OPTIMIZING THE IMPLEMENTATION OF THE YOLO AND DATAALGORITHM AUGMENTATION IN HANACARAKA JAVANESE SCRIPT LANGUAGE CLASSIFICATION

Dadang Iskandar Mulyana[1], Ykhsanur[2]*
[1,2]STIKOM CKI Indonesia
Jl. Raden Inten II No.8, Duren Sawit, City of East Jakarta, Indonesia
E-mail: Ykhsanur@gmail.com

ABSTRACT- The Javanese language and Javanese script are one of the rich cultural heritages in Indonesia, but there are still many people who do not have sufficient understanding of the Javanese language and culture, including the Javanese script. This can have an impact on the loss of language and cultural diversity, as well as the loss of the local identity of the Javanese people. The lack of knowledge about Javanese script language culture canbe caused by various factors, such as the lack of access to adequate learning resources, the minimum use of Javanese language and script in daily life, and the lack of attention from the government and society towards the preservation of Javanese language and culture. This study aims to optimize the application of the YOLO (You Only Look Once) algorithm and data augmentation techniques in the Javanese language classification Hanacarakascript. The method used in this study was collecting data on Javanese Hanacaraka script images, data labeling, data augmentation, and model training using the YOLO algorithm. The results showed that the Javanese script pattern recognition method used the YOLO algorithm which had gone through the data augmentation process, showing good results with an accuracy of 96.4% using 3021 image data sources for the hanacaraka letters.

Keywords: YOLO, Javanese script, Augmentas

INTRODUCTION

The Javanese language and Javanese script play an important role in the richness and diversity of Indonesian culture. Javanese itself is the language used by more than 80 million people in Indonesia, especiallyin Central Java and East Java. Meanwhile, the Javanesescript is a writing system used by the Javanese centuries ago and is still used by some Javanese people today.[1].Although the Javanese language and Javanese script have a long and rich history, there are still many peoplewho do not understand Javanese language and culture,including the use of Javanese script. This can have an impact on the loss of language and cultural diversity and the loss of the local identity of the Javanese people. The lack of understanding and use of the Javanese script can be caused by various factors, such as the lackof access to adequate learning resources, the minimum use of Javanese language and script in daily life, and the lack of attention from the government and society towards the preservation of Javanese language and culture.

In the era of increasingly advanced information technology, character recognition using computer algorithms can be a solution to improve the recognition of Javanese characters. One of the algorithms that can be used for object detection indigital images is the YOLO (You Only Look Once) algorithm. This algorithm has advantages in speed and accuracy[2], so thatit can be used for character recognition of Javanese characters. However, to improve the performance

training datavariations by manipulating existing training data into new variations. With this technique, the classification model can learn more variations of the Javanese script characters, so as to improve the accuracy of the detection and classification of the Javanese Hanacaraka script using the YOLO algorithm.[4].

Preservation of Javanese script culture can be done in various ways, such as through education, government policies, and technological development. Education about Javanese language and culture, including the use of Javanese script, can be provided inschools so that the younger generation can understand and preserve ancestral culture. Government policies can also provide protection and support for the preservation of Javanese script culture, such as promoting the use of Javanese script in the mass media and supporting the development of Javanese script character recognition technology. In the context of technology development, character recognition for Javanese characters can be done using various methods, such as classification algorithms, segmentation, and image processing.

The YOLO algorithm and data augmentation technique are methods that can be used to improve the character recognition of the Javanese script, especially the Javanese Hanacaraka script. By increasing the accuracy of Javanese characterrecognition, it is hoped that people can more easily access and use the Javanese script, so that they can helppreserve Javanese script culture. In addition, the development of Javanese script character recognition technology can also open up opportunities for developing applications that can facilitate the use of Javanese script in various fields, such as translators, handwriting recognition, and so on. so that it can help the preservation of Javanese script culture.

