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To cite this article: Ramgiri Siva and Adimoolam M 2022 *ECS Trans.* **107** 12953

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Linear Regression Algorithm based Price Prediction of Car and Accuracy Comparison with Support Vector Machine Algorithm

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Aim: The aim of the study is to use Linear Regression (LR) algorithm based price prediction of car price and accuracy comparison with support vector machine (SVM) classification algorithm. **Materials and methods:** LR(N=205) and SVM algorithm (N=205) are applied for car price prediction as a mechanism. The accuracy and prediction of the classifiers was evaluated and recorded with G power 80% and alpha value 0.05. **Results:** The SVM produces 89% accuracy in predicting the car price on the sample dataset and the LR predicts the accuracy at the rate 91.7%. LR algorithm based accuracy appears (significant 0.563) to be better than SVM algorithm for car price prediction. **Conclusion:** The accuracy performance parameter of the LR algorithm appears to be better than the SVM algorithm.

Keywords: Linear Regression, Support Vector Machine, Machine Learning, Novel Car Price Prediction (NCPD).

Introduction

Car price is a significant piece of the car body parts. Car id, car name, symboling, fuel type, aspiration, door number are major parts of the car price calculation. The capacity of the car is done as expected, it will influence other car prices. Accurate car price prediction involves expert knowledge because price usually depends on many distinct features and factors (Monburinon et al. 2018; Chandak et al. 2019). The most critical ones are generally the brand and model, age, horse power, and mileage. Owing to the regular changes in the price of petrol, the fuel type used in the vehicle as well as fuel consumption per mile have a major effect on the price of a car. Predicting the values particularly for higher priced cars is quite far from actual price (Kanwal Noor, Sadaqat Jan 2017). As a result, more research with a larger dataset is needed, as well as more experiments with different networks and structures in order to achieve better prediction (Monburinon et al. 2018; Chandak et al. 2019). A car price prediction having the highest interest research area, considerably the distinct attributes for the reliable and accurate prediction. Another application of car price prediction discussed for machine learning algorithms (Sun et al. 2017).

To build the model price prediction of the car, the data is said about the car body parts of the prices. It is to look at how supervised machine learning methods can be used to predict the price of used cars in mauritius. The forecasts are based on data collected daily. Used multi linear regression to predict the vehicle car price. In supervised machine learning, the regression based method has been proven to be reliable in predicting the continuous variables (Noor and Jan 2017). During the last decade, the number of vehicles on mauritian roads has steadily increased by 5%. The national transport Authority registered 173954 vehicles in 2004. The aim of this research is to see if artificial networks can be used to predict the price of used cars (Gültekin and Organ 2020). With the rapid increases in the number of private cars on the road development of the used cars market, used cars have become the most popular option for the car buyers and sellers to engage in peer to peer trading. Second hand cars have become more popular as the number of private vehicles has increased and become the second hand car market (Sun et al. 2017). Yet another car price prediction of used cars was discussed for naive bayes algorithms differently than LR and SVM algorithms (SameerchandPudaruth 2014). This prediction work was achieved with considerably less accuracy. The vehicle price prediction using machine learning algorithm (Kanwal Noor, Sadaqat Jan 2017) was discussed to predict accurately. In this work, multilinear regression was adopted as an accuracy prediction algorithm. The dependent variable was applied to calculate the precision of vehicle price prediction.

There is a research gap in the already existing system. Since it may be difficult to predict the car price accurately and precisely. Some research has been carried out in machine learning algorithms for share market price prediction (John. et al. 2019). It is important to add more values to the dataset and trained dataset to predict accurately. However, it is important to analyse and compare the various classification algorithms that provide better accuracy. Hence, the work aims to compare the accuracy of LR and SVM algorithms for predicting the car price prediction.

Materials And Methods

Around 40 research papers have been published on the car price prediction concept. LR (Monburinon et al. 2018) is a machine learning algorithm based on supervised learning and it is taken as a group 1 algorithm. It performs a regression task. Regression models target predicting values based on the independent variables. It is mostly used for finding our relationship between variables and forecasting. Different recession models differ based on the king of relationship between the dependent and independent variables, they are considering and the number of independent variables being used linear regression having accuracy with (91.70%) in previous LR having 89% and improved the accuracy with test and train, where train having (91.70%) and train having (81.80%).

