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A SWIFT SOLUTION FOR VEHICLE LICENSE PLATE DETECTION: LEVERAGING VERTICAL EDGE DETECTION ALGORITHM

K. Ashwini[1], Gandam Sucharitha[2], Mohd Atif Uddin[2], Banda Apoorva Reddy[2], Sugurureddy Sindhu Reddy[2], P. Raja Sekhar[2]

[1]Assistant Professor, [2]UG Scholar, [1,2]Department of Computer Science Engineering

[1,2]Malla Reddy Engineering College and Management Sciences, Medchal, Hyderabad

ABSTRACT

This paper's primary goal is to provide a quick technique for Vehicle License Plate Detection (VLPD) utilising the Vertical Edge Detection Algorithm (VEDA). This research presents a three-pronged approach to vehicle licence plate detection (VLPD). The VLPD method is made faster by the vertical edge detection algorithm (VEDA), which uses the contrast between the grey scale values. Adaptive thresholding is utilised to binarize the input picture. After performing morphological procedures to improve the picture, VEDA is used. The second addition is the ability of our suggested VLPD approach to handle webcam photos with extremely low resolution. Following VEDA's detection of the vertical edges, the most similar plate features are highlighted using colour data. After that, the candidate region will be extracted using logical and statistical procedures. The third compares the accuracy and performance of VEDA with the Sobel operator.

Keywords: Adaptive thresholding, vehicle license plate detection, sobel operator, vertical edge detection**.**

1. INTRODUCTION

Automatic License Plate Identification (LPI) stands as a crucial stage within automatic vehicle identification, consisting of three major components: License Plate Detection (LPD), character segmentation, and character recognition. The ALPD is an important research field in the Intelligent Transportation Systems (ITS) domain. All vehicles in the world have license plates as their principal identifier. With the rapid development of machine vision technology, robust automated object detection methods are being introduced in the ITS. An integral component of the ITS is vehicle License Plate Recognition (LPR), which identifies vehicles through character recognition on license plates. Therefore, the LPD is the primary step in any LPR system because its detection accuracy and computational efficiency largely determines the overall performance of the whole system. Recently, many LPD methods have appeared in literature. Many of them perform well in constrained environments, such as a single license plate in an input image with a simple background, fixed illumination, and a slightly distorted/blurred license plate. Recent state-of-the-art techniques, such as put less limits on object/license plate detection at the expense of higher computing complexity. Moreover, extracting license plates from complicated scenes remains a significant challenge for these methods. Automatic number-plate recognition can be used to store the images captured by the cameras as well as the text from the license plate, with some configurable to store a photograph of the driver. Systems commonly use infrared lighting to allow the camera to take the picture at any time of day or night. ANPR technology must consider plate variations from place to place. Privacy issues have caused concerns about ANPR, such as government tracking citizens' movements, misidentification, high error rates, and increased government spending.

They are considered as an interesting topic in computer vision community due to its various useful applications in real life such as intelligence transport systems, access control, automatic motorway road tolling, smart parking. Especially, in recent years thanks to the impressive performance of deep learning approach, ALPR has drawn significant attention from researchers and accomplished major improvement in performance compared with traditional methods. A typical ALPR system is a pipeline composing of the following sub-tasks: vehicle detection, license plate detection (i.e., one license plate attached to one vehicle), license plate segmentation, and character recognition. Modern methods (i.e., using deep learning) for ALPR can address each of these sub-tasks by employing a convolutional neural network (CNN) as done. Several works propose addressing the later two sub-tasks by a single neural network to avoid error-prone caused by the character segmentation process. In this case, the model takes as input the whole detected license plate and outputs the corresponding characters.

2. LITERATURE REVIEW

Kim et al. [1] proposed a new method to extract the plate region using a distributed genetic algorithm. The algorithm offers robustness in dealing with deformation of vehicle images and inherent parallelism to improve the processing time. A test with seventy images showed an extraction rate of 92.8%, working well within real world situations. These results suggested that the proposed method is pertinent to be put into practical use. Arth et al. [2] presented a full-featured license plate detection and recognition system. The system is implemented on an embedded DSP platform and processes a video stream in real-time. It consists of a detection and a character recognition module. The detector is based on the AdaBoost approach presented by Viola and Jones. Detected license plates are segmented into individual characters by using a region-based approach. Character classification is performed with support vector classification. Ozbay et al. [3] considered ANPR in segmentation part, smearing algorithms, filtering, and some morphological algorithms are used. And finally statistical based template matching is used for recognition of plate characters. The performance of the proposed algorithm has been tested on real images. Based on the experimental results, this work noted that this algorithm showed superior performance in car license plate recognition.

