# License Plate Detection Methods Based on OpenCV

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***ABSTRACT---Since the technology was discovered with the automobile, this advancement in computer vision detection technology has slowly become part of the intelligent traffic management system. This technology can be used to divide vehicle images into different parts and outline specific regions for further identification across many systems. It is also highly applied in intelligent traffic management and video surveillance for automobiles among other applications. This paper introduces a new state-of-the-art License Plate Detection system using the CV2 Algorithm. Existing approaches have been highly prone to substantial sensitivity of the changes in illumination, not well defined and rather complex backgrounds themselves together with the plates which deterd recognition. Generally, the proposed future system is expected to exhibit high accuracy improvement and the cost of recognition for the present system may offset the problems that the current system has. All these considerations are taken into account when designing the proposed system. The proposed system based on CV2 Algorithm is supposed to exhibit considerable efficiency and robustness in handling noisy data. In this context, we gave our working model the analytical results to prove that our proposed model is much more beyond the current system since it uses the Python programming language.***

***KEYWORDS--- OpenCV2 Algorithm, OCR (Optical Character Recognition system), Automatic license plate recognition (ALPR), BINARIZATION, Gray threshold (GT), EDGE DETECTION, NUMBER PLATE LOCALIZATION, DESKEWING, SPYDER3.***

## *I.INTRODUCTION*

Deep learning enables multilayered models to learn data representations at several abstraction levels. It has changed speech and visual recognition, object detection, drug discovery, and genomics. Using the backpropagation algorithm, deep learning discovers complex structures in large datasets by readjusting internal parameters based on the layers prior. Deep convolutional nets work well in image, video, speech, and audio processing while recurrent nets are specialized on sequential data, like text and speech.

From devices that take images and recognize objects to transcribing voices, and matching content to your interests, web searches, social media filtering, or e-commerce recommendations, many things use machine learning within them. Raw natural data processing has been a challenge for machine learning. It required significant knowledge in engineering and domain to transform raw data-the pixels of an image, say-into a feature vector to be classified for decades. Such a process is what helps machines automatically interpret raw data and look for patterns. The capacity of deep learning is representation learning, wherein machines transform input signals with simple modules into a nonlinear hierarchy of abstract representations. There are enough transformations to capture complex functions. In classification, important features in the input are boosted up in higher representation layers, and irrelevant variations are filtered out. An image is represented by an array of pixel values. The first layer identifies the edges at specific orientations and locations. The second layer detects motifs by recognition of edge arrangements, ignoring the small differences. The third layer combines motifs into the parts of objects familiar for human perception, and every extra layer identifies objects based on that combination. Deep learning uniquely learns feature layers from data rather than through design. It addresses long-standing AI challenges by uncovering the complex structures in big data, applicable across science, business, and government. The tool outperformed all previous techniques in image and speech recognition and even outperformed other techniques in the prediction of drug activity, particle data analysis, brain circuit reconstruction, and assessing non-coding DNA mutations on gene expression and disease. It has also outdone the previous techniques in natural language processing, topic classification, sentiment analysis, question answering, and translation. There should be many productions soon because of less human input in engineering, with much more computing and much more data. This process shall further be fueled by novel algorithms and architectures for deep neural networks.

The last two decades of social and economic improvements in China have profoundly shaped automobile ownership and its role within the global automobile industry.

Transport and construction rose in China. In the last ten years, motor vehicles advanced rapidly. This results in increased road traffic accident. Most accidents happened within expressways. Injuries, fatalities went up rapidly. Available solutions include the reduction of motor vehicles, which is far from sustainable; enlargement of the transportation infrastructure, which suffers from financial and design problems; and incorporation of AI technologies into intelligent transportation systems.