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Thus, the development of Javanese script character recognition technology can make a positive contribution to thepreservation of Javanese script culture and enrich the diversity of Indonesian culture. Overall, the introduction and preservation of Javanese script culture, including the Javanese Hanacaraka script, is a very important effort in maintaining Indonesia's cultural diversity. The development of Javanese script character recognition technology can be a solution to increase the recognition and preservation of Javanese script culture. Therefore, there is a need for support from various parties, both the government, society andacademics, in efforts to preserve Javanese script culture and develop Javanese script character recognition technology.

METHODS

The process and stages of this research if described in general can be seen in Figure 1. From Figure 1, the research begins by collecting image data[6]then after the data is collected, the pre-processing of the image data is carried out again whichconsists of labeling and changingthe size of the image[7]. Then the YOLO network configuration stages are carried out which are in accordance with theimage data and data that have been trained so that a newYOLO modelis formed[8]. The final stage of theresearch is testing the model using existing image data[9].

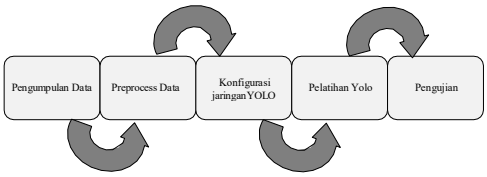

Figure 1. Research Process Flow(Source: Own research project)

Data collection

The images of the HANACARAKA characters used in this study were taken from a datasetthat had been previously collected, totaling 3467 images of the HANACARAKA letters in jpg format, each filled with 3021 training data images, 283 validation data images and 163 test data images. Someexamples of sample data sets can be seen in Figure 2.

Figure 2. Hanacaraka dataset (Source: Own research project)

Data Image Pre-Process

In this step the data will be pre-processed with theaim of providing labeling and resizing the image. Image labeling is the initial stage where each image in the dataset is labeled with the aim of storing image information[7][10]. The labeling stage is carried out using a method by inserting a bounding box and class name for each image object. Furthermore, the image size is changed to improve the performance of theYOLO model in object recognition[11][12].

YOLO Network Configuration

Network configuration is required as a model network to load the data to be trained[13][14]. The batch or iteration used is 20 which means that each iteration contains 20 images. Subdivision is 4 so that the modeling process divides the batch into 5 parts. Therefore, there are 20/4 = 5 images per mini batch thatare sent to the GPU to be processed and repeated 5 times until it's finished[4][15]. The next iteration startswith 20 new images.

Models Training

The YOLO model used in this study has several artificial neural networks consisting of a convolutionallayer with a kernel size of 3 × 3, a max-pooling layer with a size of 2 × 2 kernels as shown in Figure 3. Furthermore, the last convolutional layer has a size of 1 × 1 kernel used to reduce data to 13 × 13 × 40. 13 × 13 is the grid size, 40 is obtained from the sum of the filter formulas[16][17]. The parameters used in this model training can be seen in Figure 3 below.

layer	filters	size/strd(dil)	input	output
0 conv	16	3 x 3/ 1	416 x 416 x 3 ->	416 x 416 x 16 0.150 BF
1 max		2 x 2/ 2	416 x 416 x 16 ->	208 x 208 x 16 0.003 BF
2 conv	32	3 x 3/ 1	208 x 208 x 16 ->	208 x 208 x 32 0.399 BF
3 max		2 x 2/ 2	208 x 208 x 32 ->	104 x 104 x 32 0.001 BF
4 conv	64	3 x 3/ 1	104 x 104 x 32 ->	104 x 104 x 64 0.399 BF
5 max		2 x 2/ 2	104 x 104 x 64 ->	52 x 52 x 64 0.001 BF
6 conv	128	3 x 3/ 1	52 x 52 x 64 ->	52 x 52 x 128 0.399 BF
7 max		2 x 2/ 2	52 x 52 x 128 ->	26 x 26 x 128 0.000 BF
8 conv	256	3 x 3/ 1	26 x 26 x 128 ->	26 x 26 x 256 0.399 BF
9 max		2 x 2/ 2	26 x 26 x 256 ->	13 x 13 x 256 0.000 BF
10 conv	512	3 x 3/ 1	13 x 13 x 256 ->	13 x 13 x 512 0.399 BF
11 max		2 x 2/ 1	13 x 13 x 512 ->	13 x 13 x 512 0.000 BF
12 conv	1024	3 x 3/ 1	13 x 13 x 512 ->	13 x 13 x1024 1.595 BF
13 conv	512	3 x 3/ 1	13 x 13 x1024 ->	13 x 13 x 512 1.595 BF
14 conv	40	1 x 1/ 1	13 x 13 x 512 ->	13 x 13 x 40 0.007 BF

