

PREDICTION OF USED CAR PRICES USING ARTIFICIAL NEURAL NETWORKS AND MACHINE LEARNING

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ABSTRACT

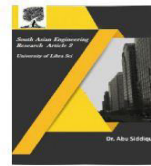
The number of cars on Mauritian roads has been increasing by 5% annually. In 2014, there were 173,954 cars registered with the National Transport Authority, meaning approximately one in every six Mauritians owned a car, most of which were second-hand or reconditioned vehicles. In an effort to predict the prices of these second-hand cars, a study collected data from 20 vehicles and applied four different machine learning algorithms. The results indicated that support vector machine regression slightly outperformed neural networks and linear regression in terms of accuracy. However, some predicted prices, particularly for high-priced cars, were significantly off from the actual prices. This suggests that while machine learning models can be useful for estimating car prices, they may not always provide precise predictions, especially for more expensive vehicles. The study concluded that further research with larger datasets and experimentation with various network types

and structures a necessary to improve the accuracy of these predictions.

Keywords: Car price prediction, machine learning, support vector regression, second-hand vehicles, Mauritius, neural networks, linear regression, used car valuation, predictive modeling, automotive data.

1. INTRODUCTION

Mauritius has experienced a significant surge in the number of vehicles on the road. From the National Transport Authority indicates a 254% increase in car registrations, rising from 68,524 in 2003 to 173,954 in 2014. This substantial growth suggests a parallel rise in the sale of second-hand imported (reconditioned) and used cars, as new cars constitute only a small fraction of annual sales. Consequently, many Mauritians are keen to understand the resale value of their vehicles for future transactions in the used car market. Several factors influence the pricing of second-hand cars. Key determinants include the vehicle's manufacturing year, make, model, mileage, horsepower, and country of origin. Additional considerations encompass fuel type and consumption, braking system, acceleration



capabilities, interior design, physical condition, engine displacement (measured in cubic centimeters), car size, number of doors, weight, consumer reviews, paint color and type, transmission type, sports car classification, sound system quality, alloy wheels, power steering, air conditioning, GPS navigation, and safety features. In the Mauritius context, unique factors such as the number of previous owners and the history of significant accidents are also pertinent. Given the multitude of variables affecting second-hand car prices, accurately predicting these values is a complex endeavor. This study aims to evaluate the efficacy of neural networks in forecasting the prices of second-hand cars. The performance of neural networks will be compared with other predictive methods, including linear regression and support vector regression, to determine the most effective approach for price prediction in this context. The structure of this paper is as follows: We begin with a literature review that summarizes various studies on neural networks and price prediction methodologies. Next, we detail the methodology employed in data collection and analysis. Subsequently, we present the results of our price prediction models for second-hand cars. Finally, we conclude with a discussion of our findings and propose directions for future research in this area.

II. LITERATURE SURVEY

"Predicting the Price of Used Cars using Machine Learning Techniques" by Pudaruth (2014)

In this study, Pudaruth explores the application of machine learning algorithms to estimate the prices of second-hand cars in Mauritius.

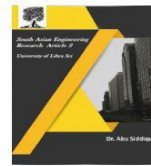
research employs various techniques, including linear regression, k-nearest neighbors, naïve Bayes, and decision trees, to predict car prices based on attributes such as make, model, year, mileage, and condition. Findings indicate that while decision trees and naïve Bayes algorithms are effective for classification tasks, they may not be suitable for numerical value prediction.

"Stock Market Analysis Based on Artificial Neural Network with Big Data" by Bharambe and Dharmadhikari (2015)

Bharambe and Dharmadhikari investigate the use of artificial neural networks (ANNs) in analyzing stock market trends using big data. The study highlights the potential of ANNs to process large datasets and identify complex patterns, offering insights into market behavior and aiding in investment decision-making. The authors emphasize the importance of data preprocessing and feature selection in enhancing the accuracy of ANN models in financial analysis.

"Car Paint Thickness Control using Artificial Neural Network and Regression Method" by Jassibi et al. (2011)

Jassibi and colleagues address the challenge of controlling car paint thickness during manufacturing by integrating artificial neural networks with regression methods. The research demonstrates how ANNs can predict optimal paint thickness levels, leading to improved quality control and reduced material waste in the automotive industry. The study underscores the effectiveness of combining machine learning techniques with traditional methods for process optimization.



"The Comparison of Methods, Artificial Neural Network with LineaRegression using Specific Variables for Prediction Stock Prices in Tehran Stock Exchange" by Ahangar et al. (2010)

Ahangar and his team compare the efcy of artificial neural networks and linear regression models in predicting stock prices on the Tehran Stock Exchange. The study evaluates the performance of both methods using specific financial variables, concluding that Aoffer superior predictive accuracy due to their ability to model nonlinear relationships inherent in ficial data. The authors advocate for the adoption of ANNs in financial forecasting to enhance investment strategies.