## *II. Related Work Area*

### *Morphology-Based License Plate Detection*

Salient contrast features from clutter images is a morphology-based method given by Hsieh et al. (2012) to guide the searching method of license plates. These robust to lighting changes and have other translation invariance, as it is scalable, transformable, and skew able in order to increase it a fragmentation part recovered through a recovery algorithm used followed up with accurate results. This will reduce regions taken in consideration in order to accelerate the detection process of a license plate.

### *License Plate Location Based on Texture and Colour*

Han and Han, 2012 presents a two-stage approach. In the pre-location stage, it utilizes the edges features extraction process of Haar wavelet and Gabor filter, from a Gray-level image. Then in accurate localization, the colour features extraction is taken care of using colour space HSV. Through thresholding on a binary image taken from colour space HSI via projection analysis, correct positioning for license plate location can be arrived at. This approach is quite efficient and effective in spotting the number plates.

### *Automatic License Plate Recognition (ALPR) Survey*

Du et al. (2012) provide a comprehensive review of state-of-the-art ALPR techniques. They categorize different techniques based on their feature extraction methods and compare them in terms of accuracy, speed, and robustness. The survey highlights the challenges of ALPR, such as varying lighting conditions, occlusions, and diverse plate formats. It discusses the importance of accurate license plate detection as a crucial first step in the ALPR pipeline.

### *Improved Edge Detection Techniques*

Deng et al. (2011) introduces an enhanced Sobel operator and superposition technique, which comprises the integration of interleaving the Sobel operator and wavelet transform, Canny algorithm, and the Prewitt operator. In this edge fusion technique, the performance of edge-detection accuracy is significantly improved through the reinforcement of anti-noise capability and edge continuity.

Gao et al. (2010) combine Sobel edge detection and a soft-threshold wavelet demonising in such a way that Sobel edge detector can operate as efficiently as possible under the influence of the noise. This process can completely remove the Gaussian noise and, as a result, it yields an edge resulting in higher quality edge detection compared to the conventional one.

## *.III. Methodology*

*CAPTURE IMAGE:*

In vehicle image acquisition using the camera in the image acquisition system, image data may be inputted to the system in various ways by analog camera or by digital camera, and due to advances in digital technology, the more ideal way to input the image data is by digital cameras or by direct digital images. When the vehicle travels on the road, the camera detects the movement of the vehicle and tries to take its front view or a rare view of the vehicle, respectively, based on the location of the vehicle.

*BINARIZATION:*

Then we have the concept of binarization in which the image is a grayscale image and aiming to make black and white images. Binarization techniques are one of the crucial pre processing techniques that enable the application of various computer vision algorithms on grayscale images. These algorithms usually have as their main goal to figure out the most suitable parameters that allow injecting trace amounts of Gray pixels into the image that is made of black and white pixels. In this paper we propose a method of image binarization which uses information of edges and contours of nearby regions for smoothing textural information in normal textured images. This method makes use of the local edge information and calculates a threshold suitable for text region segmentation for license plates observations.

*EDGE DETECTION:*

Once the image has been binaries, the next task involves separating the edge of the vehicle's body from that of the license plate. Let an image foreground be represented by G1 and background by G2 gray levels such that G1 > G2. It is usual that the intensity gray levels between the background and the foreground are a gradual transition. For binarizing such an image, there ought to be a threshold ≥ such that G1≥GT ≥G2. An ordinary edge detection algorithm would outline contour lines at all location marked by the arrows or some of them shown in Figure 2. The edge image is employed and the edge points are used to set the threshold GT for binarization. One easy way of finding an average value of that edge point is approximately equal to the average gray value of all pixels surrounding it.

