International Journal of Research Publication and Reviews

AI BASED PRICE PREDICTION MODEL USING MACHINE LEARNING

Virat Raj Saxena [1], Piyush Kumar [2], Abhishek Gupta [3], Anmol Tiwari [4], Arpit Kunwar [5]

[1] Assistant Professor, Raj Kumar Goel Institute of Technology, Ghaziabad viratfai@rkgit.edu.in

[2] Raj Kumar Goel Institute of Technology, Ghaziabad ag594275@gmail.com

[3] Raj Kumar Goel Institute of Technology, Ghaziabad anmol.tiwari2404@gmail.com

[4] Raj Kumar Goel Institute of Technology, Ghaziabad arpitkunwar09@gmail.com

[5] Raj Kumar Goel Institute of Technology, Ghaziabad piyushshroti819@gmail.com

ABSTRACT:

In the past few years, the automotive sector has experienced significant technological progress, leading to an increasing requirement for precise pricing models. Accurately predicting car prices plays a crucial role for various stakeholders, including manufacturers, dealerships, and consumers.[10]

The suggested model utilizes a diverse range of features, such as vehicle specifications, market trends, economic indicators, and historical pricing data. A comprehensive dataset containing various attributes like brand, model, year, mileage, fuel type, engine size, and geographical location is collected and pre-processed.

Through experimental evidence, it has been proven that the proposed car price prediction model is effective, achieving high accuracy and reliability in estimating the prices of different car models within various market segments. In summary, the proposed approach offers a practical and efficient solution for predicting car prices, thereby making a significant contribution to the advancement of pricing strategies in the automotive industry and enhancing the overall customer experience.

Keywords: Machine Learning, Linear Regression, Pre-processing, Flask, Prediction, Testing.

1. INTRODUCTION

The automobile industry is one of the most dynamic sectors globally, with incessant technological advancements, shifting consumer preferences, and economic fluctuations influencing car prices. Accurate prediction of car prices is crucial for various stakeholders, including manufacturers, dealers, insurers, and consumers. Predictive models play a pivotal role in assisting these stakeholders in making informed decisions, mitigating risks, and maximizing profitability.

This research paper aims to explore and compare various predictive models for forecasting car prices. By leveraging historical data encompassing factors such as brand, model, mileage, year, features, economic indicators, and market trends, predictive analytics techniques can provide insights into future car prices with reasonable accuracy. Understanding the strengths and limitations of different modelling approaches is essential for devising robust pricing strategies and enhancing market competitiveness.

Academically, it offers insights into the effectiveness of different predictive algorithms in forecasting car prices, thereby enriching the field of predictive analytics and machine learning. Practically, it provides valuable guidance to industry professionals on selecting the most suitable predictive model for their specific requirements, thereby facilitating better decision-making and improving business outcomes.
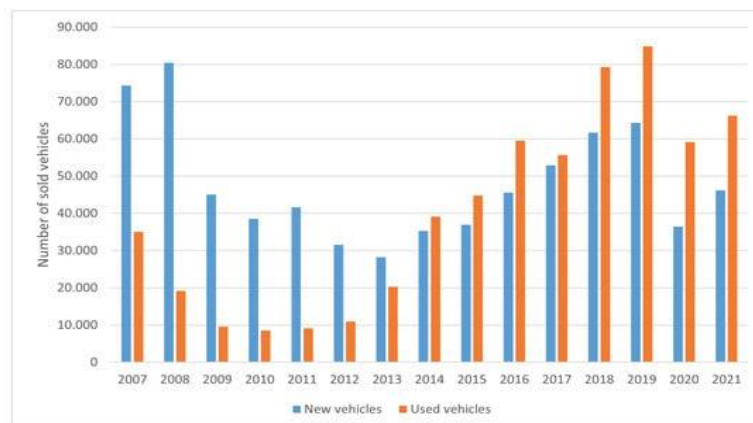
2. DESCRIPTION

The resale value of a used vehicle is not easily determined, as many people are unaware of the various factors that influence the price. These factors typically include the age, horsepower, origin, mileage, and make of the vehicle.

