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

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ABSTRACT

The quantity of vehicles traversing Mauritian roads has demonstrated a consistent 5% increase over the past decade. In 2014, the National Transport Authority recorded 173,954 registered cars, indicating that approximately one Mauritian out of every six possesses a car, with the majority being second-hand reconditioned or used vehicles. This study aims to explore the feasibility of predicting the prices of second-hand cars using artificial neural networks. To this end, data from 200 cars from diverse sources was compiled and subjected to analysis using four distinct machine learning algorithms. Our findings indicate that support vector machine regression yielded slightly superior outcomes compared to neural network or linear regression methods. Nonetheless, certain predicted values notably deviate from actual prices, particularly for higher-priced cars. Consequently, further investigations employing larger datasets and experimentation with diverse network types and structures are imperative to enhance predictive accuracy.

I. INTRODUCTION

Given the myriad of elements that influence a pre-owned vehicle's market value, determining its quoted price is a big challenge. This research focuses on the creation of machine learning models capable of reliably estimating the price of used cars based on their characteristics, allowing for more informed purchasing decisions. We use and evaluate various learning algorithms on a dataset of sale prices from various brands and models. To determine the best approach, we compare the efficacy of machine learning methods such as linear regression, ridge regression, lasso regression, elastic net, and decision tree regression. We determine the car's pricing by taking into account certain elements. Regression algorithms are used for their ability to generate continuous output values, allowing precise predictions of actual car pricing rather compared to price ranges. Furthermore, we've developed a user interface capable of receiving inputs from consumers and presenting the car's price based on their criteria.

II. LITERATURE SURVEY

The initial study explores the utilization of supervised machine learning methods to forecast the prices of pre-owned cars in Mauritius, leveraging historical data sourced from daily newspapers. Various techniques such as multiple linear regression analysis, k-nearest neighbors, naïve Bayes, and decision trees are employed to formulate the predictions.

The subsequent investigation delves into predicting the prices of used cars in Bosnia and Herzegovina by scrutinizing a considerable number of distinct attributes. The study employs three distinct machine learning techniques Artificial Neural Network, Support Vector Machine, and Random Forest to construct a reliable model for price prediction.

Lastly, a novel approach is presented in the third paper, proposing a price evaluation model for the secondary car market based on BP neural networks. The model capitalizes on extensive big data analysis of widely circulated vehicle data and numerous transaction records. It utilizes an optimized BP neural network algorithm to analyze price data across various vehicle types, with the aim of establishing an effective model for second-hand car price evaluation tailored to individual vehicles.

III. METHODOLOGY

The system comprises two basic phases: 1. During the training phase, the dataset is used to train the system,

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which subsequently builds a model (line/curve) depending on the chosen algorithm. 2. During the testing phase, inputs are sent to the system to evaluate its functionality and accuracy. As a result, it is critical that the data used for training and testing the model is appropriate. The system's goal is to detect and anticipate the pricing of used automobiles, which requires the employment of proper algorithms for these tasks. Before continue with the selection of algorithms for further implementation, numerous algorithms were compared in terms of accuracy, and the best one for the task was picked.

Artificial Neural Networks (ANNs) are computational models that draw inspiration from the biological neural networks found in the human brain. These networks are comprised of interconnected nodes or neurons arranged in layers, including the input layer, hidden layers, and output layer. Within this structure, each neuron receives input signals, processes them utilizing an activation function, and then transmits the resulting output to the subsequent layer.

