Intelligent Vehicle Image Recognition System Based on Deep Convolutional Neural Network VGG19

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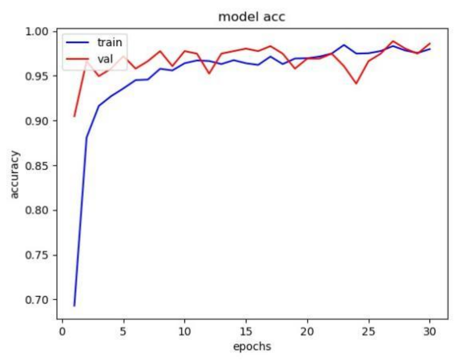
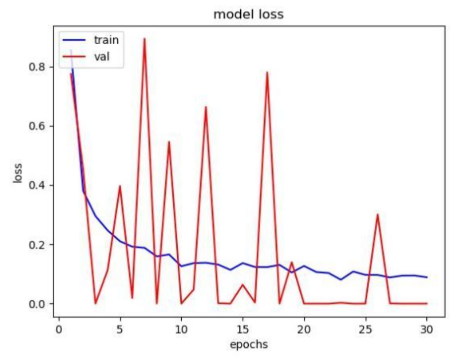
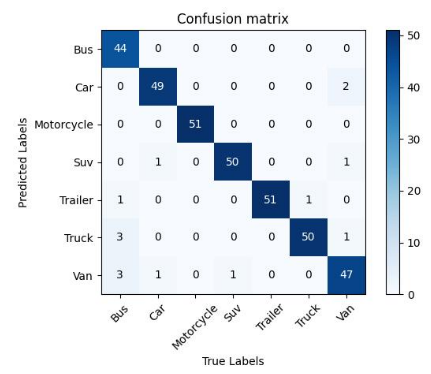
Abstract

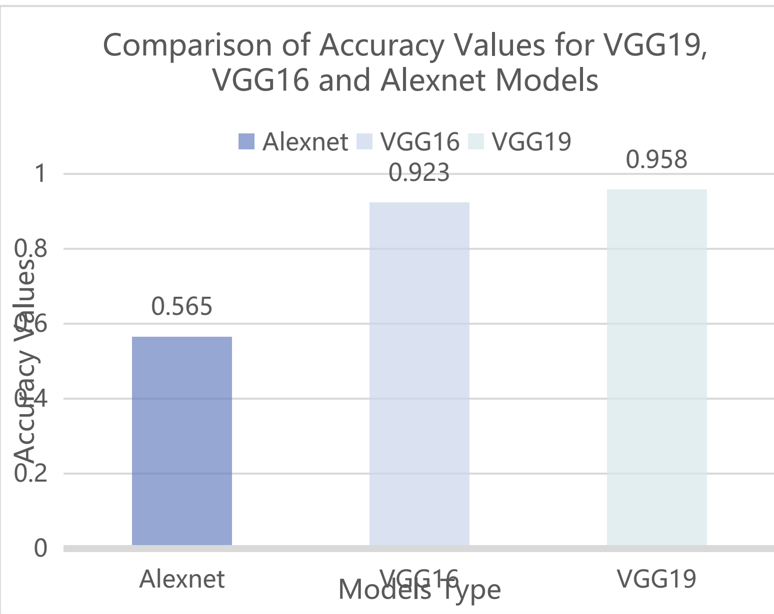
In the future, intelligent transportation systems will replace traditional ones. Vehicle type recognition systems will play an important role in urban traffic supervision, unmanned autonomous driving, public transport safety and other aspects. However, vehicle identification is challenging due to similar colors and shapes of many vehicles and complicated background interference. This project discusses the design and implementation of an intelligent vehicle attribute recognition system based on convolutional neural network VGG19 with smaller convolutional kernel and deeper network depth. The experimental evaluation metric performances of this project are as follows: accuracy of 95.8%, precision of 95.9%, recall of 0.958, and specificity of 99.3%.