Algorithm steps for LR algorithm:

Input - Car price assignment

Output - Accuracy

1. Import the pandas and import the dataset into programs using pandas.
2. Read the dataset and plot the figure with size count the plot graph with a car body.

3. From sklearnpreprocessing import label encoder and plot figure with size and heat map.
4. Split the dataset into sets (x_test,y_test) and (y_train,x_train).
5. Classify the fitting into two sets x,y train and x,y test.
6. Predict and check accuracy.

The SVM (EnisGegic et al. 2019) is a regulated machine learning algorithm which can be utilized and it is taken as a group 2 algorithm. For both classification and regression challenges. In this study, to train the SVM the class of scikit learn library was used. Import the car price assignment.csv dataset and load the dataset. The dataset is split randomly into training and testing with accuracy. The target variables are selected. Then, the SVM classifier based on the training is generated. Linear Regression was used as the value of the kernel parameter. The testing set is predicted based on the training set. The SVM classifier is evaluated and the accuracy is calculated. The accuracy of the SVM is (89%).

Algorithm steps for SVM algorithm:

Input - car price Assignment dataset

Output - Accuracy

1. Import the packages and import the dataset into programs using pandas.
2. Load the dataset bold text and read the dataset with 205 rows and 26 columns.
3. Knowing the data information with the data frame and column with null values d- type
4. Removing the irrelevant features and checking for null values.
5. Converting categorical values to numeric values.
6. Split the data into training and testing sets and model building and training.
7. Check the Accuracy.

The research work was experiment in google colab, the Hardware and Software requirements for experimenting the work includes i5 processor, 1 TB HDD, 4 GB RAM, Windows OS, python: colab/jupyter. The dataset was divided into two parts: Training and testing sets. Then the algorithm is experimented on and the training sets are varied 10 times based on the set size.

Statistical Analysis

The experimental analysis was done for this research work and evaluated statistically using packages for social sciences (SPSS). The independent variables in the dataset are car name and car ID and the dependent variables are aspiration, gear type and engine type. The analysis was done to obtain mean, standard deviation and standard error mean for accuracy prediction. An independent T Test was carried out to compare the parameters on both the groups LR and SVM algorithms.

Results

The price of the car was predicted and which is shown in Fig. 1. It shows the car price with their values in the graph and the car prices to minimum to maximum price of the graph. The price of the graph range is 5000 to 450000, in between the range of 8000 to 150000 removing the outlier from the price and having a difference between the mean and maximum value to be high and this experiment was a novel approach to identify the car price prediction and it is termed as Novel Car Price Prediction (NCP). Figure 2 shows removing the columns that show the high correlation exists during data preparation. To create the training and testing data, create the dummy columns to translate the category column into numeric columns and after dropping removing highly correlated variables from the heat map of car information.

Table 1 represents the sample size of LR and SVM calculation for accuracy. Comparison made to predict the accuracy of LR and SVM for 5 iterations by varying text size too. The sample size 100 to 205 with five iteration accuracy went from 70% to 90% for the SVM algorithm and for LR went to 60% to 89%. The mean, standard deviation and significant difference of LR based car price prediction and SVM based car price prediction was tabulated in Table 2. LR algorithm has an accuracy mean of 91.70%, standard deviation of 8.51 for the dataset value 205 samples where the SVM has lower mean accuracy of 89%. Standard deviation of LR 8.51 appears higher than SVM 7.29. Table 3 shows that there is a significant difference between the two groups. The mean difference standard error difference for two groups is tabulated. Figure 3 represents the bar graph plotted for mean accuracy of the two groups including error rates. LR appeared to be more accurate than the SVM algorithm.

Table 1: Comparing Accuracy for LR and SVM for 10 iterations. Accuracy of the LR appeared more than the SVM algorithm.

S. no.	Sample size	Linear Regression accuracy	SVM accuracy
1.	100	70%	60%
2.	125	79%	67%
3.	150	80%	70%
4.	200	87%	80%
5.	205	91%	89%

Table 2: The mean of the LR algorithm appears higher than the SVM algorithm. As the accuracy increases the error rate decreases.

