IJITCE

ISSN 2347- 3657

International Journal of Information Technology & Computer Engineering

Email : ijitce.editor@gmail.com or editor@ijitce.com

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2, 2025

Examination of Machine Learning for the Prediction of Used Car Values

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Abstract

At the outset, the manufacturer sets the price for vehicles of a certain brand, model, and year that come with a certain set of characteristics. Their value changes with time and the secondary market based on factors like supply and demand for their unique characteristics and their unique history. The more unique they are in comparison to other vehicles of a similar kind, the more difficult it is to evaluate them using standard techniques. A more precise valuation of a vehicle is possible with the use of Machine Learning (ML) algorithms that make greater use of data on all of its less common features. Machine learning (ML) techniques including Linear Regression, Ridge Regression, Lasso Regression, and Random Forest Regression are evaluated in this study for their ability to predict used car values. An successful tool for predicting prices relies heavily on its dataset, which improves its capacity to provide accurate forecasts in the complex and ever-changing used automobile market. Machine learning—more especially, a linear regression model trained on the carefully selected dataset—is the backbone of the Car Price Predictor. In this scenario, the characteristics included in the automobile affect its price, and linear regression, a basic statistical analysis tool, skillfully fits a linear equation to the observed data points to enable the model to predict the numeric value of the target variable. to account for depreciation, which enables a better use of past data for forecasting present pricing. The research study analyzed a large public dataset that included pre-owned automobiles.

Keywords— Supervised machine learning algorithms, price prediction, used vehicles, regression analysis, depreciation

INTRODUCTION

At the very top in its field, the Car Price Predictor is an advanced web-based application that provides consumers with an exceptionally precise estimate of the worth of used cars. The program focuses on using the linear regression method to its full potential and is based on state-of-the-art machine learning techniques. This tool is based on a large dataset that has been carefully selected to include many different factors that are important for estimating how much an automobile is worth. Important facts such as the vehicle's make, model, year of purchase, fuel type, and total kilometers driven are among these variables. Careful attention to detail in handling data is a hallmark of the Car Price Predictor's dedication to accuracy. In order to ensure that the tool's predictive model is as accurate as possible, it performs thorough cleansing and preprocessing on the dataset before making any predictions [1]. Training the model on a high-quality dataset is ensured by this meticulous approach. While training, the suggested model takes into account a large number of input features—the year of purchase, model, and manufacturer—and outputs a single variable—the price of the vehicle. The model can extend its knowledge from past data and produce accurate predictions for new occurrences by learning from previous data. When dealing with market variables like gasoline price swings, economic uncertainty, and other factors that impact vehicle costs, the capacity to quickly adjust to new circumstances is invaluable. After training and validating the model, the Car Price Predictor converts its predictive power into an intuitive online interface. The app's user-friendly layout allows users to quickly and easily enter their desired car's specifications. Details such as fuel type and kilometers traveled are included with the more basic information like manufacturer, model, and year of purchase. Everyone, even those with little technical knowledge, will be able to utilize the tool because to its intuitive design. The Car Price Predictor goes into gear as soon as it gets these inputs. It takes the supplied data and runs it through the trained linear regression model to provide an accurate estimate of the car's pricing [2]. Next, the consumer is given this forecast in an easy-to-understand format, frequently with visuals and explanations to assist them comprehend what went into making the prediction. Customers are able to make educated judgments about what to buy or sell in a market that might be difficult to understand at times because of this openness. The

ISSN 2347–3657

Volume 13, Issue 2, 2025

user interface is only the beginning of the Car Price Predictor's all-encompassing methodology. With a focus on data preparation and state-of-the-art machine learning models, the tool demonstrates a dedication to provide trustworthy estimates in the dynamic used vehicle price market. Users may confidently traverse the complexity of the used automobile market thanks to the fusion of innovative technology and diligent attention to data quality. In addition to being a prediction engine, the tool is a useful resource that may improve decision-making and help create a more informed and efficient car market.

