VEHICLE NUMBER DETECTION AI SYSTEM FOR PEDESTRIAN SAFETY

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Abstract

With the spread of CCTV, various technologies have been developed for identification of the number of vehicles violating the law and for accurate judgment of the situation. The development of computer vision technology for processing recognized images ensures that there is no damage caused by erroneous situational judgment due to misrecognition. Recently, artificial intelligence deep learning technologies have been introduced to accurately recognize the number of vehicles that violate traffic laws using various image processing techniques. With the rapid change of society, traffic laws are also evolving at a rapid pace. We propose a deep learning algorithm for accurate situation determination of recently revised traffic laws. The proposed algorithm outputs accurate information after detecting a violation, extracting the detected vehicle license plate using image processing, and performing a number recognition process with a pre-learned cnn model. The cnn model for license plate recognition used YOLO. The YOLO learning model was used to extract areas by processing the images of vehicles, crosswalks, traffic lights, and pedestrians. In order to increase the accuracy of model validation, if the accuracy is less than 80%, it is judged that the bias is high and the image preprocessing is performed again or the loss value is reduced. Find the optimal model. In the future, it can be used as a recognition system not only in automobiles but also in various fields such as two-wheeled vehicles.

Keywords: YOLO, CNN, OCR, Deep Learning, Accuracy

I. Introduction

Vehicle license plate recognition is one of the representative applications where deep learning technology and computer vision technology can be applied practically. Among them, it is most commonly used in parking control, CCTV security, and road traffic management systems. The recent intersection pedestrian accident rate is 29.7% on average, and according to an experiment conducted in 19, 9 out of 10 teenagers passed without making concessions to pedestrians.[1] This study implements using YOLO and

CNN(Convolution Neural Network) to identify vehicles that do not pause or pass when green discrepancies.

After extracting the license plate area, which is a specific Region Of Interest (ROI) using YOLO, the number and character of the license plate are preprocessed using CNN(Convolution Neural Network), and character recognition is performed using OCR (Optical Character Recognition) in the CNN (Convolution Neural Network) learning model.[2]

II. Method

2.1 YOLO Object Recognition Course

The structure of YOLOv5 is shown in Fig. 1. The backbone that extracts the feature, the neck that increases performance by fusing the extracted feature, It consists of three types of parts, such as a head that converts feature bounding box parameters.[3]

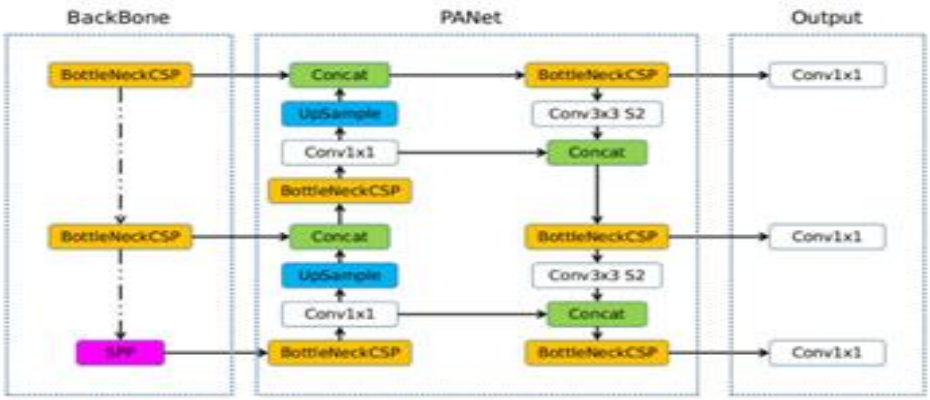

Fig. 1: Overview of YOLOv5

It is a process of recognizing the violation vehicle, pedestrians, and traffic lights as a model obtained through learning through deep learning-based YOLO when turning right at a crosswalk. In order to detect objects using YOLO, we create a yaml file that manages object classes.[4] We build a data set of images of vehicles, pedestrians, and traffic lights, and create an area file of each image. The files contained in the image and area are divided into training data and test data in a 7:3 ratio. When learning, you can learn by entering the image size, batch size, epoch value, yaml file path, model type, and weight.

2.2 CNN (convolutional neural network)

The convolutional neural network generates an optimal feature map for the image by optimizing the weights of the kernel through the learning process.[5]

In about 4,000 datasets, data processing is classified into associated images through a process that is automatically learned to suit. An analysis is performed with a relationship between one pixel of the image and surrounding pixels by grasping a portion rather than the entire image. Analysis is faster and more efficient because it is judged by looking at parts that are not the whole.

After that, as shown in Fig.2, generating multiple bounding boxes for a given image, a filter is repeatedly applied to increase the recognition rate of the object for each bounding box to find a pattern.