Sulehria et al. [4] presented a method for recognition of the vehicle number plate from the image using neural nets and mathematical morphology. The main theme is to use different morphological operations in such a way so that the number plate of the vehicle can be extracted efficiently. The method makes the extraction of the plate independent of color, size, and location of number plate. Qadri et al. [5] implemented and simulated this work in Matlab, and its performance is tested on real images. It is observed from the experiment that the developed system successfully detected and recognized the vehicle number plate on real images.

Roy et al. [6] addressed the problem of ANPR by using a pixel-based segmentation algorithm of the alphanumeric characters in the license plate. The non-adherence of the system to any country-specific standard & fonts effectively means that this system can be used in many different countries a feature which can be especially useful for trans-border traffic e.g., use in country borders etc. Arulmozhi et al. [7] studied a novel Skew Correction Algorithm is proposed focusing on boundary line that optimized speed and accuracy by using the Hough transforms to get the skew corrected License plate image. Du et al. [8] presented a comprehensive review of the state-of-the-art techniques for ALPR. This work categorized different ALPR techniques according to the features they used for each stage, and compared them in terms of pros, cons, recognition accuracy, and processing speed. Future forecasts of ALPR are given. Hsu et al. [9] studied applications of vehicle license plate recognition (LPR) into three major categories and proposed a solution with parameter settings that are adjustable for different applications. The three categories are access control (AC), law enforcement (LE), and road patrol (RP). Each application is characterized by variables of different variation scopes and thus requires different settings on the solution with which to deal. Experiments showed that the proposed solution outperforms many previous solutions, and LPR can be better solved by solutions with settings

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oriented for different applications. In [10] author presents the development of automatic vehicle plate detection system using image processing technique. The famous name for this system is Automatic Number Plate Recognition (ANPR). his system is applied to monitor road traffic such as the speed of vehicle and identification of the vehicle's owner. This study also involved the development of Graphical User Interface (GUI) to ease user in recognizing the characters and numbers in the vehicle or license plates.

3. PROPOSED SYSTEM

In the realm of intelligent traffic management systems, the efficient control of diverse vehicles on roads is pivotal, and modern technology, specifically computers and advanced communication systems, play a key role in achieving this. Among the various components of such a system, traffic lights and automatic vehicle identification systems are paramount. The initial step involves determining the position of the license plate within an image. This step is fundamental, as the accuracy of character segmentation and recognition in subsequent stages relies heavily on the precise extraction of the license plate as shown in Figure 1. LPD poses significant challenges due to several factors. Firstly, license plates typically occupy a small area of the overall image, making their detection a non-trivial task. Secondly, license plates come in various formats, styles, and colors, further complicating the detection process. In response to these challenges, digital image processing technology emerges as a viable solution. In this paper, a novel LPD technique is proposed. The method involves a two-step process. First, the algorithm determines the rows' position of license plates by leveraging vertical edge features. These features serve as distinctive markers aiding in the identification of potential license plate regions. The second step involves locating the column positions of the license plates. The proposed algorithm achieves this by identifying small blue-colored sections at the left side of the license plates within the previously determined rows. This approach significantly enhances performance by eliminating the need to search the entire RGB image for the blue part. The targeted search not only saves computational resources but also improves the efficiency and accuracy of the LPD process.By focusing on specific regions and employing advanced edge detection techniques, the proposed LPD method showcases a promising avenue for overcoming the challenges posed by varying license plate formats and styles. This detailed approach ensures precise localization of license plates, laying a robust foundation for subsequent stages of character segmentation and recognition within the Automatic License Plate Identification system. Pre-processing is the process of extracting the license plate and the numbers from the image taken. There are a unit totally different aspects that create this idea very little sophisticated like noise within the image, frame of the plate, plate orientation, intensity level and area marks. several systems are proposed to beat these issues. The way meander is recommended in this happiness network watchfulness of the in name just structure is Pre-preparing which incorporates the info numerate comprises of hues and the personage is inclined at to advance the associated with and prepares it to root for phases of the criterion criteria. Benefit of the tails of has surrogate colors the conventions determination revises the RGB images to gray zenith images run out of NTSC important modus operandi. Gray=0.299*Red+0.587*Green+0.114*Blue In the next phase the gray image is filtered using median filter to remove the noise, while preserving the sharpness of the image. The drip hand-me-down is a non-linear sift pivot it replaces ever after pixel in a history by-product by computing the significant of epistemology of pixels. Color input image is converted to gray scale image that means converting a color image into a black and white image which is easy to recognize and represent.

