Character Translation on Plate Recognition with Intelligence Approaches

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ABSTRACT

In recent years, the number of automobiles in Indonesia has expanded. This rise has a knock-on impact on street crime. On this problem based, a preventative road safety prevention system is required. This research contribution is to develop an efficient algorithm for detecting vehicle license plates. This study's technique incorporates artificial intelligence technology with character translation. Yolov3 and Yolov4 are the artificial intelligence systems employed in this study. The detection of objects in the form of license plates is the result of this approach. In artificial intelligence, object detection results are utilized as input for image processing. The image processing method is used to translate characters. Optical Character Recognition (OCR) is used to decode the characters in the image precisely. The artificial intelligence data training resulted in a 76.53% and 89.55% mean average precision (mAP) level. Using OCR, the system is capable of character translation. These results give an opportunity to develop more complex image-processing applications.

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1. INTRODUCTION

The number of vehicles in the world has been increasing in recent years [1]–[3]. In comparison, Indonesia has also experienced an increase in the number of motorcycle vehicles [4]. The increase in vehicles has both positive and negative impacts. The positive impact of the increase is a macroeconomic improvement and driving the automotive industry [5]. In addition, the rise in the number of motorized vehicles also results in negative impacts such as the environment [6], security [7], and crime [8]. Negative impacts on the environment can be the increased production of carbon exhaust gases by vehicles [9] and oil waste. Furthermore, the impact of security and crime is the potential for street crime to increase due to the quantity of vehicles. Regarding security, street crime can be vehicle snatching or theft of a vehicle.

Handling road crimes that have been carried out in Indonesia include the use of electronic ticketing systems (e-Tilang), the use of CCTV cameras, and road patrols. The system used still experiences limitations in centralized data and real-time monitoring. Thus, a more integrated, fast, and centralized security system is needed. The vehicle safety system can be in the form of vehicle type vehicle detection and license plate reading.

Vehicle classification [10], [11], and detection systems [12] in recent years have been widely developed. The classification system can be integrated easily using artificial intelligence. One of the applications of the classification system in object detection includes garbage [13], [14], humans [15], animals [16], plants [17], [18], signals [19], and vehicles [20]. Meanwhile, object detection or recognition is also developed in detecting an object including cars, motorcycles, bicycles, and license plates [21]. License plate image detection is limited to plate objects in vehicles. It still has the potential for development in translating characters into license plates.

The character translation system inside an object can be done using an image-processing concept application. OCR or Optical Character Recognition, is one of the actual implementations of processing in translating characters in imagery [22]. One of the implementations of using OCR in imagery includes data on house numbers [23], digital textbooks [24], and license plates [25]. The translation of characters on plates in previous studies has not been linked and integrated with artificial intelligence.

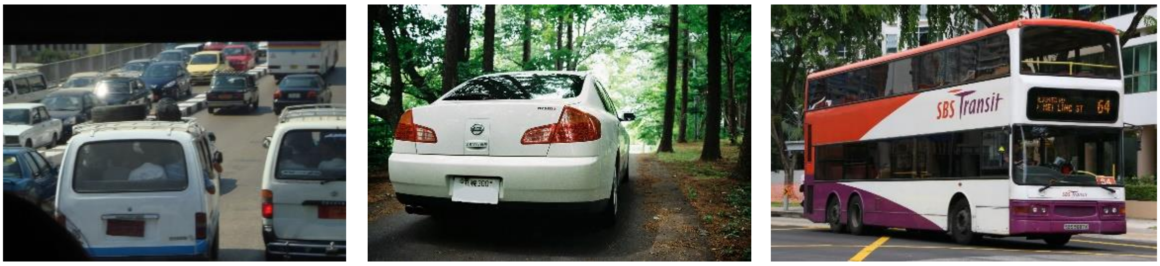
This study’s contribution is to integrate the plate detection system using two approaches: artificial intelligence and image character translation. Later, this system can be used in real-time and directly connected to a centralized database.