In the filter, image size 28x28, batch size 128, and epoch 100 are set to be repeatedly trained. At this time, a loss occurs while processing the filter, and to solve this problem, padding is used to prevent the loss. In other words, since the border consisting of zero is wrapped around the edge of the image, the size of the input value and the result value becomes the same, and information loss does not occur. After that, many bounding boxes try to increase the recognition rate of objects by removing duplication through 'Non maximum suppression'.[6]

After image processing, we are going to use the Tesseract Optical Character Recognition (OCR) technique for character recognition. It is an open-source engine provided by Google and can be easily implemented through libraries.[7]

Fig. 2: After removing the duplicate bounding box

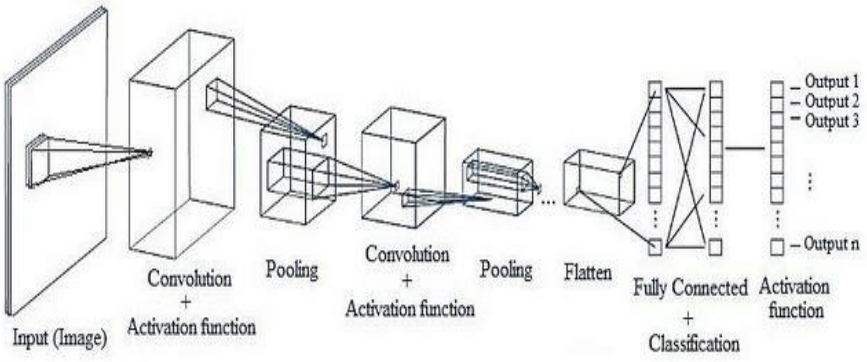

Fig. 3: CNN Algorithm Structure

2.3 Integrated Algorithm Configuration

As shown in Fig. 4, proposed system is a model obtained through YOLO learning for detection of vehicles, crosswalks, traffic lights, and pedestrians, and a CNN(Convolution Neural Network) network for license plate recognition, which is obtained through learning.

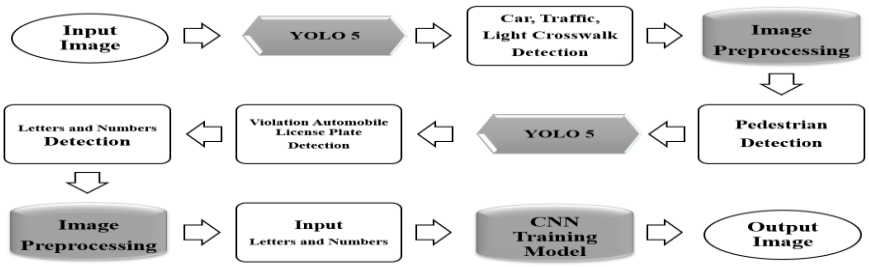

Fig. 4: Overall System Instruction

The proposed system is largely divided into object detection, image processing, and image recognition parts.

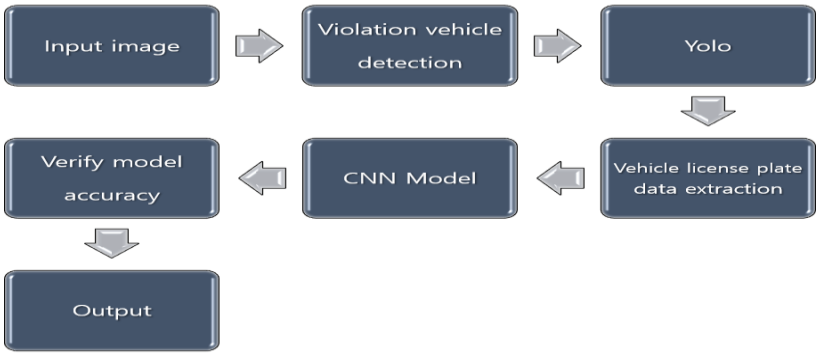

Fig. 5: System Flow

As shown in Fig. 5, YOLO learning model was used to extract areas by bounding images of vehicles, crosswalks, traffic lights, and pedestrians. Image processing is a preprocessing process that extracts whether or not a violating vehicle and the number and characters of a license plate when the traffic light is G or R. It was used to recognize the number and character of the license plate as text as a CNN(Convolution Neural Network) learning model using the number and character of the license plate extracted using the preprocessed data.

In the license plate recognition process, 150000 data are used to learn the model, and learning data and verification data are divided at a ratio of about 7:3. In CNN(Convolution Neural Network) learning model, the activation function uses Relu and Adam optimization to optimize the error function, learning rate 0.001, batch size is 128 and epoch is 100 times.

After that, we will proceed with the performance verification of the model trained with CNN. If the model's performance is more than 80%, it is judged to be a good model and the output value is return.

III. Conclusion

The proposed system has established a system for recognizing license plate information of violating vehicles using YOLO and CNN(Convolution Neural Network). Through this

system, it is expected that the accident and death rate due to the right-turn violation vehicle will be reduced and the stability of pedestrians will be guaranteed. However, the recognition rate of the proposed system is lowered due to environmental factors or aging CCTV systems.

In the future, we intend to add technology that increases low-definition to high-definition and establish a system that recognizes violations of motorcycles other than automobiles.

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