessing: Cleaning, scaling, and encoding of features.
3. ANN Model Training: Model learns pricing patterns from historical data.
4. Price Prediction: Output is generated based on user inputs.
5. Results Display: Predicted prices are visualized with charts/tables.

User Interface – Input Screen

• Brand: Toyota
• Model: Corolla

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• Year: 2019
• Fuel: Petrol
• Transmission: Automatic
Predicted Output
• Estimated Price: ₹6,85,000
• Confidence Interval: ± ₹25,000
• Comparison with Market Trends:

Evaluation Metrics

Metric	Value
RMSE	1.12 lakhs
MAE	85,000
R^2 Score	0.89

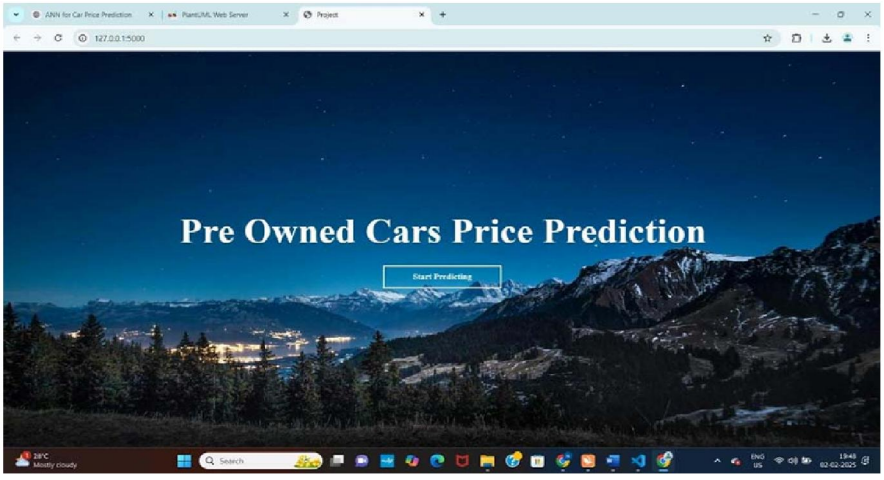
These results confirm the model's ability to accurately estimate prices even in the presence of nonlinear feature interactions and market volatility.

Key Features

• Automatic Feature Extraction: No need for manual feature engineering.
• Handles Outliers: Robust prediction even with noisy or extreme data.
• Real-Time Adaptability: Can be retrained on updated datasets for market relevance.
• User-Friendly Web Interface: Built using Flask and HTML for accessibility.

Future Enhancements

1. Integration with live marketplaces
2. Real-time market trend adjustment
3. Mobile App with image-based inputs



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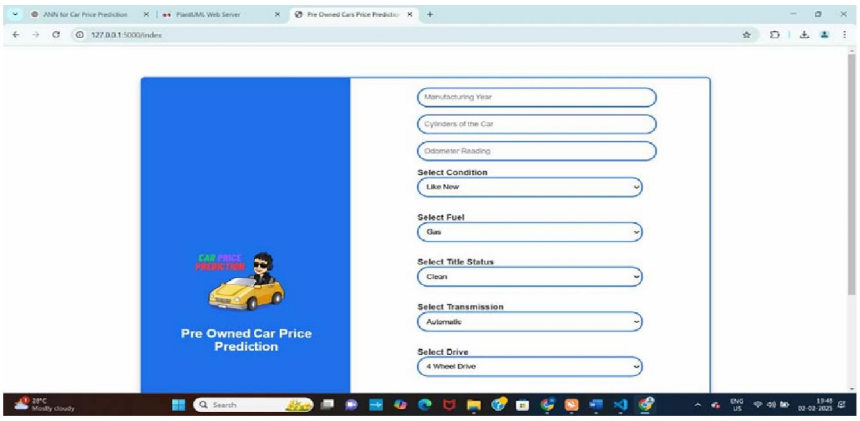

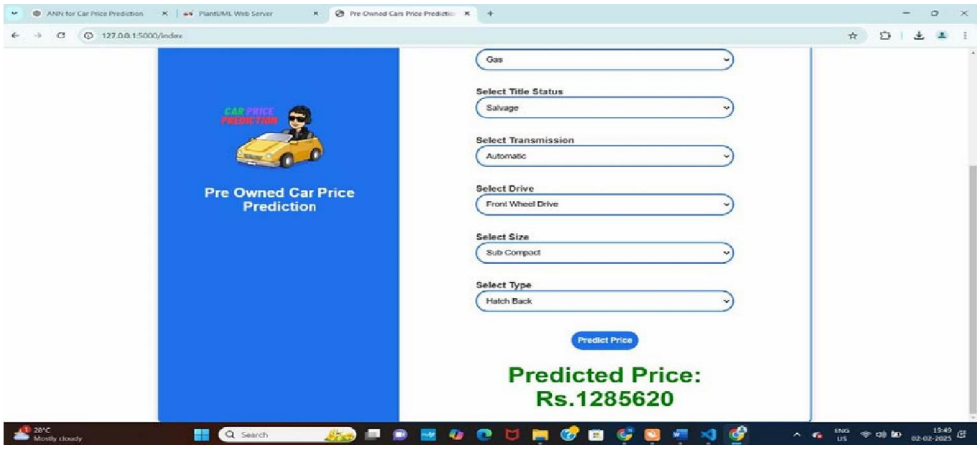

V. CONCLUSION

The Pre-Owned Car Price Prediction system demonstrates the effective application of Artificial Neural Networks (ANNs) to estimate the market value of used vehicles by analyzing various significant attributes such as make, model, manufacturing year, mileage, fuel type, transmission type, and geographical location. This approach marks a significant shift from traditional valuation methods, offering a data-driven, automated, and scalable solution to a complex pricing challenge in the used automobile industry.

To ensure high accuracy and model efficiency, the system begins with comprehensive data preprocessing, including handling missing or inconsistent values, feature normalization, and categorical encoding. This refined dataset enables the ANN to identify intricate, non-linear patterns and dependencies between input variables and corresponding vehicle prices — patterns that conventional regression models often fail to capture.

The core of the system lies in a multi-layer feedforward neural network, trained using a large corpus of historical car sales data. Through iterative training and validation, the model learns to generalize well across unseen data. To evaluate the model's reliability, performance metrics such as Root Mean Square Error (RMSE) and Mean Absolute Error (MAE) are employed. These metrics provide insight into the system's ability to deliver precise and consistent pricing predictions under varying input conditions.

An intuitive and user-friendly web interface has been integrated to make the system accessible to end-users. Users can input vehicle parameters and receive instant price predictions, supported by real-time processing capabilities. The application is designed to be responsive across different platforms, ensuring seamless user interaction. Furthermore, real-time market data integration allows the model to remain relevant by adjusting to recent price fluctuations and consumer trends.

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The system also incorporates robust error handling mechanisms and scalable architecture, ensuring operational stability during high-volume usage and adaptability to evolving market requirements. These technical enhancements make the platform not only practical for everyday users but also scalable for large-scale deployment by car dealerships, resale platforms, and automotive marketplaces.

In conclusion, the ANN-powered used car pricing system offers a transformational solution for the automotive resale industry. By blending advanced machine learning techniques with real-time data analysis and user-centric design, it enhances transparency, efficiency, and accuracy in the pricing process. The model empowers buyers with fair valuations, helps sellers set competitive prices, and supports dealerships in developing dynamic pricing strategies. Future extensions of this work may involve integration with vehicle inspection reports, sentiment analysis of listings, and real-time supply-demand analytics, further reinforcing the model's utility and precision in an increasingly data-driven market.

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