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Designing a Real-Time-Based Optical Character Recognition to Detect ID Cards

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Abstract

This research 0aims to design a Real-time ID card detection based on Optical Character Recognition (OCR). OCR detects and records information into CSV files using a camera. Hopefully, it can become one of the administrative solutions in Indonesia by using existing identity cards using OCR in real time. This research method was carried out independently in August 2021 using ID cards as objects. The tool involved was a 320x320 pixel webcam camera on an HP Intel Core i5 7th Gen notebook. The software used by Easy OCR was Pytorch-based. ID cards were detected using an algorithm by TensorFlow object detection with SSD MobileNet V2 FPNLite 320x320 as the pre-trained model of Tensorflow. The researchers collected ID card images using a webcam with various light conditions and orientations and label them using labeling. The researchers trained it with only 20 photos. After 3000 training steps, the researchers obtained about 0.17 loss and 0.95. Thus, the ID card detection tool using OCR runs well.

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INTRODUCTION

With technology today, electronic data and information must be increasingly developed, effective, efficient, and become the primary choice for an agency [1]. Improving the service of data and information sources is an essential IT role [2]. Personal data exchange in Indonesia is done manually by filling out forms or asking many questions about electronic ID cards (e-KTP). Scenes like this are familiar and strange occurences in the society. The electronic ID card (e-KTP) has a chip containing the user's data that is designed to exchange data electronically. Even so, the use of this chip is infrequent [3].

Currently, the ID card data is entered through manual input by the operators [4]. It is inefficient because a lot of time are required to manually entering data. Therefore, automatic systems are required [5]. The disadvantage of this manual system is that it is inefficient, time-consuming, and error-prone. Even if this confidential data is sent via digital channels, unauthorized persons often know of it [6]. The current technology is a method to verify personal identity with a computer [7]. Computers are required to detect the text on the ID cards and recognize the text. [8],[9]. So, the above problems to investigate the Real-time-based Optical Character Recognition (OCR) to Detect ID cards.

The critical role of the nature of Real-Time is described in one of the studies by Zhao et al. [10]. It is potentially used for real-time control and has been reviewed and compared. Many efforts have been devoted to (i) integrating the single-cell model with accessories to study the system performance, (ii) incorporating aging effects to enable long-term performance prediction, and (iii) evaluating the computational speed. Zero-dimensional analytical and empirical models are also widely investigated in the literature in an attempt to be used for real-time control of PEM fuel cells due to their ease of implementation and fast computing speed.

This research is also supported by Bian et al.'s research on the importance of Real-Time [11]. This paper presents the real-time monitoring system of manufacturing workflow

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for the Smart Connected Worker that utilizes machine learning techniques to create an automated and intelligent manufacturing workflow. By passing the real-time digital and visual data into the system's dedicated modules, SCW can extract high-level information, such as machine states, human-machine interaction status, and energy profile of individual devices, all of which are essential to further analysis and optimization. The evaluation process that took the 3D printing for plastic as one use case is currently being deployed into metal additive manufacturing and may be extended to the use cases of robotics and assembly lines. The developed work, with an entirely automated workflow and a real-time GUI, should smoothly fit into existing advanced manufacturing systems and may serve as an auxiliary unit or substitute for human labor.

The previous research on OCR was by Afdholudin [3]; it used descriptive qualitative while the researcher used a case study applied research method. The advantages of this method are: (1) speeding up the process of inputting personal data because it is done automatically; (2) Facilitates data exchange; (3) Assisting small non-governmental organizations (such as small cooperatives and MSMEs) in automating the management of electronic ID card (e-KTP) data; (4) there is no longer a lack of availability of electronic ID card (e-KTP) readers and the high price of tools; (5) with the automation of any work that needs human supervision will be reduced slowly.

One method that is used by many people to read (detect and recognize) is OCR. OCR reading is the process of converting the image (image) of letters into ASCII characters that are recognized by the computer as an alternative to solutions based solely on image recognition [12][13][14]. In Indonesia Government and non-governmental organizations, the OCR method has not been implemented yet to read text information from citizen ID cards, especially Indonesian ID cards. In addition, although OCR is effective for sentence recognition, the currently developed OCR has various characteristics. For example, Tesseract and Mathpix [14]. Extracting people's names and blurring them in OCR text is much more complex due to the noise inherent in the data. In many applications, a ranking list of entities identified from OCR text is more desirable than simply trying to distinguish them [15].