*NUMBER PLATE LOCALIZATION:*

Once edges of the vehicle have been identified, the next task is to accurately mark the location of the number plate that automatically raises license plate identification issues owing to the variety in size and shapes of vehicles. For instance, we interpret the number plate as a rectangular area that has an increased density of horizontal and vertical edges. This algorithm sometimes incorrectly identifies a certain area which is presumed not to contain any number plate. This is the reason for the widespread use of multiple algorithms that target the identification of the license plate region. There are several heuristics, which are used to determine the cost of selected candidates according to their properties. Also, these heuristics have been chosen on ad-hoc basis during the practical experimentations. In such a case, the recognition logic reports the candidates in their order of cost with the costliest first and so forth with costlier ones until the lowest. Afterwards, the most suitable one is subjected to a more detailed analysis. This higher level analysis will either reject the candidate or accept the candidate. In common practice, however, an analysis of this nature is likely to take a long time since it requires the investigation of individual characters.

*DESKEWING:*

Since the vehicle can usually present itself in varying angles with respect to the camera, the rectangular plate may appear skewed or rotated at different positions; hence, under certain conditions, where the license plate is skewed, it becomes visually inaccessible. Hence it may lead to developing some devices that could sense detection for such skewed plates in advance or correct skewness in plate recognition. Number plates are projected toward the two-dimensional image at the time of capture and are three-dimensional forms. In many cases, the position of this object may skew the angle and sizes. Hough Transformation is a specific method developed to extract features of selective geometrical characteristics from an image. The classical Hough transform is mostly used for line detection, while some types of Hough transformations are used in machine vision problems. Here, the Hough Find is adopted solely to detect the skewness in the plate when being captured and calculate the angle at which skewness would be localized. At first, they find the bounding box of number plates from vehicle images captured either from the front or rear side. The number plate is defined as a rectangular area where horizontal and vertical edges have a higher frequency. However, at times, owing to characters of different contrasts on letters and numbers, the frequency ratio between horizontal and vertical edges in that rectangle does not hold true. The candidates prevailing with different algorithms are going to be high. The heuristics measure the cost of selected candidates with respect to their features. The heuristics have mostly been chosen on an ad-hoc basis through practical trials. The recognition logic sorts through all candidates based on cost, from the most rational to the least rational. The most rational candidate is then selected.

*SEGMENTATION:*

Now the characters are separated from the license plate and identified. Actually, it's the most important step in license plate recognition, for all other steps depend on it. Character segmentation becomes a difficult task since several factors, like image noise caused by the plate frame, rivet, space mark, angularity of the plate, illumination change, and so on have disturbed the character segmentation process. Here, is proposed a robust algorithm that works pretty well on images for which these types of problematic factors have been identified. The steps involved in that image preprocessing of segmentation are gray scale conversion and binarization. We use horizontal projection for segmentation by assuming only one-row plates, where the process of segmentation is to look for the horizontal boundaries between the characters. The segmented part of the plate contains superfluous blanks and other unwanted areas that could obscure some portions of the outlined characters. under adaptive thresholding, the segment contains only standard binary black-and-white pixels the result is merged with similar pixels into larger pieces; any of those pieces contains a character. At this point, determine how to separate the segment into as many parts as possible and assign a font character to one of them. Further in the process of segregation include enhancements or modification of segments; the heuristically chosen segment is a black-and-white bitmap. Each such image corresponds to a certain horizontal segment. Such images will be treated as the output of segmentation. Character normalization The normalization process starts with adjusting the brightness and contrast of the segmented character imaging; next, the size of the other characters should not be taken into consideration and they should be scaled into equal size; lastly, feature extraction starts wherein the specified algorithm discerns efficient descriptors from this normalized set of characters.

