Artificial Intelligence Project Proposal

Improving Car Image Detector

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1. Project Background

⬭ Business Perspective

This project was designed based on the fact that while young people's interest in automobiles grows after graduating from college and getting a job, they lack information about their preferred car. In particular, the fact that it is difficult to remember or find accurate information such as the year and model other than the brand after seeing your preferred car emphasizes the help of the machine learning system. We intend to implement a detector system that provides more accurate vehicle information based on the features of the vehicle image and improve its performance using different types of techniques.

⬭ Technical Perspective

From a technical point of view, the project can be broadly divided into a car detection system, which detects the part of an automobile in given pictures, and an image classification model that lets you know the type and brand of the given picture . In terms of a classification model, we will analyze the existing CNN-based classification model, apply various new applicable technologies, and then compare them to implement the optimal one. For the detection system, the project will take advantage of YOLO5 model.

2. Related Work

⬭ Original Car Detection Model

According to “Generation of Domestic Vehicle Identification Classifier System using R-CNN Algorithm and Composition of the vehicle dataset”, R-CNN model is used for image recognition model. The YOLO model, which processes the method as one-stage, increases the accuracy by performing the step of dimension cluster, which can serve as a fitting for the object image size of the training data. This model generates a CNN model by dividing it into two types, vehicle type and vehicle type, and sequentially classifies it. For the first data model, it uses the entire set to create the model which will classify the type of car. Then, we use the dataset suitable for each model applied to the secondary model training.

⬭ Applicable techniques for improving performance

Currently, many studies are being conducted to improve the image classification model, and we try to find the optimal car classifier model by comparing them. It was found through research that ODE-NET and Res-NET can perform better than the existing 1-layer MLP in terms of accuracy, memory usage, and time.

Also, by using SDE-NET, we try to improve the performance of CNN by developing a model that can reduce the training cost and handle uncertainty. Comparing the performance and

accuracy of each model with different set of data, the purpose of this project is to select the most optimized method for car detection.

3. Goal and new perspective of the project

The previous researches or products about car recognition mainly focus on the front or the rear of the car, which makes identifying registration plates more easier. However, the data that our project uses is photos which are taken from various directions. Moreover, the data amount is quite large because the data is from the government (AIHub). Thus, our project can provide more precise car-recognition by learning the data. This makes users convenience because they can take a picture of the car in any direction, for searching the car information.

The aim of the project is a car recommendation system. When the user provides the car photo to the service, it can provide information about what the car name is or different cars made by the same company. Moreover, It may give information about what is the favorite car of the users, too.

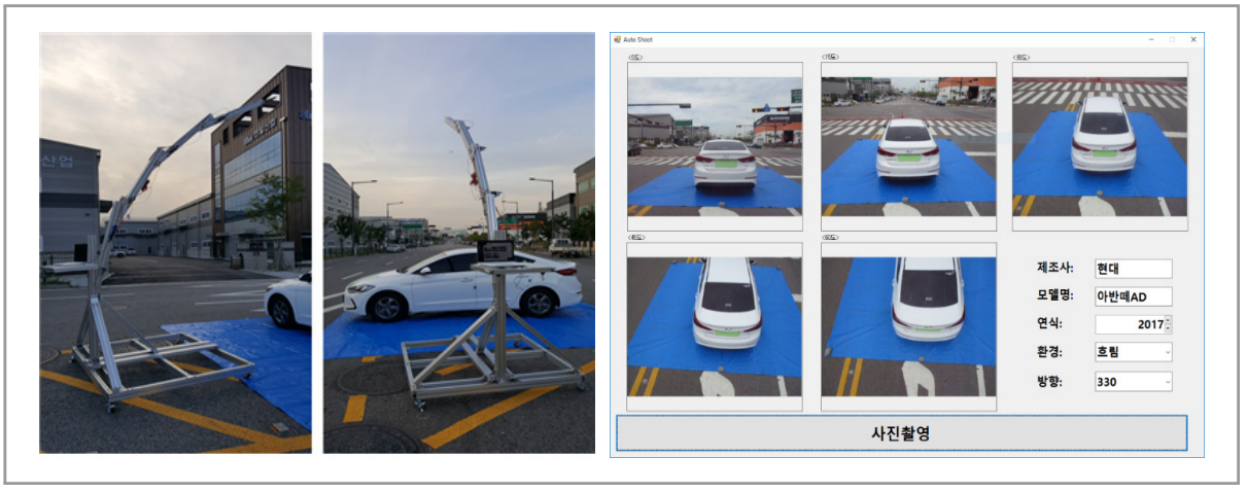
Technically, we would use the yolo5 model, which is known as the most intelligent model in vision processing. Also, the project would utilize Neural ODE that is conceptualized in 2018. Neural ODE utilizes Euler method and Adjoint Sensitivity method in backward propagation. For more information, please read the paper named “Neural Ordinary Differential Equations”. By using the method, we would expect the following advantages.

1) Lower memory cost by Adjoint sensitivity method
2) Fitting appropriate with irregular time points data

4. Dataset

The data set is served by the Korea government, taken in 2018, which is represented by AIHUB.

The dataset is about 100 different vehicles. There are an average 650 photos of each car. The photos are taken by using a mechanical machine and taken from different directions. When the focus is not correct, the photo is re-taken. The dataset is surely validated by Cross-Validation. For the model not being affected by the daylight or moonlight, the photo is taken at morning, noon, afternoon, night and indoor. The following is a photo about the way of taking the photos.



5. Evaluation Methods

Evaluation can be done in two perspectives, accuracy and unknown class detection. For accuracy, AUC area and f1 score are mainly used for classification task evaluations. AUC area is the area under the ROC curve, which is derived from precision and recall. For multi-class, each class can gain scores and can get appropriate hyperparameters. Furthermore, to handle imbalanced prediction like the image below, variance of f1 scores can be used. For service, using covariance of vehicle model portions and f1 scores can be used. For unknown class detection, it also can be evaluated by f1 score, treating unknown class as another new class.

$$F_{1,macro} = 2\frac{\text{recall}_{macro} \times \text{precision}_{macro}}{\text{recall}_{macro} + \text{precision}_{macro}}$$