Implementation Of Morphological Segmentation And Local Binary Pattern On K-Nn License Plate Recognition System

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Abstract: We have seen technological developments lately. Computer science has evolved and implemented into various aspects of life such as health, education, transportation, etc. Intelligent Transportation System (ITS) is one result of the development of computer science. One variant of ITS is the license plate recognition system. Segmentation techniques are usually used to distinguish an image or separate the image into a set of new imagery. The segmentation result of an image is usually a set of new images. In the plate recognition system the result of segmentation is the image of the characters found on the plate. The character image is extracted before entering the character recognition stage. Local Binary Pattern (LBP) is one approach that can be done to feature extraction from an image. In this research, the process of license plate recognition is done by using morphological method as segmentation technique and LBP as its feature extraction.

Index Terms: Plate Recognition, Segmentation, Morphological, Character image, Local Binary Pattern

1. INTRODUCTION

We have seen technological developments lately. Computer science has evolved and implemented into various aspects of life such as health, education, transportation, etc. [1]. Intelligent Transportation System (ITS) is one result of the development of computer science. One variant of ITS is the license plate recognition system [1]. The license plate recognition system implements digital image processing and character recognition in general to identify passing vehicles by reading the license plate automatically [2]. The processes that typically occur in license plate recognition systems are character segmentation on the plate, character recognition and non-characters, feature extraction and number plate matching. Segmentation techniques are usually used to distinguish an image or separate the image into a set of new imagery [3]. Implementation of morphological-based segmentation techniques ever done by [3]. Yadav et al implements a morphological-based image segmentation technique on medical imagery [3]. Morphological transformation uses a dilation function to reduce internal noise and erosion functions to reduce external noise. Li et al also conducted research on 2D-barcode image segmentation using morphological approach [4]. Using the technique, barcodes can be read even if they have a complex background. The segmentation result of an image is usually a set of new images. In the plate recognition system the result of segmentation is the image of the characters found on the plate. The character image is extracted before entering the character recognition stage. Local Binary Pattern (LBP) is one approach that can be done to feature extraction from an image. In research that have done by [5] and [6], they agree if LBP is one of the prominent texture descriptors. LBP has been applied to many applications such as texture recognition, edge detection, etc. The license plate recognition process can be started by segmenting the plate image. The result of the segmentation is a piece of image of the letters contained in the plate image. Next process is to extract the feature using LBP on each image of the letter. In this research, the process of license plate recognition is done by using morphological method as segmentation technique and LBP as its feature extraction. Therefore, this paper will apply two models, namely feature extraction that have been developed to license plate recognition. Section 2 describes the License plate recognition models. Section 3 describes the analysis and discussion of the results. Finally, conclusions are summarized in Section 4.

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2 EXPERIMENTAL DETAIL

The steps in the license plate recognition process are shown in Figure 1. Initially, the plate image enters the segmentation process using a morphological approach. The result of the segmentation is a collection of character images contained in the license plate. The set of images then enters the feature extraction process using the LBP algorithm. The extraction results in this process then become the input parameter of the matching process. In this research, the matching process using k-NN algorithm after passing k-NN process, the result obtained in the form of text from license plate image which become input at the beginning of process. Previously, a database of character training (alphabets and numbers) was created. Creation of the character database is done by collecting the letters A to Z and numbers 0 to 9 obtained from vehicle plates

2.1 Morphological Segmentation

The basics morphological functions are: erosion, dilation, and hit-or-miss [3]. In this study, the image is segmented in the form of binary imagery. Value 0 for black and value 1 for white. All other morphological operations are defined in terms of combination of dilation and erosion, such as opening, closing, etc. [7]. The process of dilation usually causes the object to grow larger, depending on the structure of the element. Conversely, erosion causes the object to become smaller. Hit-or-miss makes it possible to get information about how objects are related to the surrounding environment. The color of segmented images is binary. So, the extraction can be done faster because there are just 2 colors in range, 0 and 1.

2.2 Local Binary Pattern

LBP has been applied to many application areas, such as texture recognition and edge detection. Compared with other texture descriptors, the LBP method has a low computational complexity and is invariant to monotonic illumination changes

[5, 8]. The original LBP of a pixel is generated as follows:

$$LBP_{P,R}(g_c) = \sum_{P=0}^{P-1} S(g_p - g_c)2^P, s(x) = \begin{cases} 1 & x \geq 0 \\ 0 & x < 0 \end{cases} \quad (1)$$

Where g_c is the value of the central pixel, g_p (p = 0,…, P −1) represents the value of a neighbor pixel on a circle of radius R and P is the number of sampled neighbors. The neighbors that do not fall at the integer positions can be estimated by bilinear interpolation. LBP has been observed to be a highly efficient feature descriptor for texture classification [9]. A 3x3 mask is used against the neighborhood pixels to define a particular texture and evaluate a LBP. The feature vector is then taken up for processing using the Nearest Neighbor and Support vector machine algorithm to classify the texture images.