Information obtained through the OCR detection camera is in the form of access (name of cardholder, face image, unique credential number / No id, expiration date, or status) [16]. This research was conducted because of the complexity of the administrative process for the needs of civilians. So here, the researchers designed an ID card detector and OCR to detect and record information into a CSV file using a webcam (laptop camera). To see characters on the ID card, the researchers used the Pytorch-based EasyOCR library. This research aimed at designing ID card detection and OCR to detect and record information into CSV files using a camera. Hopefully, it can become one of the administrative solutions in Indonesia by using existing identity cards using OCR in Real-Time.

METHOD

This research was carried out independently in August 2021 using ID cards as objects. The tool involved was a 320x320 pixel webcam camera on a HP Intel Core i5 7th Gen laptop. The software used was Pytorch-based EasyOCR. The researchers detected ID cards using an algorithm by TensorFlow object detection with SSD MobileNet V2 FPNLite 320x320 as the pre-trained model of Tensorflow.

The method used in this research was an algorithm by implementing self-testing. The method used three main stages that can see in Figure 1 below:

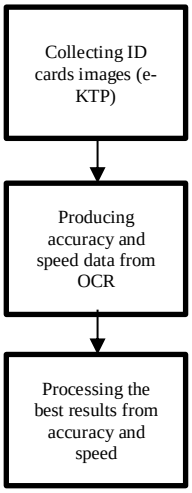

Figure 1 . Method of Research

Collecting Photo ID Card (KTP)

This pre-processing stage optimized the marked images to improve reading accuracy. In this stage, the researchers reduced the noise in the image (noise reduction), data normalization, and compression. Compression aimed to shrink image data so that OCR processing does not consume too many computer resources. It should also note that the compression process is lossless, which means that essential data and required details will not be lost even if the size is reduced.

Produces Accuracy and Speed data from OCR

This stage is the processing stage of the image detector until it becomes a character that OCR recognizes. This stage consisted of the following steps:

1. Optical Scanning

This stage is where the object is captured into a digital image using a webcam. It will convert the captured images into grayscale, making it easier for the computer to detect. In this research, the researchers collected the ID cards and then divided the data into training data and test data. After collecting the appropriate data, pre-processing was carried out to create the image used in future tasks.

2. Location Segmentation

The next step was extracting the text area to determine the character area to be taken. The researchers defined the kernel with the desired. In this stage, the program detected any location in the image with text. The program marked the image so the unmarked area would be skipped when doing letter pattern recognition. Location segmentation is beneficial for reducing errors and preventing the program from reading objects other than text, such as images or logos. Text area extraction and segmentation were carried out to determine the area to be taken automatically.

3. Segmentation

This segmentation is different from location segmentation. The areas marked in the location segmentation will be segmented again at this stage. This segmentation aimed to separate each letter from the entire text in the marked area. The separation will help the program recognize letters because the program only needs to focus on one letter instead of the whole text. Image segmentation is used to determine the portion of the text to be captured. In this study, the portions taken were the NIK character, address, place and date of birth, and name.

4. Representation

Representation refers to taking images of the results of the segmentation process and representing them in a more straightforward format. This step was done to reduce program complexity while increasing accuracy.

5. Feature Extraction

The researchers used the TensorFlow OCR techniques to extract the features of the images. There were eight characters in the image. The components in the photo, such as curvature, angle of curvature, many curvatures, and other features, were taken for processing in the next stage. In the last step, OCR was used to predict the character on the ID cards [5].

Recognition training and recognition was the main stage of the OCR method. At this stage, the extracted features were analyzed so that the program can determine the letters in the images.

Processing the Best Results from Accuracy and Speed

This stage was the final stage of OCR. Generally, this stage aimed to clean the processed data from spelling errors and detection. This data can also be used as a new dataset that can be combined with machine learning methods to collect ID card images using a webcam with various light conditions and orientations and label them using labeling.

RESULTS AND DISCUSSION

Collecting electronic ID card (e-KTP) Images

In t0his stage, the researchers determined which ID card that would be used as the object of research. The researchers determined ID cards belonged to the volunteers to be used as the research objects.

Produces Accuracy and Speed data from OCR

OCR training is the first test to be carried out on this application. This test aims to determine the accuracy and duration required for the OCR feature in this application to recognize each text image from personal data/user biodata on a captured ID card. This

test has several measuring variables that have been determined so that the results of each test can be compared and analyzed so that it will produce information about how to get optimal results when using the OCR feature in this application.

For object detection and optical character recognition, the researchers used two main models: Tensorflow for object detection and Easy-OCR for optical character recognition. The Tensorflow model was used to train unique datasets for ID card detection. This model used a 320x320 pixel image, which was good enough to detect and recognize ID cards. The model was tuned by training with 500 epochs and a batch size of 8 for good accuracy. For character recognition, the researchers used Easy-OCR, which is similar to the human eye [17]. However, and more likely, if the human eye can see the source quickly, it is also possible to achieve good OCR results. The easier it is to separate characters from the background, the more refined the OCR smoothness and the better the source image quality.

