Car brand Identification using CNN

1. Introduction

Car brand recognition is the task of identifying the brand or make of a car based on its image. It has various practical applications, such as automated parking systems, traffic monitoring, and surveillance. With the advancements in deep learning and computer vision, it is now possible to develop accurate and robust models for car brand recognition. In this project, we focus on car brand recognition using the Kaggale Car Dataset [1]. The dataset contains images of cars from 842 different images ,and three classes making it a challenging task due to the large number of classes and variations in car appearances. Our approach involves using transfer learning with the CNN MobileNetV2 architecture [2].Aim of this project is to build a robust and accurate machine learning model capable of identifying car brands from digital images.

2. Related Work

Placzek [3] suggest a method in his study about that vision-based vehicles recognition. The fuzzy description of image segments was used for vehicle recognition from image. This description considers selected geometrical properties and shape coefficients which were determined for reference images segments. The proposed method was applied using reasoning system with fuzzy rules. An extension of the algorithm with set of fuzzy rules was provided classification of vehicles in traffic scenes. The author noted that, this method is suitable for application in video sensors for road traffic control and surveillance systems. In study by Rachmadi and Purnama [4] were presented a method which uses Convolutional Neural Network (CNN) to vehicle color recognition. CNN was designed to classify images based on shape information. They proved that CNN can also classify based on color distribution. Saghaei [5] proposed a system for mechanized and automatic recognition of license and number plate. The system could detect license plate number of the vehicles which is passing through specified location without using GPS and RFID. They used localization, orientation, normalization, segmentation and finally optical character recognition for identifying.

3. Materials and Experimental Evaluation

3.1 Dataset

We used kaggale dataset having 3 different classs and total of 842 images.

"We used 80% of the data for training and 20% for Validation"

3.2 Methodology

In this,we imported necessary modules such as NumPy, pandas, Keras, etc.,

- Load images from the dataset and the images are then converted into a NumPy array and finally normalising the array.

- Here we used Convolutional Neural Network architecture for image classification because in recent years it earned much popularity in the image processing field.
- Split the dataset into training and test datasets and create accuracy and value accuracy of the model and plot the accuracy model between them.
- Predicting the accuracy score of the model and we have taken the best one as our model and save it.
    - we used the best model for the prediction of 3 number of car brands.
- By saving the model, creating some HTML files with python code using the flask application, and creating a stream lit application for the prediction of car brands.

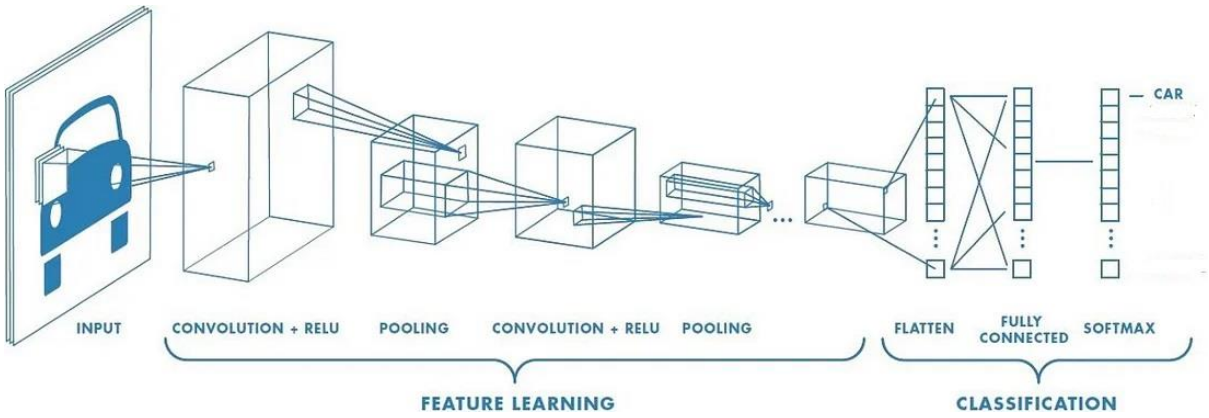

Figure 1 : Methodology architecture

3.3 Results

To assess the performance of our model, we utilize a confusion matrix. The confusion matrix provides a detailed breakdown of the model's predictions and actual labels. This evaluation metric gives us insights into how well our model is able to classify different car brands.