2. METHODS

This study's method includes steps of a methodical approach. The procedure begins with data collection, artificial intelligence training, and image processing integration.

2.1 Dataset Collecting

This study's dataset was collected from Google Open Images. The collection contains 1800 vehicle photos. The data was divided into 1500 photos for data training and 300 images for data validation. The pixel size of the entire picture is resize to 608x608. Figure 1 is an example of an image dataset.



(a) **(b)** **(c)**

Figure 1. (a)-(c) Images example of Google Open Image

2.2 Artificial Intelligence

Artificial intelligence is a methodical and adaptable technique for modifying picture patterns. Deep learning, an artificial intelligence algorithm, was applied in this investigation. Deep learning is a step of artificial intelligence that use pictures as input. ResNet [26], DenseNet [27], RCNN [28], and Yolo [29] are some of the deep learning algorithms. Yolo is used as the foundation of the image-processing technique in this study. Yolo is one approach for detecting objects in images using the bounding box technique. Yolo went through many developments, from Yolo V1 [29], Yolo V2 [30], Yolo V3 [31], and Yolo V4 [32]. The Yolo approach used in this study will later compare the accuracy level of Yolo V3 and Yolo V4.

2.3 Image Processing Approach

Several image processing techniques may be used to process digital images. Image processing techniques are screening, enhancement, morphology, and image geometry. The image processing procedure is used in this study to get character information from images. OCR, or Optical Character Recognition, can be used to accommodate the process of translating or extracting text in picture processing. Figure 2 depicts the OCR-based image processing procedure.

Figure 2. OCR Process

3. RESULT AND DISCUSSION

This study's findings are split into two sections: testing systems with artificial intelligence and incorporating OCR image processing. The number of items correctly spotted while testing artificial intelligence systems results in accuracy. Regarding OCR results, it integrates with OCR using items discovered using artificial intelligence.

3.1 Artificial Intelligence Results

The YoloV3 and YoloV4 algorithms are utilized in the artificial intelligence approach. This algorithm is used to train vehicle datasets. Mean Average Precision (mAP) is a metric used to assess artificial intelligence techniques. This assessment approach employs the correctness of reading items in the image to achieve an accuracy value. The graph of the mAP findings for each Yolo algorithm is shown in Figure 3 and Figure 4. Figure 3 shows the resulting precision configuration for the YoloV3 method. The mAP shows an increasing trend from iteration 1000-6000. The mAP was elevated to yoloV3 at iteration 6000 with 76.53%. In line with this, using the YoloV4 configuration shows the same tendency for results. However, mAP levels in YoloV4 have higher yields. The mAP results for YoloV4 can be seen in Figure 4.