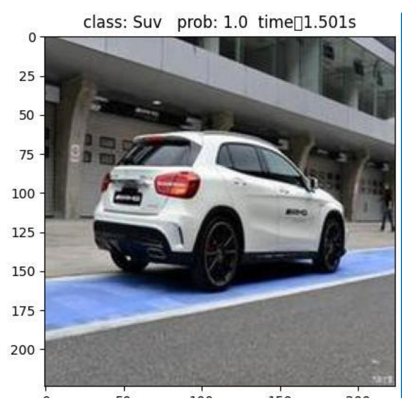


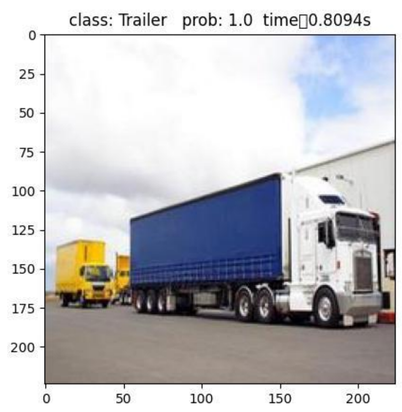


VGG19 performance evaluation and model comparison



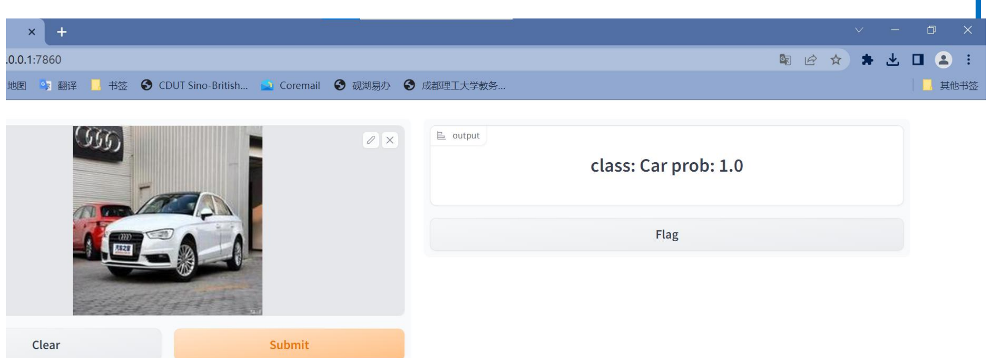
The performance of the three models in the vehicle image recognition system was evaluated in terms of accuracy, loss function, and confusion matrix. Comparing the accuracy values, the figure demonstrates that Alexnet has a relatively low value of 0.565, while the two VGG models have similar accuracy values, with VGG19 being superior. Hence, VGG19 was selected as the more suitable training model for the project's vehicle image recognition system.





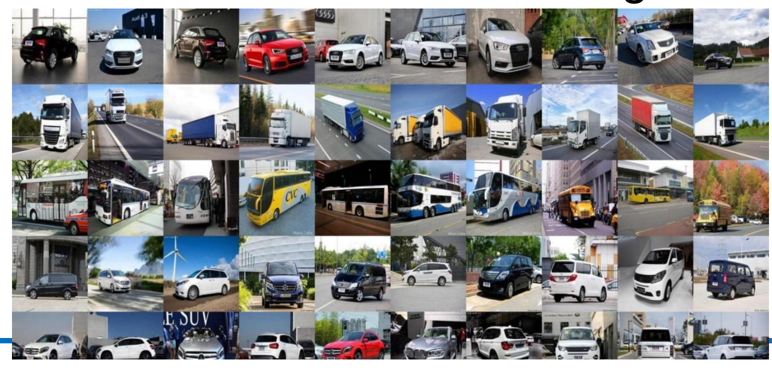
Graphical User Interface Design

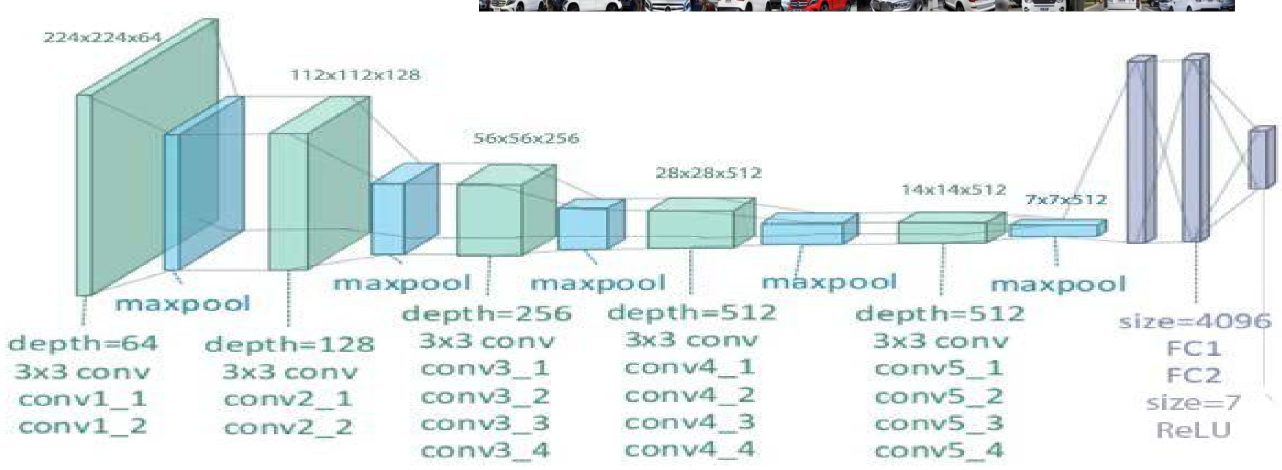
A user-friendly interactive interface was designed for the project in order to make the recognition accuracy more intuitive for the viewers to refer to, and to provide a better experience for the users who need to recognize the selected graphics.



The Use of Data Sets

The passage discusses the use of the VGG19 model for a vehicle image recognition system. It explains the importance of datasets in training and evaluating the model's performance. The dataset used in the project is obtained from Google Dataset Search, containing over 21,000 vehicle images divided into seven categories. The dataset is divided into a training set, a validation set, and a test set for model training, parameter tuning, and testing. The VGG19 model requires images of size 224x224 and normalized pixel values of [-1,1]. The dataset images are resized and normalized accordingly. The dataset is split into training and validation sets based on random indices to avoid overfitting.





The performance of VGG19 in vehicle image recognition system

The VGG19 architecture is a deep convolutional neural network developed by the Visual Geometry Group (VGG) at the University of Oxford in 2014. It belongs to the VGG network family and is known for its high accuracy in image recognition, especially on the ImageNet dataset. With 19 layers, including 16 convolutional layers, 3 fully connected layers, and 5 max-pooling layers, VGG19 is deeper and more refined than its predecessor, VGG16. Its simplicity is a notable strength, employing a small filter size of 3x3 and a fixed architecture, making it easy to implement and replicate. This simplicity also aids in training, as it requires fewer resources and computational power compared to more complex architectures. VGG19 has demonstrated impressive performance across various image recognition tasks, surpassing many state-of-the-art models. Consequently, it has become a popular choice in the computer vision field and serves as a baseline for developing new architectures.

Reference

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