*FEATURE EXTRACTION:*

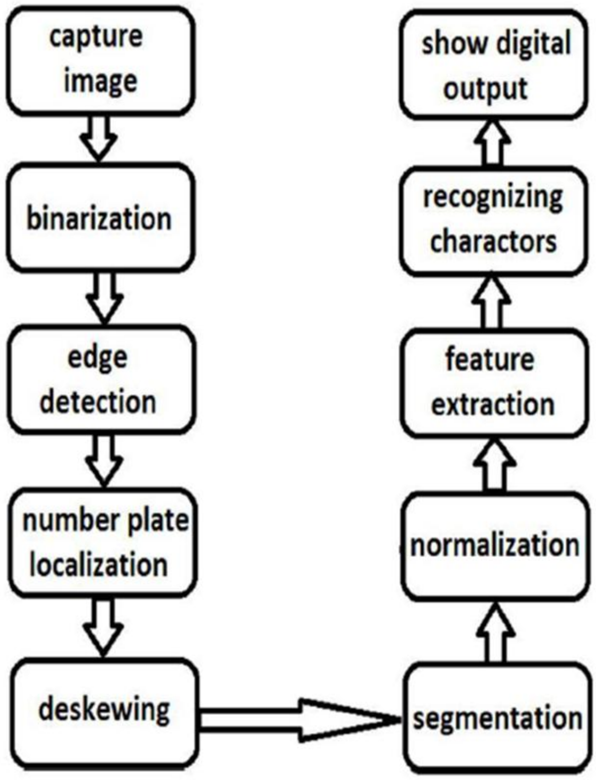
Among many others, another aspect of building the beginning part of the process is to resample the original character bitmap image, which should be normalized by resizing. Resampling is the process of changing the dimension of characters, which involves generally down sampling in applications whereby the original un normalized character size is commonly greater than that normalized size. To down sample means to reduce information carried by the processed image. This can be achieved by many means, including, but not limited to, pixel resize, bilinear interpolation, weighted average resampling, etc. Generally, we cannot specify which one to adopt because each method has performed well in many respects under certain conditions. Descriptors are extracted to describe the character from the bitmap representation. The extraction is a critical part of the whole OCR process that makes the extracted features invariant with respect to variations in lighting conditions, the font used, and destruction because of character skewing of the image. Features used to describe a normalized character depend on external characteristics, since we speak only of properties, such as character shapes. The feature descriptor vector includes the number of lines, the number of bays and lakes, the number of horizontal, vertical, and diagonal edges, etc. Feature extraction transforms data from bitmap representations into a form of descriptors suitable for computer processing

*CHARACTER RECOGNITION:*

The output of plate extraction would finally yield the last image of that final license plate. The following figure presents the last extracted license plates. There are several hindrances introduced in License Plate Detection or Recognition due to variation in types and settings of number plates. These hindrances include the following: 1) Binding Location: Plates may find themselves in different places within an image; 2) Relational Quantity: An image may contain zero or more than one plate; 3) S z: The size of plates may change according to distance from a camera or large zoom factors; 4) Colour: Different characters and backgrounds may exist on different plate types or by varying capturing devices; 5) Font: Many countries have different fonts and languages, sometimes mixtures, used for register plates. This feature is explained here as block binary pixel sum, used previously in a paper that enables automatic reading plates.

*DIGITAL OUTPUT:* After the character recognition procedure, the recognized numbers were plugged into Python software for further treatment by the OPENCV2 algorithm, which provided very good reliability and returned the final result for output, showing the license plate number as described above.

*SYSTEM ARCHITECTURE :*




*IV. RESULT AND ANALYSYIS*

This license plate detection thing is all about snapping some pictures from a process, then using computer vision plus some cool image processing tricks. It basically takes a picture of a car, edits it to make it look pretty, finds the places where the license plate could be, breaks down the characters, so the right OCR techniques can pick them up. You can totally use all these cool things like machine learning and deep learning to make it way more accurate and reliable. Putting these steps together with efficiency, LPD systems can totally nail identifying and recognizing license plates from different images, which opens up applications in security, traffic management, and automated systems.

*V. Conclusion*

Extracting license plate, segmenting characters. In general the level of success in characterization will determine the contribution of target features and thus the contribution of that to the performance of targeted classifiers. It is not surprising that experimental results show that the proposed approach, combining the three methods, can achieve a very high recognition rate of up to 98.5% for OPENCV2, where the system has been evaluated on static vehicle images divided into a multiple levels increasingly challenging set of images. When a set of blurred/distorted images are used a worse recognition accuracy is achieved compared to a set of undistorted images. The purpose of the experiments was not to find a set of 100% recognizable images, but to test the invariance of the algorithms to a set of random images that have been classified into the corresponding sets according to their features.