Additionally, gasoline type, indoors design, braking system, acceleration, engine size, protection features, size, variety of doors, paint colour, patron reviews, producer awards, cutting-edge condition, sports activities automobile classification, cruise manipulate availability, transmission type, and possession popularity all play a function in figuring out the value.

In Mauritius, buyers also consider the number of previous owners, accident history, and whether the vehicle was driven by a woman. The design of the car also significantly impacts its price.

2.1 PROPOSED METHOD

SOME KEY FACTS

1. The Company name, Model name, Year of Purchase, Fuel Type and Number of Kilometres driven are all some attributes which can influence the value of the car.
2. The characteristics that affect the car's pricing may differ by region and are difficult to predict precisely.
3. The trends changes quickly and since everyone has distinct likes and dislikes, modifying a car may have a negative impact on its worth.

MACHINE LEARNING

A branch of computer science known as machine learning allows machines to learn without being individually programmed. Among the most fascinating technologies that have ever been discovered, machine learning is one of them. As the name implies, it enhances the computer's intelligence by giving it the ability to learn. Machine learning is being implemented in a significant number of locations, far beyond one's expectations.[4]

The utilization of Artificial Intelligence has brought about significant changes in the realm of technology. It is important to mention that the terms Artificial Intelligence and Machine Learning are sometimes used interchangeably.

AI may be viewed from three angles:

I) The computer calculation used to decide.
II) The criteria and traits that should go into making a decision.
III) For base data, the response is known, which facilitates (readies) the system to develop.

3. PURPOSE OF THE STUDY

The objective of a study for predicting car prices typically involves developing accurate models or algorithms that can estimate price of car based on various factors. These factors may include attributes of the car itself (such as make, model, year, mileage, condition, features, etc.), as well as external factors like market trends, economic conditions, and geographical location. The study uses a dataset of sales pricing for multiple manufacturers and models to train various learning algorithms.[6]

Here are some key objectives and purposes of such a study:

1. **Market Understanding**: Gain insights into the factors that influence car prices in a particular market or region. This involves analyzing historical pricing data and identifying trends.
2. **Decision Support**: Provide valuable information to car buyers, sellers, dealerships, and financial institutions to make informed decisions about pricing, buying, selling, and financing cars.
3. **Optimization**: Optimize pricing strategies for car sellers to maximize profits and minimize inventory turnover time.
4. **Risk Assessment**: Assess the risk associated with investing in or financing certain types of cars based on their predicted prices and market conditions.
5. **Research & Development**: Drive innovation in machine learning and predictive analytics by continuously developing and improving algorithms to improve price forecast accuracy.
6. **Customer Satisfaction**: Enhance customer satisfaction by providing accurate price estimates, reducing negotiation friction, and ensuring fair pricing practices.

4. METHODOLOGY

There are two stages in the system:

1. Training stage: The system is trained to fit the model(line/curve) with the suitable algorithm chosen based on the values from the data set.
2. Testing stage: During the testing stage, the system is put through its paces and put through various tests to check if its efficient and working. The precision has been double-checked to model or test it, it must be appropriate.

4.1 PyCharm

PyCharm is an exclusive Integrated Development Environment (IDE) designed specifically for Python. It encompasses a wide array of indispensable utilities that are seamlessly integrated, ensuring a convenient workspace for Python programmers and developers. This IDE is highly effective for Python coding, data science, and web development.

4.2 PyCharm Features

PyCharm empowers developers with a wide range of features to optimize their coding experience. These include code inspections, intelligent code completion, real-time error flagging, and quick-fix solutions. Additionally, PyCharm offers advanced navigation capabilities and automated code refactoring to facilitate efficient and error-free coding.