Figure 2. An example of an ID card image used to detect an ID card using OCR with the python programming language.

The implementation is carried out using the Python programming language and the Tensorflow learning library 2.0 [3],[4],[12]. An Intel i5 microprocessor laptop machine and 4G RAM were used to run the implemented code. The results of the data obtained can be seen in figure 3.

13d95f1e-f5e0-11eb-a0f1-f0038c43e360.jpg,[],[],[],[],[],[],[],[],[],[],[]

1c63746e-f5e0-11eb-b98e-f0038c43e360.jpg,['PROVINSI LAMPUNG'],['KABUPATEN PESAWARAN'],['1809012803940003'],['RUSYDI ISKANOAR'],"['BANDAR LAMPUNG,28 03-1999']",['LAKILAKI'],['DUSUN NEGERI TUAKOMP'],['AISLAM'],['Status Pertawinan: BELUMKAWIN'],['PELA MAMAHASISWA'],['Kerarganegaraan; WNI']

249b2126-f5e0-11eb-bdaa-f0038c43e360.jpg,['PROVINSI LAMPUNG'],['KABUPATEN PESAWARAN'],['1809012803990003'],['Hingga'],"['BANDAR LAMPUNG;, 28-03 1999']",['LAKI LAKI'],['DUSUN NEGERI TUA KOMP'],['JSLAM'],['Status Perkawinan: BELUMKAWIN'],[],[]

2cee3458-f5e0-11eb-9ff8-f0038c43e360.jpg,['PROVINSILAMPUNG'],['KABUPATEN PESAWARAN'],['1809012803990003'],['RUSY DI ISKANDAA'],"['BANDAR LAMPUNG,28-03-1999']",['LAKI LAKI'],['GL Darah'],['ISLAM'],['Stalus'],['PELAJARMMAHASISWA'],['Kewarganegaraan']

3600107a-f5e0-11eb-8b9e-f0038c43e360.jpg,['PROVINSI LAMPUNG'],['KABUPATEN PESAWARAN'],['1809012803990003'],['RUSYDI ISKANDAR'],"['BANDAR LAMPUNG, 28-03 1999']",[],['DUSUN NEGERI TUA KOMP'],['ISLAM'],['Status Perkawinan: BELUM KAWIN'],[],[]

3f0bb328-f5e0-11eb-9618-f0038c43e360.jpg,['PROVNSILAUPUNG'],['KABUPATEN PESAWARAN'],['1809012803790003'],[],[],[],[],[],[],[],[]

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53db3b9a-f5e0-11eb-a430-f0038c43e360.jpg,['PROVNISILANPUNG'],[],[],[],[],[],[],[],[],[],[]

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799e6df0-f5e0-11eb-b17a-f0038c43e360.jpg,[],['KABUPATEN PESAWARAN'],[],[],[],['2403-1945'],['DISHn'],[],[],['PELA MR MAHASISWA'],['Kewamanenaraan; WNI']

Figure 3 . OCR-readable characters

Figure 3 shows that the results obtained from the 20 experimental photos are letters, words, and sentences on the ID card that OCR can read, including Province, Regency, NIK, Name, Place/Date of Birth, Gender, Address, Religion, Marital Status, Employment, Nationality, and the ID card validity period. In total, 20 electronic ID card (e-KTP) photo samples were used in the test. Only the four examples below will be shown, while the rest will not be displayed. The researchers provide some visualization of detecting ID cards. Some trials can be seen in Figures 4-8.

Figure 4. Loss train ID Card No 1

Figure 4 shows that the total number of characters on ID card no. 1 is 177. The identified characters are 177 and the correctly read characters are 169, with an error percentage of 0,95%.

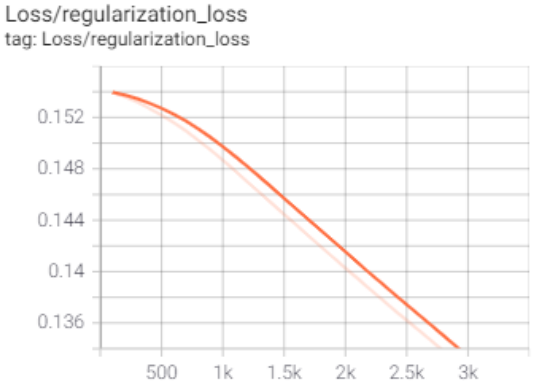

Figure 5. Loss Train ID Card No 2

Figure 5 shows that the total number of characters on ID card no. 2 is 177. The identified characters are 177 and the correctly read characters are 177, with an error percentage of 0%.