In ANNs, training occurs through supervised learning techniques such as backpropagation. During this process, the network adjusts its weights and biases to minimize the disparity between actual and predicted outputs. ANNs find application across various domains, including classification, regression, pattern recognition, and decision-making tasks. They are particularly instrumental in areas like image and speech recognition, natural language processing, and financial forecasting

Deep Learning: Deep Learning is a subset of machine learning that utilizes deep neural networks with many hidden layers. It is characterized by its ability to automatically learn hierarchical representations of data, extracting increasingly abstract features as the network goes deeper. Deep Learning models often require large amounts of labeled data for training and substantial computational resources for optimization. Convolutional Neural Networks (CNNs) are commonly used in deep learning for tasks involving images and spatial data, while Recurrent Neural Networks (RNNs) are preferred for sequential data like text and time series. Deep Learning has achieved remarkable success in various domains, including computer vision, speech recognition, natural language processing, and reinforcement learning. Advanced techniques like transfer learning, generative adversarial networks (GANs), and reinforcement learning are also

IV. ARCHITECTURE

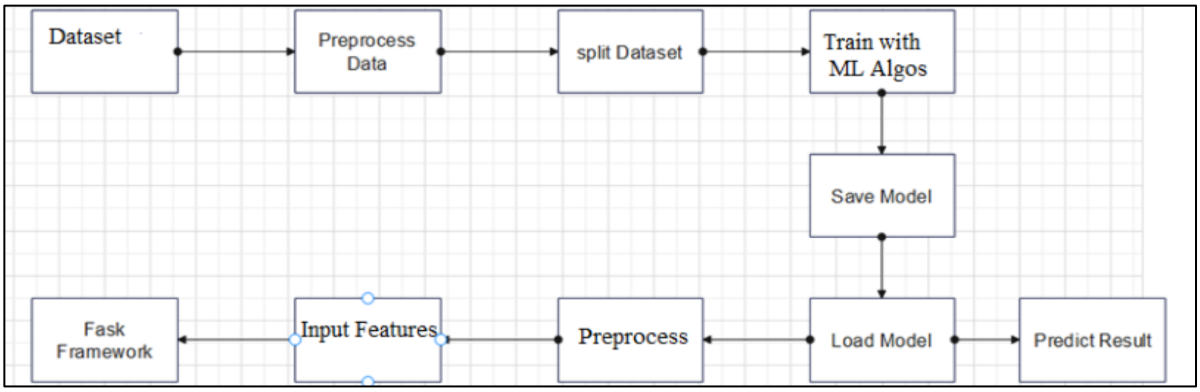

Fig 1: Architecture Diagram

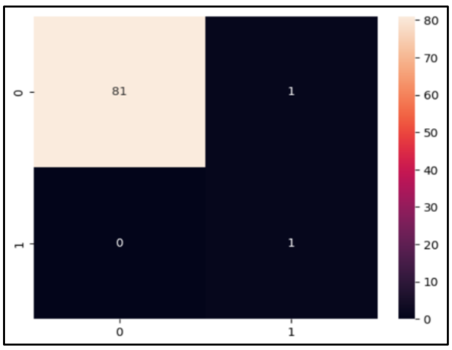

Fig 2(a): Confusion Matrix for Random Forest

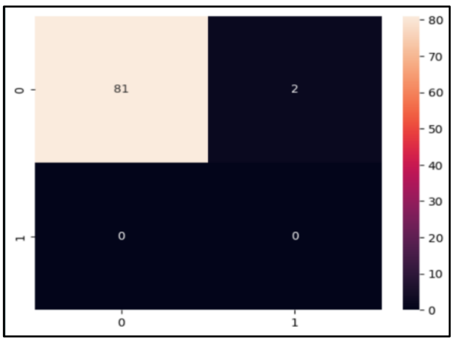

Fig 2(b): Confusion Matrix for Random Forest

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V. RESULT AND ANALYSIS

Table 1: Model: "sequential_1"

Layer (type)	Output Shape	Param
conv2d_3 (Conv2D)	(None, 222, 222, 32)	896
max_pooling2d_3	(MaxPooling2 (None, 111, 111, 3)	0
conv2d_4 (Conv2D)	(None, 109, 109, 64)	18496
max_pooling2d_4	(MaxPooling2 (None, 54, 54, 64)	0
conv2d_5 (Conv2D)	(None, 52, 52, 128)	73856
max_pooling2d_5	(MaxPooling2 (None, 26, 26, 128)	0
flatten_1 (Flatten)	(None, 86528)	0
dense_2 (Dense)	(None, 128)	11075712
dense_3 (Dense)	(None, 8)	1032

