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A SURVEY ON LICENSE PLATE LOCALIZATION METHODS

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ABSTRACT

License Plate Recognition (LPR) systems are the foundation of the Intelligent Transportation Systems (ITS), which have lots of applications in various fields of the day today lives. License Plate Recognition (LPR) systems have three basic stages: License Plate Localization (LPL), Character Recognition and Character Recognition. In recent years, so many License Plate Localization algorithms are introduced and used by the researchers. This paper is a review of various License Plate Localization techniques present in the License Plate Recognition systems and it also discusses their advantages, disadvantages and the successful localization efficiency rate.

KEYWORDS: Intelligent Transportation Systems, License Plate Localization and License Plate Recognition.



INTRODUCTION

Automatic License Plate Recognition (ALPR) system is a most important research issue in Intelligent Transportation Systems (ITS), which have a wide range of applications such as vehicle parking management, traffic control and traffic surveillance, electronic toll payment, parking fee payment, road monitoring and public security systems. The study of automatic vehicle license plate was initiated in 1990. Vehicles play a vital role in transportation nowadays. The License Plate numbers remains as the basic vehicle identifier. License Plate Recognition System mainly consists of FIVE phases. Figure 1 shows the structure of typical LPR system.

- 1) Acquire images
- 2) Pre-processing
- 3) License plate Localization
- 4) Character Segmentation
- 5) Character Recognition

The images are acquired by collecting them from the parking lots or from roads. Pre-processing step is used to improve the quality of the input vehicular images. So many pre-processing techniques are introduced by various researchers nowadays. It includes conversion of the gray scale image into binary

image, noise removal by various filters, image binarization etc.

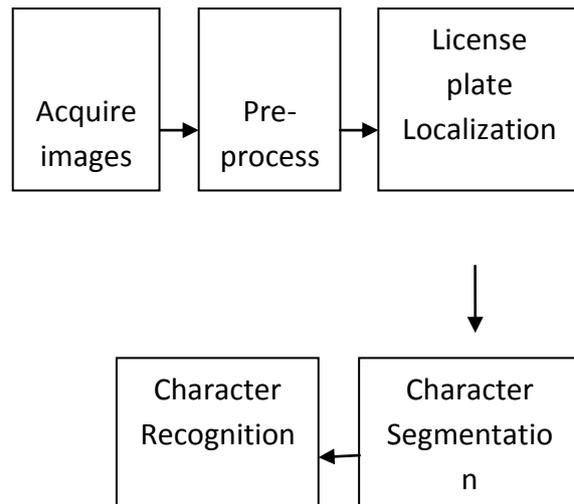


Figure 1: A License Plate Recognition System

License Plate Localization is to locate the license plate in the vehicular input image which means that it locates the image part which contains the License Plates. License plate localization is the most important phase of the License Plate Recognition systems, because the success rate of License Plate Recognition is depended on the accuracy of the License Plate Localization. Character segmentation performs the segmentation of characters for further processing in the Character Recognition. Character Recognition recognizes the segmented characters and it identifies the individual characters that the image being identified by this License Plate.



The rest of this paper is organized as follows: Section II discusses the literature review of License Plate Localization; Section III shows the comparison results of the survey and Section IV has a conclusion regarding the survey.

LITERATURE SURVEY ON LICENSE PLATE LOCALIZATION METHODS

In [1] Wangchao Le and Shaofa Li proposed a hybrid method for the License Plate extraction from the complex images, which comprises three major steps, such as a line detection method, a weight assignment scheme and a refining selection procedure. After detecting the straight lines from the edge image, dense edge regions are selected for choosing the License Plate candidate region, which enhances the performance of the proposed LPR system in the complex environments. The successful plate detection rate of the proposed method is 91.1%.

An algorithm for a multi-view vehicle License Plates Localization based on rectangle features was proposed by Xiaowei Xu, Zhiyan Wang, Yanqing Zhang and Yinghong Liang in [2], which consists of two steps. Firstly, the true License Plate regions are located, which is done by rectangle features of the License Plates

chosen by AdaBoost algorithm, by which the contour of each of the true candidate area is obtained. Secondly, each true candidate area is transformed based on nonlinear distortion model to an upright image which should be appropriate for the License Plate Recognition. The main advantage is that by using this algorithm the images are processed rapidly because it makes use of the integral image and the cascade structure and is robust against poor illumination and noisy environments. The disadvantage is that the proposed algorithm shows poor performance in case of light or shadow patterns and low contrast images, which leads to further research.