LITERATURE REVIEW

There is already a study that employs supervised machine learning techniques to forecast used car prices in Mauritius. Daily newspapers provide the historical data used to make the projections. These forecasts have been developed using a variety of methods, such as decision trees, naive Bayes, k-nearest neighbors, and multiple linear regression analysis [1]. The area of machine learning-based automobile price prediction has also been the subject of another research study [2]. To make sure the forecasts are accurate and reliable, we look at a lot of different distinct qualities. Three separate machine learning algorithms, including ANN (Artificial Neural Network) and Random Forest, were utilized by the researchers to simulate the forecast of used automobile pricing [3]. A price assessment model for the used car business is the subject of the research and development efforts suggested in [4]. The research mainly uses a BP (Back propagation) neural network as its main technique. This methodology stands out because it uses big data analysis to combine a large amount of dispersed vehicle data with a massive database of transaction data. Proposing a strong price assessment model that makes use of the abundance of accessible data is the main goal of this research. The model's primary objective is to use the improved BP neural network algorithm to examine pricing data for different vehicle kinds. To make sure the model can accurately capture the intricacies of price dynamics in the used automobile market, this algorithm is fine-tuned to improve the analysis' efficiency and accuracy. This research aims to fill gaps in our knowledge of the variables that influence the price of used automobiles by using big data and cutting-edge neural network methods. This encompasses a wide range of characteristics, such as the vehicle's type and year, its past performance, current market trends, and more. One way to get useful and reliable price forecasts is with the use of the suggested price assessment model. Predicting costs that are most in line with the features of each kind of car is achieved by studying the vast dataset, learning from trends and patterns within the data, and applying this information [5]. We want to build a model that can take into account both the present state of the market and future trends and changes. By presenting a complex model that makes use of the capabilities of big data and neural network techniques, this research study essentially aims to make a contribution to the area of used-car pricing. In doing so, it hopes to provide a more dynamic and accurate method of assessing pricing in the used automobile market, which will help everyone involved in the transaction (buyers and sellers) to make an educated decision.

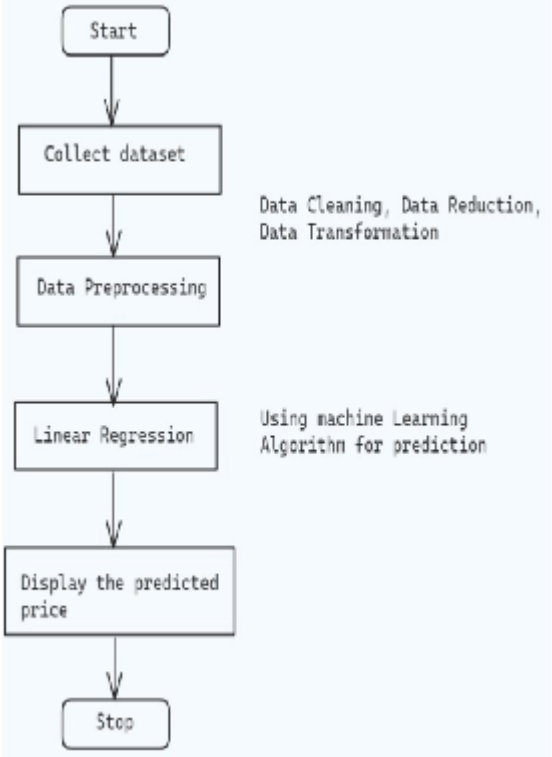
PROPOSED METHODOLOGY

There are essentially two stages to how the mechanism works: A. The first step is training, during which the system learns how to use the dataset to fit a model (a line or a curve) using the method of its choice. B. The testing step involves feeding the system data and seeing how it responds, with an eye on making sure it's accurate. Hence, appropriate data must be used for both training and evaluating the model [6]. Using suitable algorithms for these separate tasks is essential to the system's goal of identifying used vehicle prices and making price forecasts. Several algorithms were evaluated for accuracy before implementation-level algorithm selection, including the

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2, 2025



one deemed most suitable for the task was chosen.