## *VI. Future Scope*

There are also some constraints on the range of the parameters, e.g., the moving speed of the vehicle, the text of the digits on the license plate, the amount of dirt on the license plate, the grade of the image input, the tilt angle of the image, and so on, that can be substantially supplanted in the present era by improving the algorithm and performing better.

## *VII. references*

[ 1 ] L. Angeline, W. Y. Kow, W. L. Khong, M. Y. Choong, and K. T. K. Teo, "License plate character recognition via signature analysis and features extraction," Proc. Int. Conf. Compute. Intel., Model. Simulation, pp. 1-6, 2012.

[ 2 ] P. Anishiya, Prof. S. Mary Joans, "Number Plate Recognition for Indian Cars using Morphological Dilation and Erosion with the Aid of Ocrs", 2011 International Conference on Information and Network Technology IACSIT Press, Singapore, IPCSIT vol.4 2011, pp.116-119.

[ 3] Chitra, A. & Uma, S. (2010) "An Ensemble Model of Multiple Classifiers for Time Series Prediction", International Journal of Computer Theory and Engineering, 2(3): 1793-8201.

[ 4 ] Z.-X. Chen, C.-Y. Liu, and F.-L. Chang, "Automatic license-plate location and recognition based on feature salience," IEEE Trans. Veh. Technol., vol. 58, no. 7, pp. 3781-3785, 2009.

[ 5 ] Prof. Thomas B. Fomby – "K-Nearest Neighbours Algorithm: Prediction and Classification" Department of Economics Southern Methodist University Dallas, TX 75275 February 2008

[ 6 ] Hamid Mahini, Shohreh Kasaei, Faezeh Dorri, and Fatemeh Dorri. An efficient features based license plate localization method. In ICPR'06: Proceedings of the 18thInternational Conference on Pattern Recognition, pages 841–844, Washington, DC, USA, 2006. IEEE Computer Society.

[ 7 ] Danian Zheng, Yannan Zhao, and Jiaxin Wang. An efficient method of license plate location. Pattern Recogn.Lett., 26(15):2431–2438, 2005.

[ 8 ] F. Aghdasi and H. Ndungo, "Automatic licence plate recognition system,"
IEEE AFRICON Conf., vol. 1, pp. 45–50, 2004.

[ 9 ] Rainer Lienhart and Axel Wernicke. Localizing and segmenting text in images and videos. IEEE Transaction on Circuits and Systems for Video Technology, 12(4), April 2002.

[ 10 ] J. Sauvola and M. Pietikäinen, "Adaptive document image binarization," Pattern Recognit., vol. 33, p. 225-236, 2000.

[ 11 ] Elde stein, H.A. (1999) "Introduction to Data Mining and Knowledge Discovery", Two Crows Corporation, USA, ISBN: 1-892095- 02-5.

[ 12 ] V. Wu, R. Manmatha, and E.M. Riseman. Automatic text detection and recognition. Proceedings of Image Understanding Workshop, pages 707–712, 1997.

[ 13 ] Devroye, L., Gyorfi, L., Krzyzak, A. & Lugosi, G. (1994) "On the strong universal consistency of nearest neighbour regression function estimates", Ann. Statist, 22: 1371– 1385.

[ 14 ] Devroye, L. & Wagner, T.J. (1982) "Nearest neighbour methods in discrimination, In Classification, Pattern Recognition and Reduction of Dimensionality", Handbook of Statistics, 2: 193–197. North-Holland, Amsterdam.

[ 15 ] Bailey, T. & Jain, A. (1978) "A note on distance-weighted k-Nearest Neighbour rules", IEEE Trans. Systems, Man, Cybernetics, 8: 311-313.