1. The smart code editor in PyCharm offers unparalleled support for Python, CSS, JavaScript, TypeScript, Coffee Script, popular template languages, and more.
2. Utilizing PyCharm's ingenious smart search, users can easily navigate to desired classes, folders, or symbols, as well as access any IDE action or tool window, ensuring efficient code navigation within the IDE.
3. Debugging, Profiling and Testing: For Python and JavaScript, users can utilize the sophisticated debugger with an excellent graphical user interface.
4. Database tools: MySQL, SQL Server, PostgreSQL, Oracle and other databases can be accessed directly from the IDE.

4.3 Flask

Developers can easily build lightweight web applications using Flask libraries with the help of Flask, a web framework. Flask, a lightweight and compact Python web framework, offers essential features and tools for building cutting-edge Python applications. Offering an array of options, this framework entices developers, particularly those new to the field, with its ability to rapidly construct a web application using a single Python file. Some of the remarkable features offered by Flask include a development server and debugger, integrated support for unit testing, and compatibility with Google App Engine.

5. IMPLEMENTATION

On our data set, we're employing the Linear Regression approach to construct or refine an appropriate and efficient model for predicting the price of used vehicle.

Data collection

We are going to analyse a dataset obtained from the Kaggle repository, which provides details about second-hand vehicles. The estimated price of used car is determined by a range of factors. Important factors that influence value of pre-owned car are included in Kaggle dataset. The data has undergone thorough cleaning.

Input Attributes	Function/Values
car name	The name of car.
company name	The company of car.
year	The year in which car was bought.
price	The price at which owner wants to sell the car.
kms driven	The distance covered by car in kilometres.
fuel type	The fuel type of car.

	Year	Price	Kms_driven
Count	816.000000	8.160000e+02	816.000000
Mean	2012.444853	4.117176e+05	46275.531863
Min	1995.000000	3.000000e+04	0.000000
Max	2019.000000	8.500003e+06	400000.000000
Std	4.002992	4.751844e+05	34297.428044

Algorithm

A fundamental and often employed method in machine learning is the linear regression algorithm. Predictive analysis is being done here with the use of statistics. As suggested by the name, this algorithm establishes a linear relationship between the dependent variable and one or more independent variables. Linear regression, that demonstrates a linear relationship, can show how changes in the independent variable's value reflect changes in the dependent variable's value.[16]

6. FUTURE SCOPE

The future scope of AI-based car price prediction is quite promising and holds significant potential. Here are some aspects to consider:

1. **Enhanced Accuracy:** As AI algorithms continue to evolve and improve, their ability to predict car prices accurately will also advance. This would involve incorporating more data points such as market trends, consumer preferences, economic indicators, and even real-time data from various sources.
2. **Market Insights:** AI can provide valuable insights into market dynamics, helping car manufacturers, dealerships, and consumers make informed decisions. This could involve predicting future trends, identifying emerging markets, and understanding the factors influencing supply and demand.
3. **Decision Support Systems:** AI-powered car price prediction models can serve as decision support systems for buyers, sellers, and investors. By analyzing vast amounts of data, these systems can recommend optimal pricing strategies, negotiation tactics, and investment opportunities.
4. **Integration with Online Platforms:** AI-based car price prediction algorithms can be integrated into online platforms such as car selling websites, mobile apps, and automotive marketplaces. This would enable users to receive instant price estimates for vehicles based on various parameters.

The overall prospects of AI-based car price prediction appear promising, offering opportunities for innovation, efficiency, and value creation within the automotive industry. To fully realize the potential of this technology, however, issues like algorithm bias, data quality, and ethical considerations must be resolved.

7. CONCLUSION

In this study, we have investigated the creation and evaluation of multiple machine learning models for predicting car prices. By analyzing various features such as vehicle specifications, market trends, and economic indicators, we have explored the effectiveness of different algorithms in accurately estimating car prices.

In addition, feature engineering techniques and data pre-processing methods have played a pivotal role in boosting predictive performance of models. By deriving valuable insights from the data and addressing issues like missing values and outliers, we have strengthened the accuracy and robustness of our predictions.