Figure 3. YOLO models (Source: Own research project)

Testing

The test was carried out using a laptop. Tests arecarried out to determine the level of accuracy of objects with a new model that has been trained before[18][19][20].

RESULTS AND DISCUSSION

From the implementation process and the testing process, the results obtained for each process are as follows:

Training Results

The final result of the training process carriedout above using 3021 images and 20 classes. The images were trained for 20 epochs and 2 batches with an image size of 192 to produce the information shownfor the recall value in Figure 4. An accuracy level of 0.964 or about 96% of the total data was obtained.

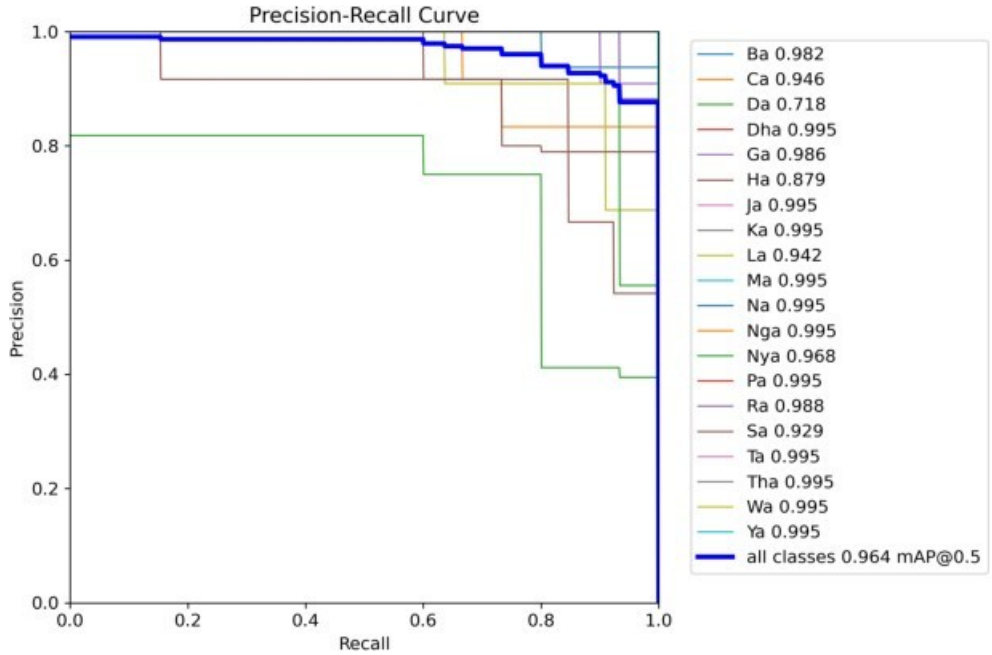

Figure 4 Precision recall curve(Source: Own research project)

And figure 5 shows the confusion matrix, and figure 6 shows the evaluation for the training process.

