Smearing Algorithm and MSER to detect Indonesian Private Lisence Plate Detection in Image

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ABSTRACT

Motor vehicles are a modern transportation that is still in use today. Each motor vehicle has a unique code bone code and machine code, and this code combined with the area code where the vehicle is registered and save in vehicle number letter (STNK). Each vehicle registration number is unique for each vehicle. This paper propose a method to detect the license plate of vehicles by using smearing and Maximally Stable Extremal Regions (MSER) detection. This paper uses private vehicle number plate as test data because on private vehicle number plate in Indonesia has high-level contrast between background and foreground. By using the smearing algorithm, the level of contrast color that can be in a license plate region can detected. An image area that has a high contrast level is re-analyzed using MSER. Areas with detection results that have characters of more than two will selected as the number plate area. The data used in this paper is randomly drawn car image data using a digital camera. Based on the available test results of 80% made on the area identified as the number plate. The test results show the method that is classified as the number plate area on the car image that has the license plate.

Keywords : Index Terms—Smearing, MSER, Vehicle License Plate, Optical Character Recognition.

1. Introduction

Today economic growth is growing rapidly. Especially in the motor vehicle industry sector. This led to an increasing number of vehicles on the streets. In 2016 in Indonesia the vehicle, population has reached 124,348,225 units based on vehicle registration from July 2016, and has growth of up to six million units per year [1]. That isabout 10 to 15 percent of his contribution came from the car. An increasingly crowded environment will affect the traffic density. This certainly brings the development of traffic management towards the development of intelligent systems.

Intelligent traffic management system can be widely used such as automatic parking door, automatic tollbooth, and vehicle tracking based on license plate. Vehicle license plate detection systems can categorized into two: detection of license plates on lanes and on streets [2]. Detection of the number plate on the road requires a device capable of capturing every detail of information because the detected number plate is a small area of a large photo frame. On detection of the number plate on the line, the vehicle will stop right around the specified area, so that the number plate can take at close range. The number plate detection is required before committing to vehicle license plate recognition [3].

Automatic vehicle license plate recognition system requires the exact number plate detection process, because if the detection process fails to find the number plate then the recognition process will not be process [4]. Vehicle license plate recognition process is influence by several factors such as lighting conditions, movement of vehicles, as well as characters and different number plate forms in each region. Globally, the vehicle number recognition system starts with a vehicle-plate detection system followed by a character recognition system.

Detection of license plate number of motor vehicle can be done by using template equality method [5] or by detecting feature of characters contained in number plate resembling template number

plate that have been provided [6, 7], but required various templates in order to processing all license plates from different regions. So the selection of features on the number plate should be a common feature that characterizes the number plate, i.e. contrast. Each vehicle number plate in different regions has a contrasting color between the base color and the text color. The contrast enhancement process can be performed [8], so that the license plate area can be identified by using edge detection [9].

The number plate is an area of contrasting characters against the plate background. The contrast value between the background and the character can be used as a feature to determine the number plate location [10, 11, 12], the location of the number plate will be based on the color contrast values found horizontally or vertically. The initial process that determines the gray degree value of each pixel element influences the process of detecting number plates using contrasting features. The initial process is to convert the colored image into gray images grayed from 0 to 255 [13]. The contrast change can be execute by converting the grayscale image into binary image, using the threshold value [14]. The problem with the contrast change process using the global threshold will have an impact on increasing contrast on other objects in one image. This will affect the detection process. The vehicle number plate is an object that has a text consisting of letter and number, just like a road sign so it can detected by using the introduction of MSER (Maximally Stable Extremal Regions) for OCR (Optical Character Recognition) [15].

This paper proposes a method for detecting number plates based on areas with characters (letters and numbers). Areas that have more than three characters adjacent will predicted as the number plate area. The area will then be marked using rectangular markers.

2. Research Method

This paper the introduction of the vehicle-plate begins with the process of changing the colored image into a gray image. This is be done because in this paper detection of vehicle license plate not based on color. The data used in this paper is the number plate of the vehicle in the country of Indonesia. The number plate of vehicles in the country of Indonesia has various basic colors and characters. The base color on Indonesian country vehicle-license plate is to recognize the classification of whether a vehicle includes private vehicles, official vehicles, or other classes. This paper will use private vehicle number plates as test data. Personal vehicle number plates used because they have a contrasting color between the background and the color of the writing, which is black as the background color, and the white color as the text color.

The process is continue by using a gray image, which is then done a background color selection process that makes the background color is a color that is close to black. This process done to reinforce the area, which is the object of an area that has a color close to white. This process will strengthen the edges of each object required to detect high contrast values. Areas with high contrast values will predicted as the number plate area with the next process as shown in Fig 1.

The process is continue by contrast analysis horizontally and vertically. The contrast analysis based on the vertical neighboring pixel change using the threshold value in the horizontal contrast analysis process, the change of neighboring pixel values above the threshold will be recorded while the pixel change value below the threshold will be ignored, as well as for horizontal analysis. The result of this process are two histograms which are each the value of vertical and horizontal pixel changes.