In summary, by demonstrating the success of machine learning for forecasting vehicle prices, our study supports pricing techniques in the automotive industry. Through the utilization of advanced algorithms and comprehensive datasets, we have demonstrated how data-driven approaches can enhance pricing decisions and improve the overall customer experience in the automotive market.

REFERENCES :

1. Varma, A. Sarma, S. Doshi and R. Nair. (2018). House Price Prediction Using Machine Learning. (Second International Conference Inventive Communication and Computation Technologies),pp. 1936-1939
2. Jia (2021). Computer mathematical statistics applied in house price prediction through machine learning and linear regression. International Conference Data Science and Computer Application (ICDSCA), pp. 769-772,
3. Noor, K.; Jan, S. Vehicle Price Prediction Model using Machine Learning Technique. *Int. J. Comput. Appl.* **2017**, *167*, 27–31.
4. Yang, R.R.; Chen, S.; Chou, E. AI Blue Book: Vehicle Price Prediction Using Visual Feature. *arXiv* **2018**, arXiv:1803.11227.
5. Banet, K.; Naumov, V.; Kucharski, R. Using city-bike stopovers to reveal spatial patterns of urban attractiveness. *Curr. Issues Tour.* **2022**, *25*, 2887–2904.Pal, N.; Arora, P.; Sundararaman, D.; Kohli, P.; Palakurthy, S.S. How much is my car worth? A methodology for predicting used car prices using Random Forest algorithm. *arXiv* **2017**, arXiv:1711.06970.
6. Chen, C.; Hao, L.; Xu, C. Comparative analysis of used car price evaluation model. *AIP Conf. Proc.* **2017**, *1839*, 020165.
7. H.C. An expert system of price prediction for used cars using adaptive neuro-fuzzy inference. *Expert Syst. Appl.* **2009**, *36*, 7809–7817. Zhou, X. The usage of artificial intelligence in the commodity house price evaluation model.
8. Liu, E.; Li, J.; Zheng, A.; Liu, H.; Jiang, T. Research on Prediction Model of Used Car Price in View of PSO-GRA-BP Neural Network. *Sustainability* **2022**, *14*, 8993.]
9. Njuskalo.hr. 2022. (accessed on 30 May 2022).
10. V. R. Saxena, T. Hassan, A. Parveen, M., "A method for the identification and analysis of stakeholders of an information system using fuzzy TOPSIS", European Chemical Bulletin, Vol. 12, Issue 10, pp. 8391-8397, 2023.

11. V. R. Saxena, R. Yadav, A. Parveen and M. Sadiq, "A Mathematical Model for the Selection of Software Requirements Elicitation Techniques," 2024 14th International Conference on Cloud Computing, Data Science & Engineering (Confluence), Noida, India, 2024, pp. 130-135.

12. Panwar and P. J. Gaurav Dhuriya. (2021). Stock Market Prediction Using Linear Regression.(ICACIT) International Conference on Advance Computing and Innovative Technologies in Engineering , pp. 629-631.

13. Sameerchand Pudaruth, "Predicting the Price of Used Cars using Machine Learning Techniques," International Journal of Information & Computation Technology, vol. 4, no. 7, pp. 753–764.

14. Zamar Khan "Used Car Price Prediction using three Different Variants of Linear Regression" International Journal of Critical Infrastructures, vol.1, issue 1 (Jan-March 2022).

15. Muhammad Asghar, Khalid Mehmood, Samina Yasin and Zimal Mehboob Khan "Used car price prediction using machine learning with optimal features" Pakistan Journal of Engineering and Technology, PakJET, Vol.4, No. 2, 2021

16. Neha Mittal , Mahima Tayal , Pallavi Dixit ,Pooja Dahiya ,Rajesh Kumar Singh," Smart Business and industrial competitiveness are drivers of ai",European Chemical Bulletein, Vol.12,Issue 4,pp.6919-6931,2023