	Algorithm	N	Mean	Standard Deviation	Standard Mean Error
Accuracy	LR	10	78.4210	8.511139	2.69154
	SVM	10	79.0910	7.29514	2.300693

Table 3: Mean accuracy, mean difference, levene's test for equality of variances, 95% confidence interval of differences, Standard error difference. Lowest and highest values for LR and SVM and mean difference.

Accuracy		Levene's Test for Equality of Variances					T-Test for Equality Of Mean		95% confidence interval of the Difference	
		F	sig	t	DF	sig.(2-tailed)	Mean Difference	Mean Difference	Lower	Upper
	Equal variance assumed	348	.563	-.189	18	.852	-.67000	3.54489	-8.11755	6.77755
	Equal variance not assumed			-.189	17.588	.852	-.67000	3.54489	-8.13006	6.79006

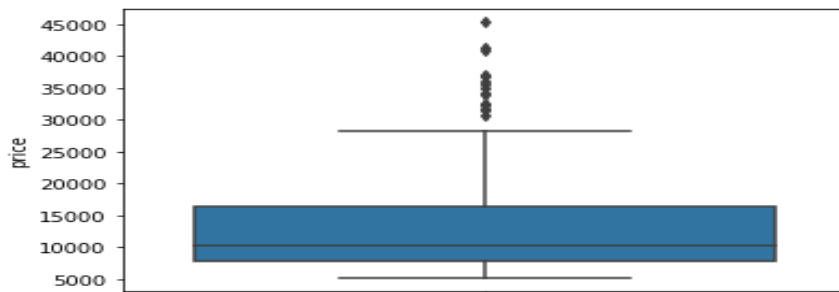


Fig. 1: The car prices minimum to maximum between 8000 to 15000. Removing the outlier from the price column as the difference between the mean and max values seems to be high.

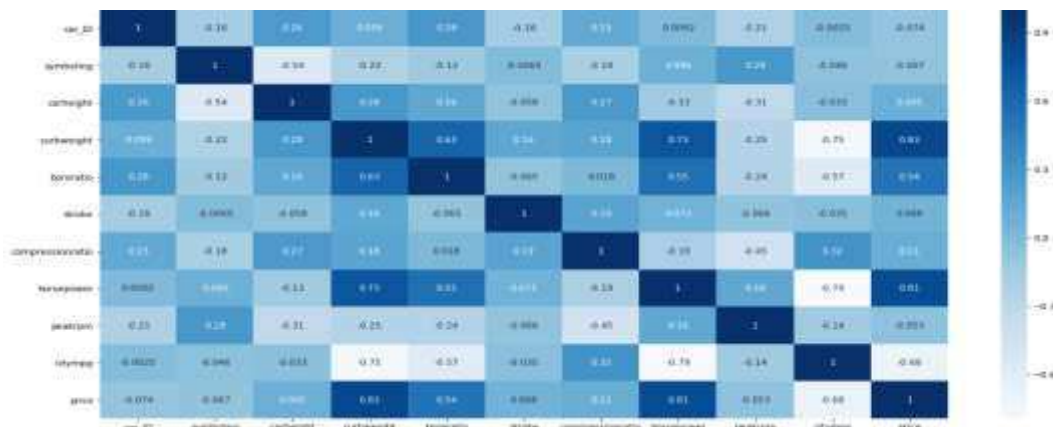


Fig. 2: Data preparation of deleting the columns with high correlation. Creating the dummy columns to convert the category column into numeric columns for creating the train and test data. The plot figure size is 20, 10. There are no independent numeric variables having more than 80% positive correlation in the above heat map.