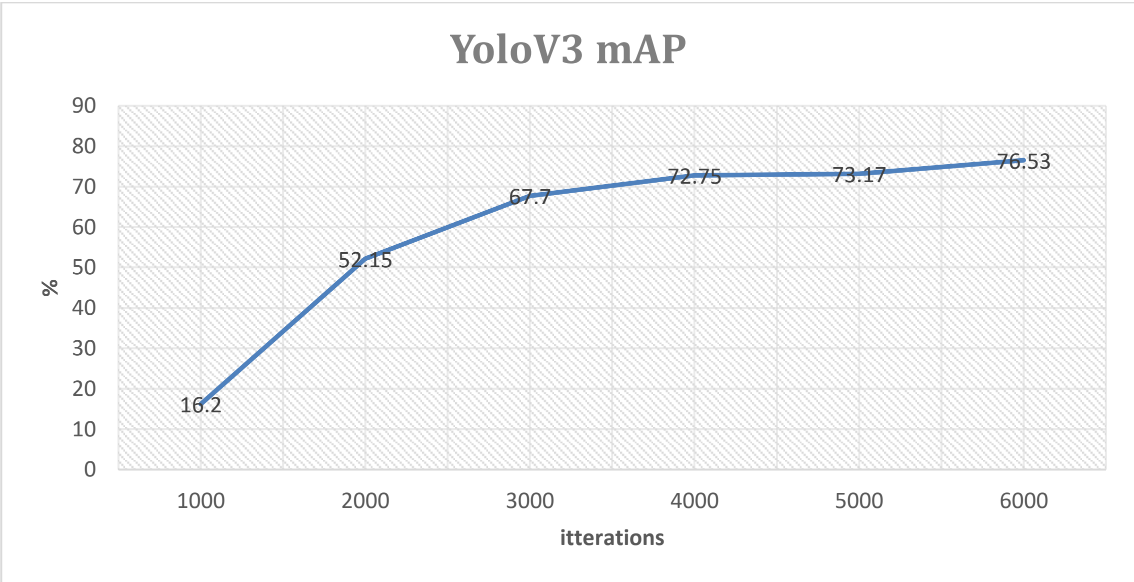


Figure 3. Yolo V3 Mean Average Precision

3.2 OCR Results

In this work, image processing was approached using OCR. The OCR approach employs bounding boxes built by artificial intelligence-assisted object identification. The source picture for OCR is this bounding box. During the program's execution, the characters enclosed within the bounding box can be translated using OCR. The results of the character translation method can be seen in Figure 5 (a)-(h).

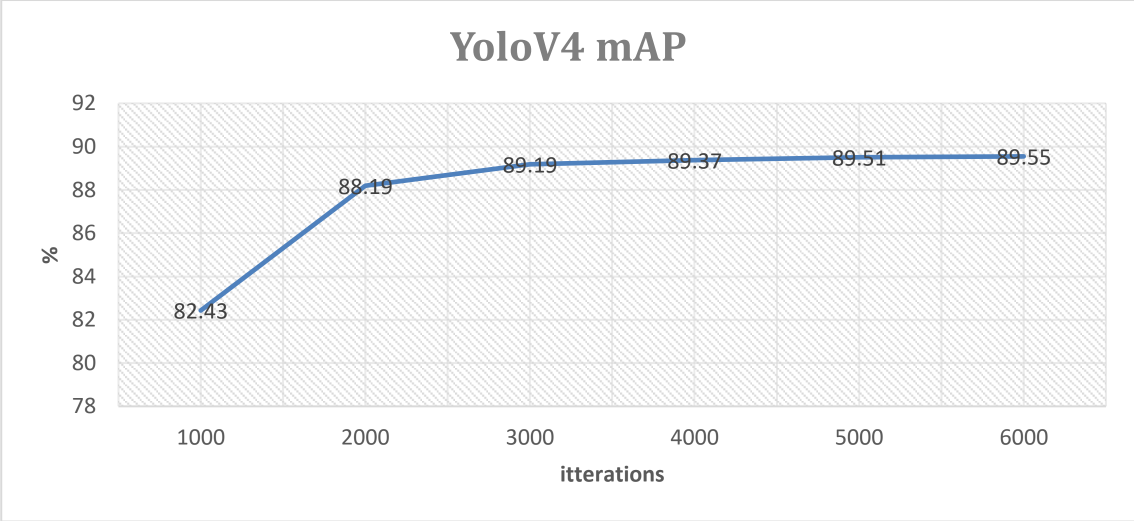


Figure 4. Yolo V4 Mean Average Precision

Figure 5. (a)-(b). images original; (c)-(d). bounding box detection; (e)-(f). digital images processing; (g)-(h). integration algorithm results

4. CONCLUSIONS

This work effectively integrated artificial intelligence techniques in the form of Yolo and OCR digital image processing. The top data training outcomes for artificial intelligence precision were 76.53% and 89.55%. The optical character recognition technique, which serves as the foundation for digital image processing, may also be used correctly to recognize characters in images. The most recent findings in this study, in the form of algorithm integration, can be further integrated into a more comprehensive system. In the future, this algorithm can be applied to create a centrally integrated detection system.

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