The process is follow by histogram analysis, which begins with smoothing process using low-pass filter. Therefore, we get a histogram that has a smoother line of change. The threshold value used to select the area, which has a high value of contrast change. The non-selected areas are then marked with a ground or black value. In the next image, each selected area will analyzed. The analysis done by detecting the presence of characters using MSER. The detected area has more than three characters to preserve while areas that do not have more than three characters will be set to default or zero. Selected areas used as

a basis for marking the selected area of the image as output.

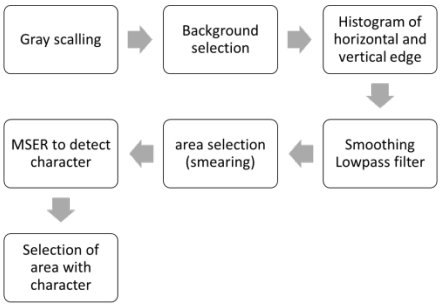

Figure 1. License Vehicle Plate Detection Process Flow

This paper uses digital image data captured using a digital camera. Digital image is the image of a vehicle that has a personal number plate, which is the vehicle number plate that has a black base color and white text color. This paper uses car vehicle-plate data, with the type of vehicle license plate without modification. At the time of data collection is selected vehicle number plate that has a good enough color to reduce the color disorder.

3. Discussion.

Figure 2. Sample Private License Vehicle Plate

Figure 3. Grayscale Image

This paper uses digital image data of various sizes, but at the time of the initial process, the image size is convert to 800 x 600 pixels. As in Fig 2.The color value in the data is not use as the main feature so the image is convert to a gray image by eliminating the RGB (Red Green Blue) color value into one two-dimensional matrix. The gray image of the Fig 2 dataset results shown in Fig 3.The next process is to get the background area by using neighboring pixel selection using convolution process. From the process obtained results as in Fig 4.

Figure 4. Background Selection

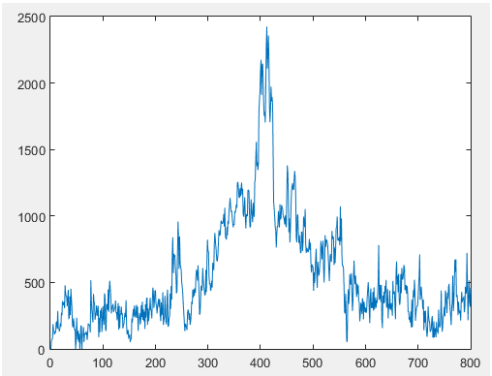

Figure 5. Contrast Horizontal Analysis

The result of the next background selection compared with the gray image value by taking the maximum value. The process continues with the edge analysis of the vertical plane as to obtain the histogram data as in Fig 5. Where axis X is the pixel position based on the X-axis of the image. The Y-Axis is the number of contrast values found in the vertical plane X. Fig 5 is the result of a contrast analysis with a recorded difference value of 50, which means the process will record if there is a contrast change of 50 degrees gray.

The histogram value is process using a low-pass filter to obtain a smoother histogram as in Fig 6. It appears that the change in value has subtly formed a graph, whichanalyzed based on the threshold value. Based on the histogram value data, the threshold value limit used to select the X-axis position, which has a value of contrast change above the threshold value. The threshold values obtained dynamically from the average value on the histogram. Selection using threshold values will result in a histogram as in Fig 7.

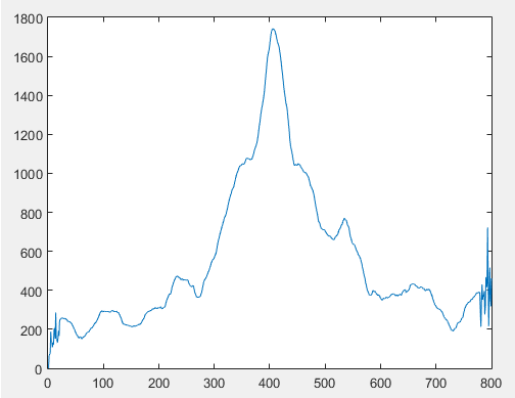

Figure 6. Contrast Horizontal Analysis after Smoothing

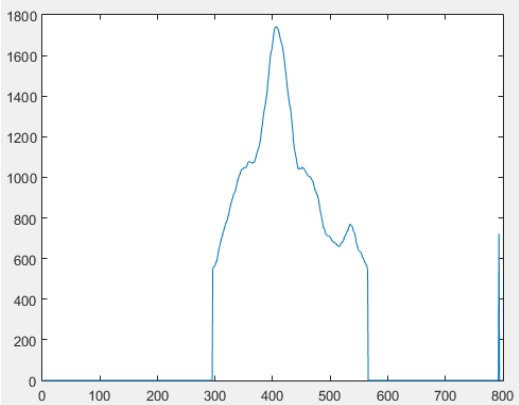

Figure 7. Histogram after Filtering Use Dynamic Threshold

The histogram results in Fig 7 show between X-Axis about 300 and 560 there is a change of high contrast value from the histogram shown in the figure plate position input image is between the X values. The result of the histogram value in Fig 7. Will used together with the histogram value of the vertical analysis, so as seen in Fig 8.