In [3] Farhad Faradji, Amir Hossein Rezaie, Majid Ziaratban, presented a real time morphology-based license plate localization algorithm, which consists of the following stages. Sobel edge detection mask is used for extracting the vertical edges from the given input image. After that the true License Plate regions are detected using the histogram analysis, which are then verified by a predefined compact factor. Finally the morphological operators give the accurate License Plate regions. The proposed method is more robust and faster. The successful License



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Plate Localization rate of this algorithm is 83.50%.

Another morphological based car License Plate extraction work is done by P. V. Suryanarayana, Suman K. Mitra, Asim Baneree and Anil K. Roy in [4]. Here, in this algorithm, after pre-processing the given input image, Sobel edge detection mask is used for the vertical edge detection. Followed by, morphological operations are performed for the License Plate Characters fusion into rectangles, for finding the noise blobs taller than the plate and for eliminating the regions with height less than minimum character height. At last, the Connected Component Analysis (CCA) is used to locate the correct position of the segmented candidate region. The advantage is that the proposed algorithm turns to be effective in the complex images with poor lighting conditions and it works accurately for all categories of License Plates with white or black background with black or white characters respectively and having variable character sizes. This system shows 100% accuracy in case of the countries having its own Structure Elements and 95% accuracy for the cases having the Structure Elements for different morphological operations.

Zhigang Xu and Honglei Zhu presented a novel approach of locating vehicle License Plate [5]. This approach makes use of the geometrical edge and corner features of the License Plate. After applying the thresholding, the vehicle image is passed through some mathematical morphological operations, by which the exact edge image is obtained. Then after, the true candidate region is extracted by using the corner detection algorithm. The proposed algorithm works efficiently under complex backgrounds and poor illumination conditions. License Plate Localization rate of success is 95.9%.

In [6], Lama Hamandi, Khaled Almustafa, Rached Zantout and Hasan Obeid proposed an algorithm for License Plate Localization using Character recognition which presents an algorithm to locate the Saudi license Plates, which consists of the following steps. After pre-processing, determine all the possible characters rich regions or objects within the input image and filter out very small or large objects which cannot be the candidates for the License Plates. Followed by calculating the objects' x-coordinates, determine vertically aligned objects and check the possibility of the number or character regions for the two



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vertically aligned objects using the algorithms, such as Pixels Density algorithm, Position of Peaks algorithm and Number of Peaks algorithm. The algorithm is based on the shape of the characters within the License Plates and geometric relationships between the objects. So it shows good experimental results and can be adapted to work on non-Saudi license plates. The main shortcoming is about the large screws and the rotations of the License Plates within the image.

Amninder Kaur, Sonika Jindal and Richa Jindal presented a new algorithm for the License Plate Recognition [7], using the Support Vector Machine (SVM). Here after pre-processing, a Feature based number plate Localization algorithm is used for locating the License Plates, which turns to be suitable for Indian number plates with the features such as the border, color and color of characters of the License Plates. Subsequently, in order to eliminate the low contrast area and shadows within the image the effect of shadows and to eliminate the low contrast area of an image, Niblack's binarization algorithm is performed adaptively. The proposed algorithm shows high reliability and time optimization and can recognize single or double line License Plate.

Jun Kong, Xinyue Liu, Yinghua Lu and Xiaofeng Zhou reviewed a new approach of the License Plate Localization method based on Textural Feature Analysis in [8]. This method describes a four-stage process, namely Pre-processing, Binarization using Otsu's global thresholding method, Approximate Region Searching and Classification (ARSC) and Skew Correction Using Radon Transform. The main stages in ARSC are:

Stage 1: Scan-line checking algorithm

Stage 2: Edge detection

Stage 3: Calculation of the transient differences arrays

Stage 4: Selecting the left and right boundary from the distance array

The experiment results show that the proposed method is more robust and accurate. The License Plates localization success rate is 96.1%. The disadvantage is happened from the poor quality of the acquired vehicle images. However the proposed method can be easily extended to locate the multiple License Plates which are present in a single image.

In the reference [9], Divya gilly, Dr. Kumudha Raimond presented a Template Matching method for License Plate



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Recognition, which is suitable for extracting both Indian license plates and foreign license plates and mainly focuses on the License Plates with white background and black characters. The pre-processing of the vehicular image is done by OTSU binarization method. Afterwards, by using Connected Component Analysis(CCA), the License Plates are extracted with the help of the basic features of the License Plates, such as aspect ratio, area etc of the License Plate. This system can only be practical on the front and rear view orientation of the License Plates. The success rate of plate localization is 80% and the total processing time is 298ms.