3 RESULT AND DISCUSION

The first process is to segment the plate image with the morphological method. Alphabets and numbers already obtained by the morphological method are further extracted features using binary features. Then, the feature matching process used k-NN algorithm. Popular non-parametric method which is used for classification and regression analysis is the k-Nearest Neighbors (k-NN) algorithm. The k-NN algorithm measures the distance between an objective point and a set of points in the data set and assigns the objective (test) point to the class that is most common between its k nearest neighbors around it [9]. The result from segmentation and extraction feature process tested using k-NN algorithm. This is the matching process. In this research, 32 license plate images is tested. There are 255 characters recognized from plate images. Thirty two characters are miss-matched and 218 that are matched. The percentage are 15% for miss-matched character and 85% for matched character. There are several factors that can be a cause of miss-matching. For example, letter ‘O’ and ‘D’ looks slightly similar or number ‘5’ and ‘S’ can be look similar too. This factor can cause the system fail to match the character.

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4 CONCLUSION

The license plate recognition process can be done by using morphological method for segmentation and local binary pattern for feature extraction process. Then, the feature matching process used k-NN algorithm. Popular non-parametric method which is used for classification and regression analysis is the k-Nearest Neighbors (k-NN) algorithm. There are 255 characters recognized from plate images. Thirty two characters are miss-matched and 218 that are matched. The percentage are 15% for miss-matched character and 85% for matched character. There are several factors that can be a cause of miss-matching. For example, letter ‘O’ and ‘D’ looks slightly similar or number ‘5’ and ‘S’ can be look similar too. This factor can cause the system fail to match the character.

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REFERENCES

[1] S. S. Tabrizi and N. Cavus, "A Hybrid KNN-SVM Model for Iranian License Plate Recognition," Procedia Computer Science, vol. 102, pp. 588-594, 2016/01/01/ 2016, doi: http://dx.doi.org/10.1016/j.procs.2016.09.447.

[2] S. Ktata, T. Khadhraoui, F. Benzarti, and H. Amiri, "Tunisian License Plate Number Recognition," Procedia Computer Science, vol. 73, pp. 312-319, 2015/01/01/ 2015, doi: http://dx.doi.org/10.1016/j.procs.2015.12.038.

[3] A. K. Yadav, R. Roy, Rajkumar, Vaishali, and D. Somwanshi, "Thresholding and morphological based segmentation techniques for medical images," in 2016 International Conference on Recent Advances and Innovations in Engineering (ICRAIE), 23-25 Dec. 2016 2016, pp. 1-5, doi: 10.1109/ICRAIE.2016.7939573.

[4] J. H. Li, W. H. Wang, T. T. Rao, W. B. Zhu, and C. J. Liu, "Morphological Segmentation of 2-D Barcode Gray Scale Image," in 2016 International Conference on Information System and Artificial Intelligence (ISAI), 24-26 June 2016 2016, pp. 62-68, doi: 10.1109/ISAI.2016.0022.

[5] Z. Pan, Z. Li, H. Fan, and X. Wu, "Feature based local binary pattern for rotation invariant texture classification," Expert Systems with Applications, vol. 88, no. Supplement C, pp. 238-248, 2017/12/01/ 2017, doi: https://doi.org/10.1016/j.eswa.2017.07.007

[6] L. Liu, P. Fieguth, Y. Guo, X. Wang, and M. Pietikäinen, "Local binary features for texture classification: Taxonomy and experimental study," Pattern Recognition, vol. 62, no. Supplement C, pp. 135-160, 2017/02/01/ 2017, doi: https://doi.org/10.1016/j.patcog.2016.08.032.

[7] Priya and V. S. Verma, "New morphological technique for medical image segmentation," in 2017 3rd International Conference on Computational Intelligence & Communication Technology (CICT), 9-10 Feb. 2017 2017, pp. 1-5, doi: 10.1109/CIACT.2017.7977282.

[8] T. Ojala, M. Pietikainen, and T. Maenpaa, "Multiresolution gray-scale and rotation invariant texture classification with local binary patterns," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 24, no. 7, pp. 971-987, 2002, doi: 10.1109/TPAMI.2002.1017623.

[9] S. Das and U. R. Jena, "Texture classification using combination of LBP and GLRLM features along with KNN and multiclass SVM classification," in 2016 2nd International Conference on Communication Control and Intelligent Systems (CCIS), 18-20 Nov. 2016 2016, pp. 115-119, doi: 10.1109/CCIntelS.2016.7878212.