Project Report: Car Classification with MobileNet

1. Introduction

The objective of this project is to build a car classification model using the MobileNet architecture. The dataset comprises images of various car models, and the task is to train a model to accurately classify these images. Transfer learning is employed by utilizing MobileNet as the base model and adding additional layers for the specific classification task.

2. Data Preprocessing

2.1 Data Loading

The dataset is loaded from the specified path, and file paths along with corresponding labels are extracted. The distribution of labels is analyzed to understand the class distribution within the dataset.

2.2 Data Splitting

The dataset is divided into training, testing, and validation sets using the **`train_test_split`** function. The training set constitutes 80% of the data, the testing set 10%, and the validation set 10%.

2.3 Data Augmentation

ImageDataGenerator is employed to augment the training data. Augmentation techniques include horizontal flipping, rotation, width and height shifting, shear, and zoom. These augmentations aim to enhance the model's ability to generalize from limited training data.

3. Model Architecture

The model architecture is constructed using the MobileNet base model, pre-trained on ImageNet. Additional layers, such as GlobalAveragePooling2D, Flatten, and Dense layers, are added to adapt the model for car classification. The final output layer employs the softmax activation function for multi-class classification.

4. Model Training

The model is compiled using the Adam optimizer, categorical cross-entropy loss function, and accuracy as the evaluation metric. Training is conducted in several rounds, each with different numbers of trainable layers and learning rates. Model checkpoints are utilized to save the best weights based on validation accuracy.

5. Model Evaluation

The trained model is evaluated on the test set to assess its performance. The accuracy metric is used to measure the model's ability to correctly classify car images. The evaluation results are visualized through plots illustrating training and validation accuracy over epochs.

6. Conclusion

The MobileNet-based model, augmented with additional layers, demonstrates effective performance in classifying car images. The use of transfer learning and data augmentation contributes to the model's ability to generalize well. Further fine-tuning and experimentation with hyperparameters could potentially enhance model performance.

7. Future Improvements

Potential areas for improvement include experimenting with different base models, adjusting hyperparameters, and exploring more advanced augmentation techniques. Additionally, increasing the diversity and quantity of the dataset may further improve the model's ability to generalize across various car models.

8. References

- MobileNet: https://keras.io/api/applications/mobilenet/
- ImageDataGenerator: https://keras.io/api/preprocessing/image/
- Model Checkpoint: https://keras.io/api/callbacks/model_checkpoint/