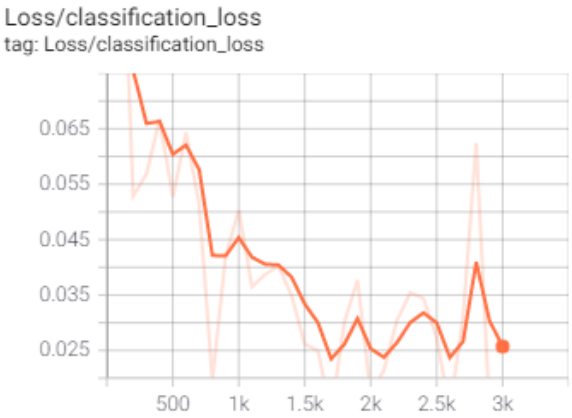

Figure 6. Loss Train ID Card No 3

Figure 6 shows that the total number of characters on ID card no. 3 is 177 characters. The identified characters are 177, while the correctly read characters are 133, with an error percentage of 0,25%.

Figure 7. Loss train ID Card No 4

Figure 7 shows tht the total number of characters on ID card no. 4 is 177. The identified characters were 177, while the correctly read characters were 143, with an error percentage of 0,17%.

Therefore, from 20 photos and after 3000 training steps, the researchers got a loss of 0.17 on average (see Figure 8).

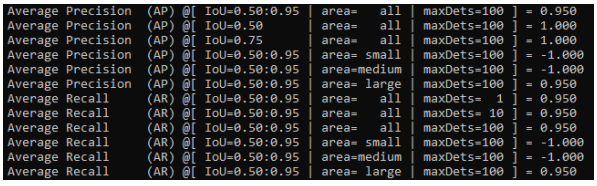

Figure 8. Precision and Recall Evaluation Chart

Processing the Best Results from Accuracy and Speed

From 20 photos after 3000 training steps, the researchers got an average Precision and Recall evaluation of 0.95. So, it can be concluded that the detector could read the data on the tested ID card images. The average percentage of tool reading errors reached 17%, with an average time of 0.95 seconds. Thus, the ID card detection tool using OCR run well. Processing the best results from Accuracy and Speed can be seen in Figure 9.

Figure 6. Processing the best results from Accuracy and Speed

Based on this image, the researchers proposed a recommendation for an ID card recognition system to overcome current problems. W. Xinming and X. Zhibing propose to make identity numbers as a means to identify someone's information [18]. Y. Hu et al. also agree that this research has determined that the detection method has advantages: online, real-time, simple, and accurate [19].

The researchers propose recommendations, first, the model must practice with more data or photos from several ID cards with several different conditions to get a more generalized model. Second, to better detect the character component in the ID card (OCR), it is recommended to use a special camera for fixed-place documents so that it is not disturbed by user movements.

CONCLUSION

The researchers collected ID card images using a webcam with various light conditions and orientations and label them using labeling. The researchers trained it with only 20 images. After 3000 training steps, the researchers got about 0.17 loss and 0.95. Therefore, the ID card detection tool using OCR runs well.

For further research recommendations: First, the model must practice with more data or photos from several ID cards with several different conditions to get a more generalized model. Second, to better detect the character component in the ID card (OCR), it is recommended to use a special camera for fixed-place documents so that it is not disturbed by user movements. Third, it can better be done by adding a case study of the application so that the benefits can be felt, especially for civil society.

REFERENCE

[1] A. Goeritno and I. Setyawibawa, "An Electronic Device Reviewed by Diagnosing on The Modules Embodiment," *Int. J. Electron. Commun. Syst.*, vol. 1, no. 2, pp. 41–55, 2021, doi: 10.24042/ijecs.v1i2.10383.

[2] M. Kesuma and R. Iskandar, "Analisis Toko dan Asal Toko Fashion Pria di Shopee Menggunakan Data Scrapping dan Exploratory Data Analysis," *Maj. Ilm. Teknol. Elektro*, vol. 21, no. 1, pp. 127–134, 2022, doi: https://doi.org/10.24843/MITE.2022.v21i01.P17 Analisis.

[3] Afdholudin, "Rancang Bangun Alat Pembaca Data E-KTP Menggunakan Library Google Vision Berbasis Raspberry PI," Universitas Jambi (Published), 2021.