By [10], Waing, Dr.Nyein Aye proposed an efficient geometric feature based License Plate Localization methodology which is used in the automatic Stop Line Violation Detection system. The basic steps in this algorithm are Pre-processing, License Plate Detection and License Plate extraction based on geometric features. Here the License Plate Detection comprises the horizontal and vertical Projection Analysis by counting the number of white pixels and non-white pixels in each row and column of the image, Passing Histograms through a Low Pass Digital Filter, Filtering out

Unwanted Regions in an Image and Region of Interest Extraction. The proposed method produces higher accuracy and faster speed and is applicable for the real time systems. The drawback is that it is sensitive to the angle of view, physical appearance and environment conditions.

[11] Presents an efficient method for automatic Licenses Plate Recognition, by Ronak P Patel, Narendra M Patel and Keyur Brahmbhatt. This algorithm contains the following stages: Image Acquisition and Pre-processing, Morphological opening Operation, Thresholding Operation, Sobel vertical edge detection, Candidate Plate Area Detection using closing and opening Morphological operations, True Number Plate Extraction using Bounding Box analysis and Adjustment of Number Plates with the appropriate angles. Here, the number plate extraction success rate is 90%. The drawback arises because of deep shadows, reflections, uneven illuminations, stained number plates and so the true License Plates could not get correctly extracted.

In [12], Mritunjay Singh proposed a new and efficient method for vehicle License Plate Detection, which passes through a sequence of steps. These steps are Image



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acquisition and gray-scale conversion, Vertical Edge Detection, Noise Removal, Horizontal Rank Filtering, Detection of max horizontal line, Horizontal clipping, Horizontal Edge Detection, Thresholding of Sub image, Vertical Rank Filtering, Dilation and finally the number plate detection. The experimental results show that the proposed approach is an efficient method and it provides 98% of true detection rate. The system cannot work well in some situations, such as poor image resolution, low-quality camera, poor lighting, low contrast conditions, reflection, and shadows; so License Plates are badly positioned.

[13] Represents License Plate Localization based on Statistical Measures, which is a novel method for License Plate Localization based on License Plate features, proposed by N. Boonsim and S. Prakoonwit. This proposed method includes two basic stages: Candidate Regions extraction stage and License Plate verification stage. In candidate regions extraction, Sobel operator is used to obtain the vertical edges and then the Candidate Regions are extracted by deploying mathematical morphology operations. In license plate verification, the standard deviation of License Plate features is calculated to

confirm exact position. The experimental results show that the proposed method performs well on the good quality images with high contrast and suitable lighting conditions and provides 98.26 % of accuracy in detecting the License Plates.

Isack Bulugu proposed an algorithm for License Plate Localization and Recognition for Tanzania car plate numbers [14]. This algorithm works as follows: Firstly, pre-processing includes converting of input image into gray scale and binarization. Secondly, Object enhancement algorithm is performed, which consists of two steps; both the character pixels and the background pixels are weakened and the characters pixels are enhanced while background pixels keep weakened. Thirdly, Horizontal segmentation is done and vertical bounds are noted to segment the characters on the License Plate of the image. This proposed method turns to be an efficient one.

By [15], Bihai Hong, Chenhui Yang presented an approach to License Plate Localization in Intelligent Transportation System(ITS).Starting with pre-processing the images, which includes gray scale converting and edge detection, then scan line method based on vehicle edge characteristics, is used to



Reference number	Year/ Month	% Efficiency
[4]	2005	95%
[8]	2005	96.1%.
[1]	2006	91.1%
[3]	2007	83.50%.
[5]	2007	95.9%.
[15]	2007	90.8%
[9]	2013 MARCH	80%
[11]	2013 APRIL	90%
[12]	2013 DECEMBER	98%
[13]	2014 JANUARY	98.26 %

locate License Plate regions. After that, HSI Model is transformed from RGB model and then edges of the License Plates are corrected by using color characteristics. Experiment results show that this proposed system is effective and can achieve high quality License Plate Localization results with high accuracy rate of 90.8%.

COMPARISON RESULTS

The overall system efficiency per reference number and year/month is shown by the table in Table 1 and the chart in Figure 2, in accordance with the literature study, which

varies with respect to the different methods used for the License Plate Localization.

CONCLUSION

It has seen that there is an incremental need for the use of License Plate Recognition systems in human beings' day today lives.

Table 1: Comparison Results

License Plate Recognition turns to be the most famous research topic in Intelligent Transportation Systems and License Plate Localization is the core module of the License Plate Recognition systems. Researchers have introduced so many methods of locating License Plates. This review paper of various License Plate Localization techniques present in the License Plate Recognition systems will be helpful for the researchers in terms of their advantages, disadvantages and the successful localization efficiency rate.