Total params: 11,169,992

Trainable params: 11,169,992

Non-trainable params: 0

Accuracy: 96.80%

Validation Accuracy: 97.50

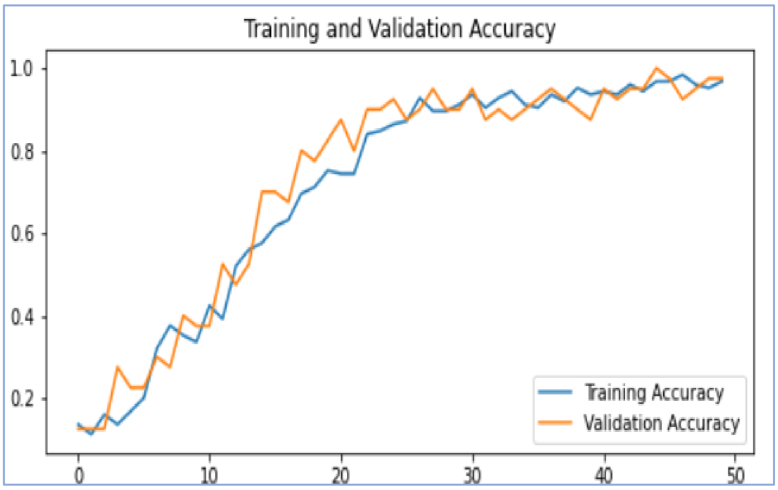

Fig 3: Training and Validation Accuracy

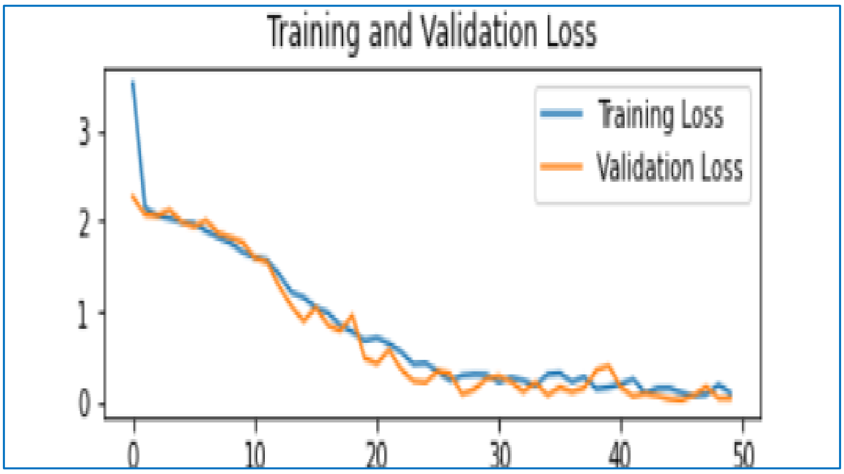

Fig 4: Training and Validation Loss

VI. CONCLUSION

As new automobile prices rise and buyers struggle to afford them, used car sales are increasing globally. There is a pressing need for a Used Car Price Prediction system that considers multiple factors to calculate the car's value. The proposed system will improve the accuracy of used automobile price predictions. This study analyzes three machine learning algorithms: linear regression, lasso regression, and ridge regression with focus on Artificial Neural Networks and Deep Learning.

VII. FUTURE SCOPE

In the future, our machine learning model could be integrated with many websites that provide real-time data for price prediction. We may also use substantial historical data on automobile prices to improve the accuracy of the machine learning model. An Android app could function as a user interface for engaging with people. To improve performance, we want to methodically build deep learning network designs, apply variable learning rates, and train on clusters of data rather than the complete dataset.

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