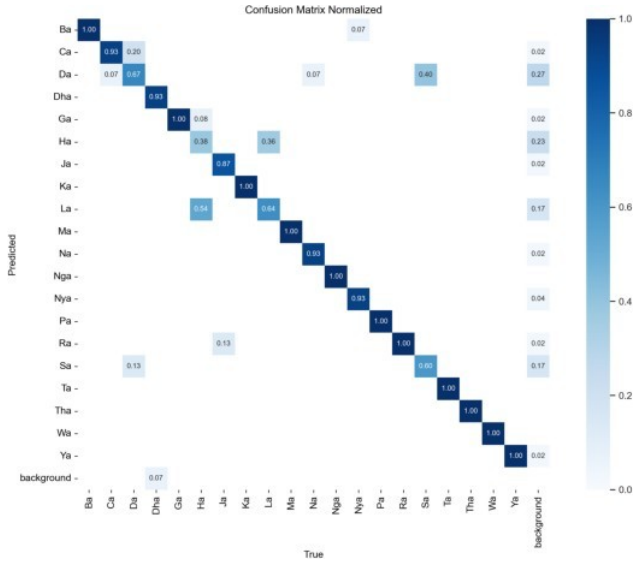

Figure 5. Confusion matrix of the training process
(Source: Own research project)

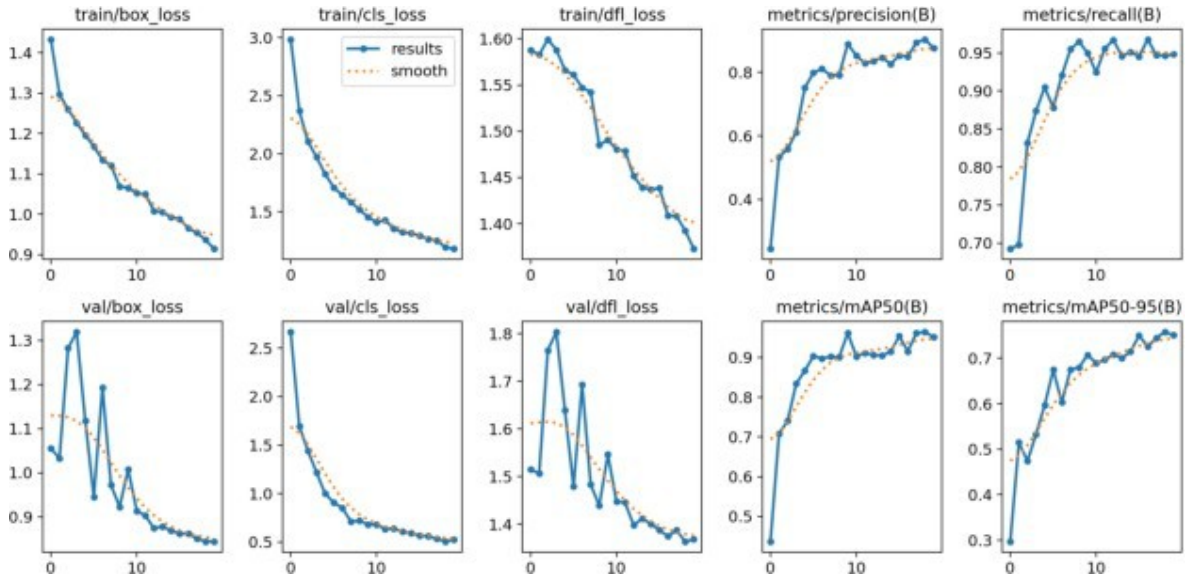

Figure 6. Evaluation of the training process

(Source: Own research project)

Validation Results

Furthermore, for the results of the validation process after the data is trained, in Figure 7 shows the value of the F-1 Confidence curve for data validation of
0.92 or 92% of the data is considered confidence