Schematic of the Suggested System (Fig. 1) The first step is to gather the dataset, as shown in figure 1. The next step is data preprocessing, which includes operations like data reduction, data cleaning, and data transformation. The next step in making price predictions is to use machine learning techniques, such as Linear Regression. After selecting the model with the best forecasting accuracy, the user is given with the expected price based on their inputs. A internet interface allows users to easily enter data into a machine learning model, which then generates forecasts for used vehicle pricing [7]. To forecast the price of an automobile given the brand, model, year, mileage, engine size, and a variety of other features of a car. C. Linear Regression (LR): By using a linear equation on the data obtained, with one variable designated as the dependent factor, Linear Regression (LR) allows a connection between a group of variables. For example, picture a data analyst using a linear regression model to try to figure out how people's weights relate to their heights. Here, the model is used to investigate and measure the possible connection between these two crucial factors [8].

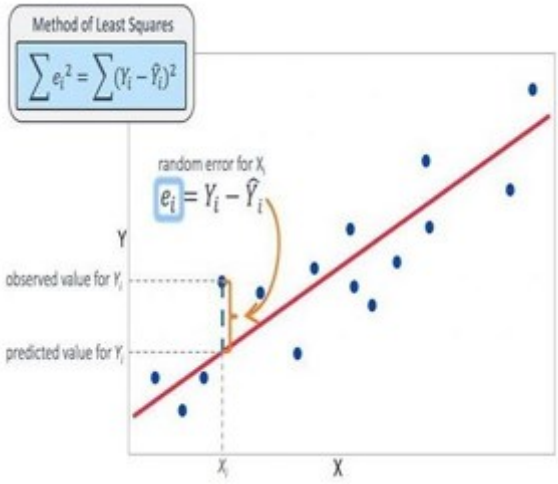


Fig. 2: General Representation of Linear Regression Process

The correlations between numerous continuous variables may be discovered using linear regression, which involves either one or more independent variables [9]. It is a useful tool for discovering relationships and interdependencies in a dataset, which may help you understand how changing one variable might affect the conclusion you're after. The expression an is equal to the sum of "c1D1 plus c2D2 plus c3D3 plus..." Add e to mc1, c2, and c3 Intercepts D1, D2, D3..., and the slope, e ... variables that are not reliant on one another It is also possible to build an API for the suggested model using frameworks like Flask or Django [10]. This research keeps tabs on the model's accuracy by retraining it with fresh data at regular intervals and seeing how well it can identify new data. When a model consistently and robustly predicts outcomes over a wide range of situations and data sets, we say that it is reliable [11].

RESULTS & DISCUSSION

Table I displays a portion of the dataset that was used for this investigation. DATASET USED (TABLE 1)

International Journal of Information Technology & Computer Engineering

ISSN 2347–3657

Volume 13, Issue 2, 2025

ID	Make	Model	Year	Price	Mileage	Engine Size	Fuel Type	Transmission	Horsepow
1	Toyota	Corolla	2016	15000	50000	1.8L	Petrol	Automatic	132
2	Ford	Mustang	2016	28000	45000	2.3L	Petrol	Manual	310
3	BMW	X5	2019	45000	15000	3.0L	Diesel	Automatic	335

CONCLUSION & FUTURE SCOPE

With the used car industry growing at an exponential rate throughout the world, this research concludes that a reliable method for predicting future prices of used automobiles is necessary. Using the Linear Regression (LR) approach from supervised machine learning, this research created a strong model that can evaluate a car's worth depending on many different factors. To train the model to uncover patterns and correlations that impact automobile pricing, this technique utilizes extensive datasets that comprise numerous parameters including make, model, year, mileage, and condition. The suggested approach shows great promise in delivering accurate price predictions, which may help buyers and sellers make well-informed decisions. Our system's goal is to create a more fair and efficient used automobile market by increasing market transparency and efficiency, which will help close the gap between consumer needs and available technology. Adding more variables and improving the algorithm using sophisticated machine learning methods should be the focus of future effort to improve the model's accuracy. To make the system even more versatile and resilient, you should add additional vehicles and market situations to the dataset. Taken together, the findings of this study provide a useful tool for both buyers and sellers in the used automobile market by demonstrating the potential of machine learning to solve real-world problems in this sector.

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