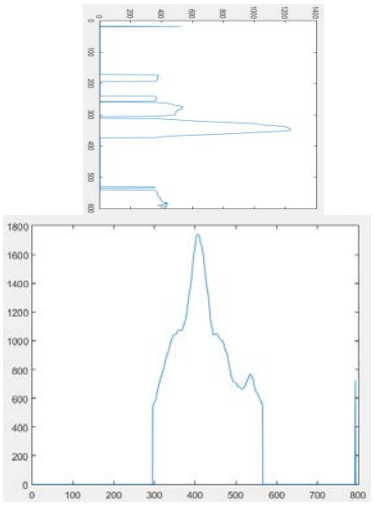

Figure 8. Histogram Vertical (left) and Horizontal (right)

By using horizontal and vertical analysis results then pixels that have high contrast value changes, we can select. From the results of the selection obtained images as shown in Fig 9.

Figure 9. Image after Filtering use Vertical and Horizontal Analysis

Image data in Fig 9. Will analyzed by using MSER to recognize letters or numbers as predicted areas of vehicle license plate area. All selected areas will be selected to produce the selected area as the character area as shown in Fig 10.

Figure 10. Image after MSER Analysis to Detect Character

Figure 11. Image with Mark of Vehicle Plate Detection

The imagery will analyzed to eliminate an area that is not a letter or number character by using a filter. Areas with more than three characters marked by character position. The result of character tagging is the prediction of the vehicle license plate area as shown in Fig 11.

4. Conclusion.

Based on the results and analysis it can concluded that the vehicle plate number detection method using Smearing and MSER is successful. Some things that affect the introduction of the number plate is the position of the vehicle that causes the position of the number plate is not perpendicular to the camera, thus requiring skew correction. Moving vehicles also affect the results because when the vehicle is moving it will cause motion blur effect.

Bibliographies

[1] Al-amri1Salem Saleh, KalyankarN.V., and S.DKhamitkar, “Image Segmentation by Using Thershod Techniques”, Journal Of Computing, Volume 2, Issue 5, May 2010, ISSN 2151-9617

[2] Angeline, L., Teo, K., & Wong, F.,“Smearing Algorithm for Vehicle Parking Management System”, 2nd Seminar on Engineering and Information Technology, (pp. 331-337), Kinabalu

[3] Bai H, Liu C.,“A hybrid license plate extraction method based on edge statistics and morphology”, Proceedings of the 17th international conference onpattern recognition, vol. 2, 2004. p. 831–4.

[4] Hermawati Fajar Astuti, Koesdijarto Roenadi, “A Real-Time License Plate Detection System For Parking Access”, Telkomnika, Vol.8No.2 Agustus 2010, 97 - 106

[5] Greenhalgh Jack and MirmehdiMajid, “Recognizing Text-Based Traffic Signs”, IEEE Transactions on Intelligent Transportation Systems Volume: 16, Issue: 3, June 2015, DOI: 10.1109/TITS.2014.2363167

[6] J.R. Parker, P. Federl, “An Approach To Licence Plate Recognition”, The

Laboratory For Computer Vision, University of Calgary, 1996.

[7] KumarTarun, VermaKarun, "A Theory Based on Conversion of RGB image to Gray image", International Journal of Computer Applications (0975 – 8887) Volume 7– No.2, September 2010

[8] Kuo HC, Lee JS, Kao ST. "An Autonomous License Plate Detection Method". Proceedings of the fifth International Conference on Intelligent Information Hiding and Multimedia Signal; 2009: 110-113.

[9] Kwaśnicka Halina and WawrzyniakBartosz, "License plate localization and recognition in camera pictures", AI-METH 2002 – Artificial Intelligence Methods, November 13-15, 2002, Gliwice, Poland.

[10] Lalimi Mahmood Ashoori, GhofraniSedigheh, McLernonDes, "A vehicle license plate detection method using region and edge based methods",Computers & Electrical Engineering, DOI: 10.1016/j.compeleceng.2012.09.015

[11] Liliana, Budhi, G., & Hendra,"Segmentasi Plat Nomor Kendaraan Dengan Menggunakan Metode Run - Length Smearing Algorithm". Industrial Electronic Seminar.

[12] Ozbay, S., & Ergun, E.,"Automatic Vehicle Identification by Plate", World Academy of Science, Engineering and Technology Issue 9, 778-781.

[13] P. Ponce, S. S. Wang, D. L. Wang, "License Plate Recognition - Final Report", Department of Electrical and Computer Engineering, Carnegie Mellon University, 2000.

[14] Redaksi Kompas , "Anda Tahu Populasi Kendaraan di Indornesia", http://otomotif.kompas.com/read/2016/08/20/103100215/Anda.Tahu.Populasi.Kendaraan.di.Indonesia. Read Online November 2017.

[15] Y. Lu, "Machine printed character segmentation", Elsevier, Pattern Recognition vol. 28, 1995.