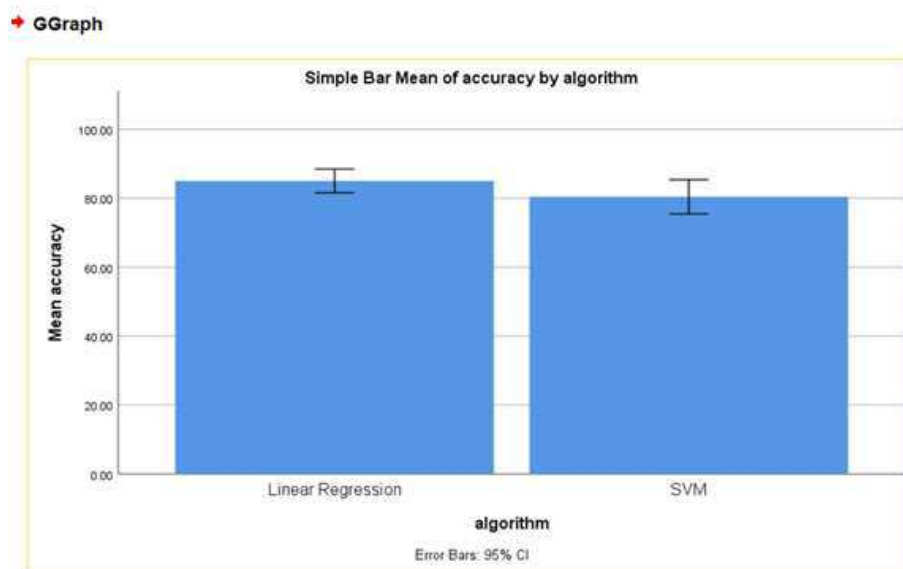


Fig. 3: Comparison of the mean Accuracy for LR algorithm and SVM algorithm includes error rates. Mean accuracy of LR is more than the SVM. The accuracy of the LR and SVM compared and LR accuracy appeared better than SVM. Standard deviation is also slightly better for LR algorithm than SVM algorithm. X Axis: LR vs SVM algorithm. Y Axis: Mean accuracy of detection. Error bars were represented as ± 1 SD.

Discussion

The experiment has been carried out to find the accuracy of car price prediction using LR and SVM algorithms. The accuracy of LR algorithm based car price prediction appears to be better than the SVM algorithm based car price prediction accuracy. The significant value was 0.563 for the conducted experiment. Cars with a target value of 1 for are affected by the car price, while those with a target value of 0 are not affected. The performance of both models was assessed using a variety of performance metrics. Comparing two algorithms and statistically significant differences in accuracy.

The automotive industry is a cornerstone industry in the national economy, so accurately forecasting car sales is critical. This paper uses the technology of auto recommendation to pick keywords and compose them into a composite index that can be used in a regression model based on the car sales (Qingyu et al. 2011). Customer behavior has shifted as the internet has matured. Before making a purchase, the majority of the customers would seek advice on the internet. Since a vehicle is high priced and long lasting items, customers should consider reading online reviews before making a purchase of the vehicle (Chiu and Shu 2017).

An accurate used cars price assignment is a catalyst for the continuing growth of the used market. In several articles, data mining has been used to predict the price of a used car. This indicates that random forest is the optimal algorithm, but shows great advantages in universal models compared with linear regression (C. Chen, Hao, and Xu 2017). Based on these results, it is conjecture that EMU will sustainably reduce the year to year volatility observed in the car price data, but without feature measures to increase european integration, it will not completely eliminate existing cross country price prediction (Goldberg and Verboven 1998).

To improve the results further this research can use the deep learning approach, for that it may require a lot of learning data, so this becomes the future scope. By extracting and implementing them, it will be able to change the performance of these versions. Furthermore, in the future it could make great use of these matrices that indicate the first minimum overlap of each test with car body parts along with the number of rows. These matrices can be used with some algorithm to build a program able to predict the price of the car with a very high efficiency.

Conclusion

LR is a classification technique that uses averaging to improve the accuracy. The work shows that the accuracy for the car price prediction using LR (91.7%) appears to be better than the SVM (89.1%). Hence it concluded that LR classifier results in acceptable accuracy than SVM.

Declarations

Conflict of interests

No conflict of interests in this manuscript.

Authors Contributions

Author RS was involved in data collection, data analysis, manuscript writing. Author MA was involved in conceptualization, data validation, and critical review of manuscript.

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Acknowledgements

The authors would like to express their gratitude towards Saveetha School of Engineering, Saveetha Institute of Medical and Technical Sciences (Formerly known as Saveetha University) for providing the necessary infrastructure to carry out this work successfully.

Funding

We thank the following organizations for providing financial support that enabled us to complete the study.

1. BrainoVision Solutions Pvt. Ltd.
2. Saveetha University.
3. Saveetha Institute of Medical and Technical Sciences.
4. Saveetha School of Engineering.

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