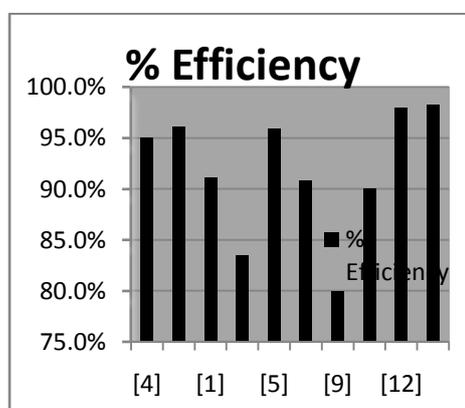


Figure 2: Comparison Results



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REFERENCES

- [1] Wangchao Le and Shaofa Li, "A Hybrid License Plate Extraction Method for Complex Scenes", in Proc. IEEE 18th International Conference on Pattern Recognition (ICPR 2006), IEEE Computer Society.
- [2] Xiaowei Xu, Zhiyan Wang (Member IEEE), Yanqing Zhang, Yinghong Liang. "A Method of Multi-view Vehicle License Plates Location Based on Rectangle Features", in Proc. IEEE ICSP, 2006.
- [3] Farhad Faradji, Amir Hossein Rezaie, Majid Ziaratban, "A Morphological-based License Plate Localization", in Proc. IEEE ICIP, pp. 57–60, 2007.
- [4] P. V. Suryanarayana, Suman K. Mitra, Asim Baneree and Anil K. Roy, "A Morphology Based approach for Car License Plate Extraction", in Proc. IEEE Indicon Conference, pp. 24–27, 2005.
- [5] Zhigang Xu and Honglei Zhu, "An Efficient Method of Locating Vehicle License Plate", in Proc. IEEE Third International Conference on Natural Computation (ICNC 2007), IEEE Computer Society.
- [6] Lama Hamandi, Khaled Almustafa, Rached Zantout and Hasan Obeid, "Using Character Recognition for Plate Localization", The International Journal of Multimedia & Its Applications (IJMA) Vol.4, No.5, pp. 39–50, October 2012.
- [7] Amninder Kaur, Sonika Jindal and Richa Jindal, "License Plate Recognition Using Support Vector Machine (SVM)", International Journal of Advanced Research in Computer Science and Software Engineering, pp. 403–407, Volume 2, Issue 7, July 2012.
- [8] Jun Kong, Xinyue Liu, Yinghua Lu and Xiaofeng Zhou, "A Novel License Plate Localization Method Based on Textural Feature Analysis", in Proc. IEEE International Symposium on Signal Processing and Information Technology, pp. 275–279, 2005.
- [9] Divya gilly, Dr. Kumudha raimond, "License Plate Recognition- A Template Matching Method", International Journal of Engineering Research and Applications (IJERA), Vol. 3, Issue 2, pp.1240-1245, March -April 2013.
- [10] Waing, Dr.Nyein Aye, "An Efficient Geometric feature based License Plate Localization and Stop Line Violation Detection System", International Journal of Advanced Research in Computer Engineering & Technology (IJARCET) Volume 2, Issue 4, pp. 1309–1313, April 2013.
- [11] Ronak P Patel, Narendra M Patel and Keyur Brahmhatt, "Automatic Licenses Plate Recognition", International Journal of Computer



IJREB

ISSN 2321-743X

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Engineering and Bioscience

Volume 2 (Issue 2) Pages (59-68)

Journal home page: www.ijreb.org

- Science and Mobile Computing”, IJCSMC, Vol. 2, Issue. 4, pg.285–294, April 2013.
- [12] Ronak P Patel, Narendra M Patel and Keyur Brahmhatt, “A New and Efficient Method for Vehicle License Plate Detection”, Volume 3, Issue 12, pg.1002–1006, December 2013.
- [13] N. Boonsim and S. Prakoonwit, “License Plate Localization based on Statistical Measures of License Plate Features”, International Journal on Recent Trends in Engineering and Technology, Vol. 10, No. 1, pg.38–45 , Jan 2014.
- [14] Isack Bulugu, “Algorithm for License Plate Localization and Recognition for Tanzania Car Plate Numbers”, International Journal of Science and Research (IJSR), Volume 2 Issue 5, pg.12–16 , May 2013.
- [15] Bihai Hong, Chenhui Yang, “An Approach to License Plate Locating in Intelligent Transportation System”, in Proc. IEEE Conference 2007, IEEE Computer Society.