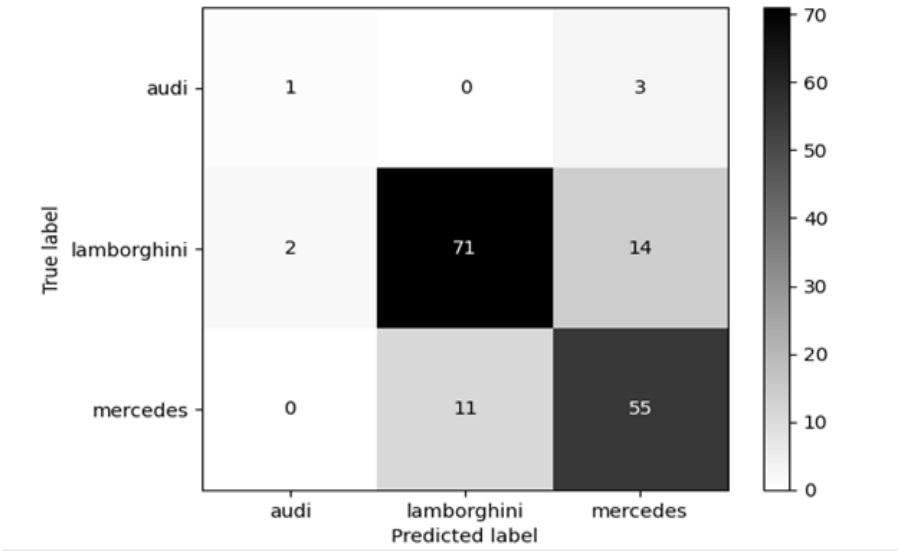

Figure 2: Confusion Matrix

- In addition to the confusion matrix, we calculate precision, recall, and F1-score for each car brand. Precision measures the accuracy of positive predictions, recall measures the coverage of actual positives, and F1-score balances both precision and recall. By examining these metrics, we gain a comprehensive understanding of the model's performance in terms of both accuracy and class-specific measures.

Classification Report:

	precision	recall	f1-score	support
0	**0.33**	**0.25**	**0.29**	**4**
1	**0.87**	**0.82**	**0.84**	**87**
2	**0.76**	**0.83**	**0.80**	**66**
accuracy			**0.81**	**157**
macro avg	**0.65**	**0.63**	**0.64**	**157**
weighted avg	**0.81**	**0.81**	**0.81**	**157**

After using both transfer learning and using our base model we are getting higher accuracy with our base model that is we are getting an validation accuracy of 0.82.

The parameters used in our model are Epochs, basic learning rate, optimiser ,batch size,Number of classes are the parameters used in our proposed model. The results ofmultiline plot is shown in figure 3.

