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Summary of Prototyping Implementation of the effective Vehicle Identification System Using EfficientNet Model

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Summary

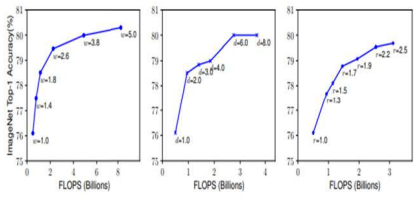
In the current uncontacted smart city environment, there are diverse needs to identify autonomous vehicles information, such as traffic flows, crime prevention, Ambulance, and traceability for efficient distribution and use of limited resources in a smart cityenvironment. To solve this, we implement a simple *license plate recognition method for vehicle inspection with CCTVs and cameras. Butsometimes we get incorrect information with a damaged license plate. Therefore, we develop a dataclassifier to classify a particular vehicle image, which is generated using the EfficientNet model.*

Keywords: *Convolutional Neural Network, EfficientNet Model, Deep Learning.*

1. Introduction

Real-time identification of vehicle information is required for efficient distribution and use of resources in a smart city environment. To solve this problem, we propose a prototype of a vehicle information identification application through vehicle image data using a deep learning model. This paper is organized in the following order. Chapter 2 refers to CNN models and approaches to enhance accuracy of identifying images.In Chapter 3, we propose a prototype of a vehicle identification application using the EfficientNet model. Chapter 4 discusses the limitations of the proposed method with conclusion and future research.

2. Related Works



$$\text{depth: } d = \alpha^{\phi}$$
$$\text{width: } w = \beta^{\phi}$$
$$\text{resolution: } r = \gamma^{\phi}$$
$$\text{s.t. } \alpha \cdot \beta^2 \cdot \gamma^2 \approx 2$$
$$\alpha \geq 1, \beta \geq 1, \gamma \geq 1$$

(a) (b)

Figure 1. Accuracy Result &EfficientNet Model Approach

To increase the accuracy of the existing CNN model, width scaling to increase the number of filters, depth scaling to increase the number of layers, and resolution scaling methods to increase the resolution of the input image are frequently used. ResNet is a representative model using depth scaling technique[1], and ShuffleNet is a representative model of width scaling technique. However, these approaches converge to a specific value as shown in Fig. 1(a) when the accuracy continues to rise. To use these three approaches simultaneously, there is the Compound scaling method, and the EfficientNet Model typically used these methods. This technique increases the Width, Depth, and Resolution of CNN within the constraint as shown in Fig. 1(b)[2].

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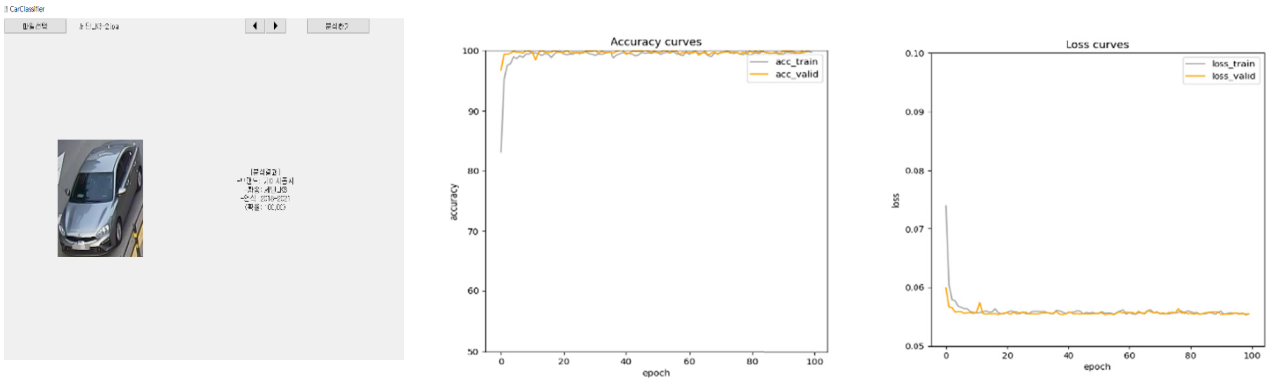
3. Vehicle Identification Application Using EfficientNet



(a) (b) (c)

Figure 2. Application Prototype with Accuracy Graph

We trained the model through the data extracted as images using the video data collected for about 2,189 hours from CCTVand additionally installed cameras in Bucheon area.Among the EfficientNet models, the efficiennet-b4 model, which is the most efficient in computing resources when considering memory efficiency and performance, is used because models after EfficientNet-b5 may stop working depending on the system environment when the memory load increases[3].Figure (a) is a picture of an image identification application prototype using the EfficientNet-b5 model.If the corresponding picture image is input, the vehicle model and information of the picture are identified with a high identification rate.Figure (b) shows the accuracy and (c) shows the loss curve.

4. Conclusion

This paper is a summary of the prototype of a vehicle identification application in an uncontacted smart city environment. Although there are still limitations for implementing application using the EfficientNet-b5 model, those deep learning is getting better as we research. In the future, we plan to use various deep learning models to increase the accuracy for the application.

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