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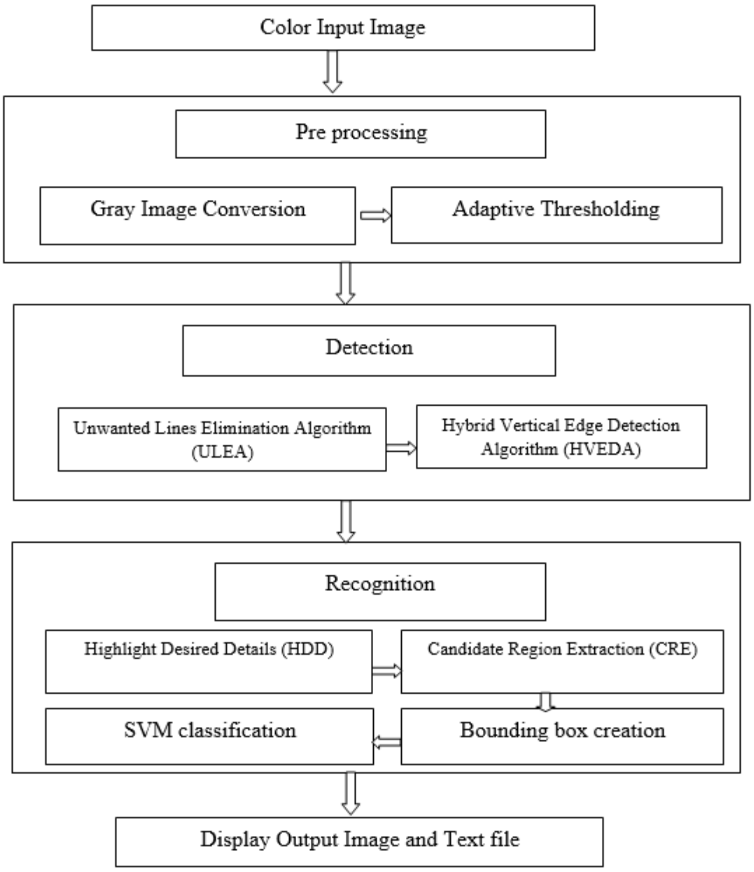

Fig.1: Proposed block diagram.

ULEA

Thresholding process in general produces many thin lines that do not belong to the LP region. we can see that there are many long foreground lines and short random noise edges beside the LP region. These background and noise edges are unwanted lines. These lines could interfere within the LP location. Therefore, we've planned associate degree algorithmic rule to eliminate them from the image. This step may be thought about as a morphological operation and improvement method. There are four cases during which unwanted lines may be shaped. within the 1st case, the road is horizontal with associate degree angle up to 0◦ as (−). within the second case, the road is vertical with associate degree angle up to 90◦ as (|). within the third case, the road is inclined with associate degree angle up to 45◦ as (/). within the fourth case, the road is inclined with associate degree angle up to 135◦ as (\). Therefore, the ULEA has been planned to eliminate these lines. During this step, whereas process a binary image, the black element values are the background, and therefore the white element values are the foreground. A 3 × 3 mask is used throughout all image pixels. Only black pixel values in the thresholded image are tested. To retain the small details of the LP, only the lines whose widths equal to 1 pixel are checked. Suppose that b (x, y) are the values for thresholded image. Once, the present pixel value situated at the veil focus is dark, the eight-neighbor pixel qualities are tried. If two corresponding values are white together, then the current pixel is converted to a white value as a foreground pixel value (i.e., white pixel).

Vertical Edge Detection Algorithm

The advantage of the VEDA is to distinguish the plate detail region, particularly the beginning and the end of each character. Therefore, the plate details are simply detected, and the character recognition

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method are done quicker. once thresholding and ULEA processes, the image can solely have black and white regions, and therefore the religious writing is processing these regions.