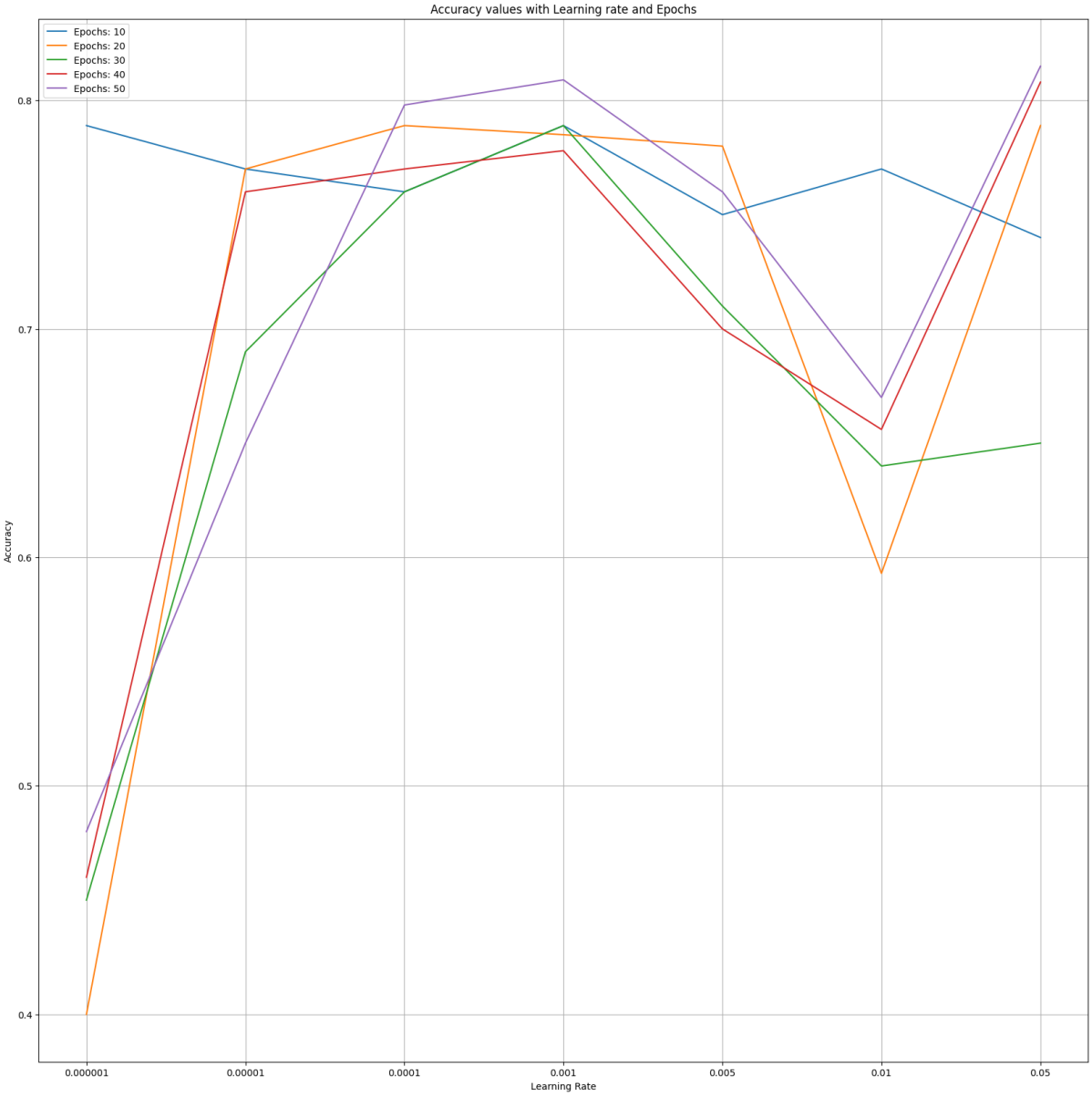

Figure 3:Multi line Plot

4. Future Work

Future improvements to the project could include exploring different architectures and hyperparameter tuning to further enhance the model's performance. Additionally, collecting and incorporating more diverse data could help improve the model's ability to generalize to different car brand appearances.

5. Conclusion

Car brand recognition has numerous potential applications, and with further advancements and refinements, the developed model can contribute to the development of intelligent systems in the automotive industry. In this project, we developed a deep learning model for car brand recognition using the Kaggle Car Dataset. We employed transfer learning with the MobileNetV2 architecture and fine-tuned the model on the combined dataset. Also as the

dataset is small so it was difficult to get better performance while using transfer learning as we got 82% accuracy. The evaluation results showed good accuracy and provided performance metrics such as precision, recall, and F1 score for selected car brand classes. The achieved performance indicates the potential of the developed model for real-world applications such as traffic monitoring, parking systems, and surveillance.

6.Reference

[1] https://www.kaggle.com/datasets/gayathrimunji/3-no-of-car-brands-dataset
[2] https://keras.io/api/applications/mobilenet/
[3]B. Płaczek “Vehicles Recognition Using Fuzzy Descriptors of Image Segments.” In: Kurzynski M., Wozniak M. (eds) Computer Recognition Systems 3. Advances in Intelligent and Soft Computing, Vol 57, 2009, Springer, Berlin, Heidelberg

[4] F. Rachmadi and K. E. Purnama ”Vehicle Color Recognition using Convolutional Neural Network” https://arxiv.org/pdf/1510.07391.pdf, last accessed, june 2019

[5] H. Saghaei, Proposal for Automatic License and Number Plate Recognition System for Vehicle Identification”, 1st International Conference on New Research Achievements in Electrical and Computer Engineering, 2016