"Support Vector Regression Analysis for Price Prediction in a Car Leasing Application" by Listiani (2009)

Listiani expl the application of support vector regression (SVR) in predicting car prices within the context of car leasing. The research highlights the advantages of SVR in handling lex, high-dimensional data, leading to more accurate price predictions compared to traditional linear models. The study suggestsat SVR can be a valuable tool for financial institutions in assessing the residual value of leased vecles.

"An Artificial Neural Network Approach on Automobile Pricing" by Iseri and Karlik (2009)

Iseri and Karlik investigate the use of artificial neural networks for automobile pricing, focusing on thility of ANNs to capture nonlinear relationships between

various car attributes and their market prices. The study demonstrates that ANNs can effectively model complex pricing dynamics, oring a more accurate and flexible approach to vehicle valuation compared to tditional pricing models.

"Neural Networks for Automobile Insurance Pricing" by Yeo (20

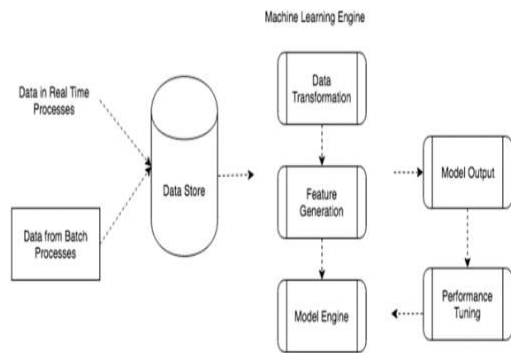
Yeo examines the application of neural networks in determining automobile insurance premiums. The research discusses how ANNs can analyze a wide range of factors, inclg driver behavior, vehicle type, and historical claims data, to set personalized insurance rates. The study highlights the potential of neural networks to enhanfrness and competitiveness in the insurance industry by providing more precise pricing models.

III.PROPOSED METHODOLOGY

Data was collected from various car websites and the classified sections of daily newspapers such as L'Express and Le Défi. data collection took place over a one-month period in August 2014 to account for potential price fluctuations over time. A l of 200 records were gathered, encompassing features of second-hand cars including the manufacturing year, make, engine capacity (in cubic centimeters), paint type (normal or metallic), transmission type (manual or automatic), mileage (number of kilometers driven), and price (in Mauritian rupees).

Exti experiments were conducted to determine the optimal neural network structure and parameters. The fins indicated that a neural network with one hidden layer and two nodes achieved the lowest mean

absolute error among the various configurations tested. However, ort Vector Regression and a multilayer perceptron with back-propagation provided slightly more accurate predictions than linear regression. Conversely, k-Nearest Neighbour algorithm demonstrated the least accuracy among the four approaches evaluated. All experimentalized 10-fold cross-validation to ensure robust results.



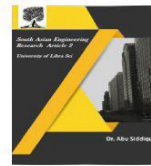
IV.WORKING METHODOLOGY

The system consists of three main modules: Service Provider, View and Authorize Users, and Remote User. Each module has a specific role in ensuring smooth functionality. The **Service Provider module** is responsible for handling the core operations of the system. The service provider must log in using valid credentials. Once logged in, they can train and test used car datasets, analyze accuracy through bar charts, and view the trained accuracy results. Additionally, they can examine different types of used car prices, find their ratio, and download predicted datasets. This module also allows the service provider to manage remote users by viewing their details. The **View and Authorize Users module** is primarily managed by the admin. The admin can view the list of users who have registered in the system. For each user,

the admin can see details such as name, email, and address. The admin plays a crucial role in authorizing users, ensuring that only verified individuals gain access to the system. The **Remote User module** is designed for users who want to predict used car prices. Before accessing any features, a user must register, and their details will be stored in the database. After successful registration, the user can log in with valid credentials. Once logged in, they can perform various tasks, including predicting the type of used car price and viewing their profile information. Together, these modules create an efficient and structured system for predicting used car prices while maintaining security and user authorization.

V.CONCLUSION:

we aimed to predict the prices of second-hand reconditioned and used cars in Mauritius, a market that has grown steadily by approximately 5% over the past decade. ite the proliferation of car websites in Mauritius, none offer a tool to predict used car prices based on their attributes. Toress this gap, we collected a dataset of 200 records, utilizing cross-validation with ten folds. The set included features such as car make, year of manufacture, paint type, transmission type, engine capacity, and mileage. We app four different machine learning algorithms to predict the prices of second-hand cars. The averresidual values were reasonably low across all four approaches. Therefore,conclude that predicting the price of second-hand cars is a challenging yet feasible endeavor. This system be valuable to car dealers and owners seeking to assess the value of their vehicles. In the future,plan to collect more data and incorporate additional



features, as well as explore a broader range of machine learning algorithms to enhance prediction accuracy.

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