Fig. 2: Intersection of white-black and black-white regions.

Highlight Desired Details: After applying the VEDA, the next step is to highlight the desired details such as plate details This process depends on VEDA output in highlighting the plate region.

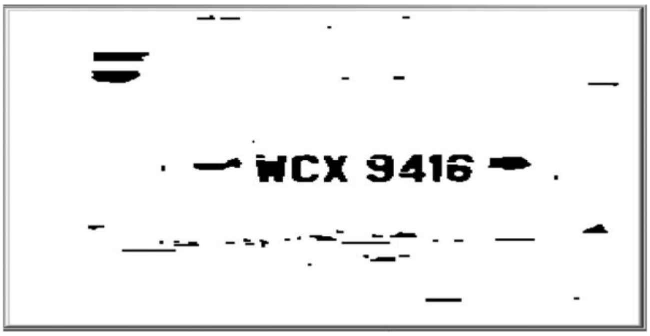

Fig. 3: HDD.

Candidate Region Extraction:

1. Count the drawn lines per each row
2. Divide the Image into multi groups
3. Count and Store Satisfied Group Indexes and Boundaries
4. Select Boundaries of Candidate Regions

Plate Region Selection: This method aims to pick and extract one correct disk.The process is mentioned in 5 elements. The primary half explains the choice method of the disk region from the mathematical perspective solely. The second half applies the planned equation on the image. The third half provides the proof of the planned equation victimization applied mathematics calculations and graphs. The fourth explains the ballot step. The ultimate half introduces the procedure of sleuthing the disk victimization the planned equation.

4. Results And discussions

This section gives a detailed analysis of simulation results. Figure 4 shows the test image, which contains the complicated background with different colors. Figure 5 shows the threshold image, where yellow colour background is converted into black colour. Then, the remaining background is highlighted as white colour.

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Fig. 4: Test image.

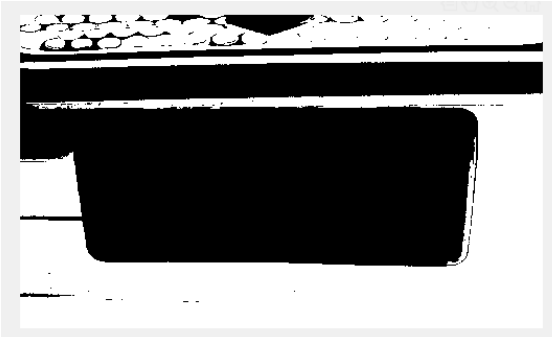

Fig. 5: Threshold image.

Figure 6 shows the number characterization image, where different characters are displayed in a white colour background and unwanted region is highlighted with black colour background. Figure 7 shows the bounding boxes applied to each character, which acts as a segmented image. Finally, figure 8 shows the text pad outcome, where the number plate outcome is converted into a text pad.

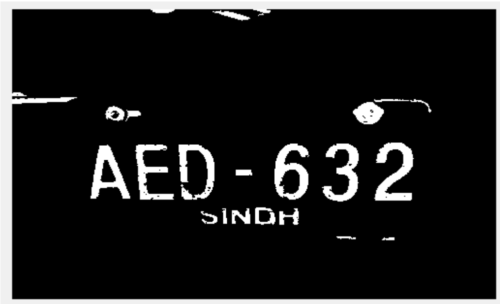

Fig. 6: Number characterization.

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Fig. 7: Segmentation.

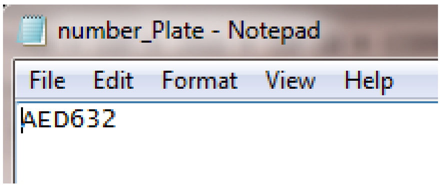

Fig. 8: Notepad text output.

5. Conclusion

This project proposes a new and fast algorithm for vertical edge detection (VEDA) in which its performance is faster than existing algorithms. VEDA contributes to make the whole proposed VLPD method faster. We have proposed a VLPD method in which dataset (images) was captured by using a web-camera. Images are taken from various scenes and under different conditions were employed. Only one LP is considered in each sample for the whole experiments. In this experiment, the proposed algorithm correctly detects license plate of the vehicle. Then it successfully eliminates the noise which are present in the license plate and extract the characters that are present in the plate. It then finally displays the extracted characters in notepad.

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