[4] M. O. Pratama, W. Satyawan, B. Fajar, R. Fikri, and H. Hamzah, "Indonesian ID Card Recognition using Convolutional Neural Networks," *Int. Conf. Electr. Eng. Comput. Sci. Informatics*, vol. 2018-Octob, pp. 178–181, 2018, doi: 10.1109/EECSI.2018.8752769.

[5] W. Satyawan *et al.*, "Citizen ID card Detection using Image Processing and Optical Character Recognition," in *The 3rd International Conference on Computing and Applied Informatics*, 2019, vol. 1235, no. 1, doi: 10.1088/1742-6596/1235/1/012049.

[6] A. Saepulrohman and A. Ismangil, "Data Integrity and Security of Digital Signatures on Electronic Systems using The Digital Signature Algorithm (DSA)," *Int. J. Electron. Commun. Syst.*, vol. 1, no. 1, pp. 11–15, 2021.

[7] W. Liu, C. Q. Cai, and Z. Zhang, "Fingerprint ID Cards and The Recognition System," in *ICCSE 2010 - 5th International Conference on Computer Science and Education, Final Program and Book of Abstracts*, 2010, pp. 1219–1221, doi: 10.1109/ICCSE.2010.5593447.

[8] M. Ryan and N. Hanafiah, "An Examination of Character Recognition

on ID card using Template Matching Approach," *Procedia Comput. Sci.*, vol. 59, no. Iccsci, pp. 520–529, 2015, doi: 10.1016/j.procs.2015.07.534.

[9] R. F. Harris, "Rancang Bangun Aplikasi Pengajuan Surat Keterangan Warga dengan Optical Character Recognition Berbasis Android Mobile," Politeknik Negeri Jakarta, 2020.

[10] J. Zhao, X. Li, C. Shum, and J. McPhee, "A Review of Physics-based and Data-Driven Models for Real-time Control of Polymer Electrolyte Membrane Fuel Cells," *Energy AI*, vol. 6, p. 100114, 2021, doi: 10.1016/j.egyai.2021.100114.

[11] S. Bian *et al.*, "Machine Learning-based Real-time Monitoring System for Smart Connected Worker to Improve Energy Efficiency," *J. Manuf. Syst.*, vol. 61, no. August, pp. 66–76, 2021, doi: 10.1016/j.jmsy.2021.08.009.

[12] R. Oucheikh, T. Pettersson, and T. Löfström, "Product Verification using OCR Classification and Mondrian Conformal Prediction," *Expert Syst. Appl.*, vol. 188, p. 115942, 2022, doi: 10.1016/j.eswa.2021.115942.

[13] S. Tomovic, K. Pavlovic, and M. Bajceta, "Aligning Document Layouts Extracted with Different OCR Engines with Clustering Approach," *Egypt. Informatics J.*, vol. 22, no. 3, pp. 329–338, 2021, doi: 10.1016/j.eij.2020.12.004.

[14] Y. Kobayashi, S. Mimuro, S. N. Suzuki, Y. Iijima, and A. Okada, "Basic Research on A Handwritten Note Image Recognition System that Combines Two OCRs," *Procedia Comput. Sci.*, vol. 192, pp. 2596–2605, 2021, doi: 10.1016/j.procs.2021.09.029.

[15] H. Dutta and A. Gupta, "PNRank: Unsupervised Ranking of Person Name Entities from Noisy OCR Text," *Decis. Support Syst.*, vol. 152, no. December 2020, pp. 113662, 2022, doi: 10.1016/j.dss.2021.113662.

[16] R. Chandramouli and P. Lee, "Infrastructure Standards for Smart ID Card Deployment," *IEEE Secur. Priv.*, vol. 5, no. 2, pp. 92–96, 2007, doi: 10.1109/MSP.2007.34.

[17] R. Sushma, M. R. Devi, and N. Maheshwaram, "Automatic License Plate Recognition with YOLOv5 and Easy-OCR method," vol. 9, no. 1, pp. 1243–1247, 2022.

[18] W. Xinming and X. Zhibing, "The Research of Second-generation ID card's Application in the Domestic Air Passenger Travel," in *2012 International Conference on Medical Physics and Biomedical Engineering*, 2012, vol. 33, pp. 476–482, doi: 10.1016/j.phpro.2012.05.092.

[19] Y. Hu, T. Muhammad, B. Wu, A. Wei, X. Yang, and L. Chen, "A Simple On-Line Detection System Based on Fiber-Optic Sensing for The Realtime Monitoring of Fixed Bed Adsorption Processes of Molecularly Imprinted Polymers," *J. Chromatogr. A*, vol. 1622, p. 461112, 2020, doi: 10.1016/j.chroma.2020.461112.