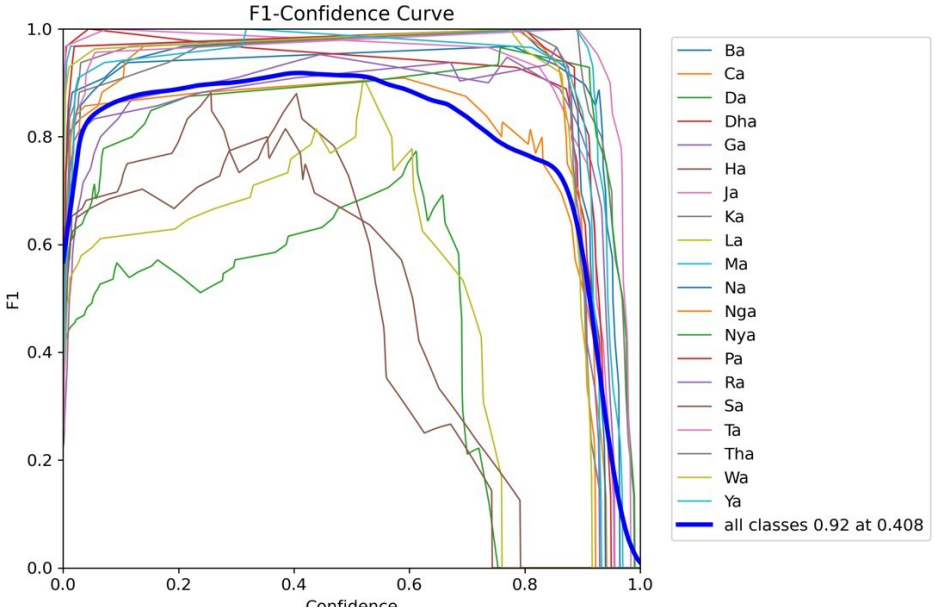

Figure 7. Confidence curve (Source: Own research project)

Then Figure 8 displays the results of the validation for the two images with an NGA class of 0.9 or 90% and aCA class of 0.9 or 90% of the validation.

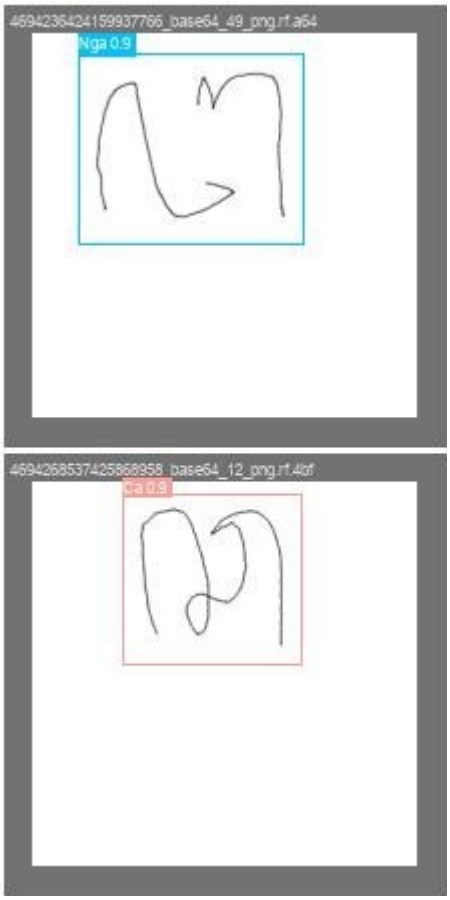

Figure 8. NGA and CA classes
(Source: Own research project)

Detection Results

Figure 9 shows the results of the detection of the CA character image which the test wants to do, showing a result of 0.77 or 77% and it is classified as aCA letter class. From the prediction results on a pictureof the letter HANACARAKA.

Figure 9. CA letter detection
(Source: Own research project)

CONCLUSION

Based on the results of the above research, based on the results of the discussion of OPTIMIZATION OF THE IMPLEMENTATION OF YOLO ALGORITHM AND DATA AUGMENTATION IN JAVA HANACARAKA LANGUAGE CLASSIFICATION, it can be concluded that the Javanese script pattern recognition method uses YOLO which has gone through the data augmentation process at the training stage showing good results with an accuracy of 96.4% with 3021 images.

SUGGESTION

Based on the results of the research that has been done, the researcher has several suggestions to improve the results of accuracy and method development to the next stage, namely:

1. To get good accuracy and regression, it is better to use a lot of images in the training dataset or test dataset and make the sample images not too different from the pattern of theletters that should be.
2. Using other methods such as edge detection sobel or robert and artificial neural networks with other methods.
3. Using letter patterns other than the alphabet such as Chinese, Japanese, Javanese, Sundanese to Arabic scripts

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