



Template Matching Technique using MATLAB for Number Plate Recognition

Soma Mukherjee

Research Scholar (M.Tech) Vivekananda Global University, Jaipur Jaipur, India
Soma.manipal@gmail.com

Prof. Anoop Singh Poonia

Professor , E & C Engineering Vivekananda Global University, Jaipur Jaipur, India
anoopsingh_25@rediffmail.com

ABSTRACT

In parking, number plates are used to calculate duration of the parking. When a vehicle enters an input gate, number plate is automatically recognized and stored in database. When a vehicle later exits the parking area through an output gate, number plate is recognized again and paired with the first-one stored in the database. The difference in time is used to calculate the parking fee. Automatic number plate recognition systems can be used in access control. For example, this technology is used in many companies to grant access only to vehicles of authorized personnel. In some countries, ANPR systems installed on country borders automatically detect and monitor border crossings. Each vehicle can be registered in a central database and compared to a black list of stolen vehicles. In traffic control, vehicles can be directed to different lanes for a better congestion control in busy urban communications during the rush hours.

INTRODUCTION

Automatic number plate recognition system is a special set of hardware and software components that proceeds an input graphical signal like static pictures or video sequences,

and recognizes license plate characters from it.

A hardware part of the ANPR system typically consists of a camera, image processor, camera trigger, communication and storage unit. The hardware trigger physically controls a sensor directly installed in a lane. Whenever the sensor detects a vehicle in a proper distance of camera, it activates a recognition mechanism. Alternative to this solution is a software detection of an incoming vehicle, or continual processing of the sampled video signal. Software detection, or continual video processing may consume more system resources, but it does not need additional hardware equipment, like the hardware trigger.

Image processor recognizes static snapshots captured by the camera, and returns a text representation of the detected license plate. ANPR units can have own dedicated image processors (all-in-one solution), or they can send captured data to a central processing unit for further processing (generic ANPR). The image processor is running on special recognition software, which is a key part of whole ANPR system. Because one of the fields of application is a usage on road lanes, it is necessary to use a special camera with the extremely short shutter. Otherwise,

quality of captured snapshots will be degraded by an undesired motion blur effect caused by a movement of the vehicle. For example, usage of the standard camera with shutter of $1/100$ sec to capture a vehicle with speed of 80 km/h will cause a motion skew in amount of 0.22 m. This skew means the significant degradation of recognition abilities. There is also a need to ensure system invariance towards the light conditions. Normal camera should not be used for capturing snapshots in darkness or night, because it operates in a visible light spectrum. Automatic number plate recognition systems are often based on cameras operating in an infrared band of the light spectrum. Usage of the infrared camera in combination with an infrared illumination is better to achieve this goal. Under the illumination, plates that are made from reflexive material are much more highlighted than rest of the image. This fact makes detection of license plates much easier.

PLATE RECOGNITION

The first step in a process of automatic number plate recognition is a detection of a number plate area. This problematic includes algorithms that are able to detect a rectangular area of the number plate in an original image. Humans define a number plate in a natural language as a “*small plastic or metal plate attached to a vehicle for official identification purposes*”, but machines do not understand this definition as well as they do not understand what “vehicle”, “road”, or whatever else is. Because of this, there is a need to find an alternative definition of a number plate based on descriptors that will be comprehensible for machines. Let us define the number plate as a “*rectangular area with increased occurrence of horizontal and vertical edges*”. The high density of horizontal and vertical edges on a small area

is in many cases caused by contrast characters of a number plate, but not in every case. This process can sometimes detect a wrong area that does not correspond to a number plate. Because of this, we often detect several candidates for the plate by this algorithm, and then we choose the best one by a further heuristic analysis.

IMAGE SEGMENTATION

The next step after the detection of the number plate area is a segmentation of the plate. The segmentation is one of the most important processes in the automatic number plate recognition, because all further steps rely on it. If the segmentation fails, a character can be improperly divided into two pieces, or two characters can be improperly merged together. We can use a horizontal projection of a number plate for the segmentation, or one of the more sophisticated methods, such as segmentation using the neural networks. If we assume only one-row plates, the segmentation is a process of finding horizontal boundaries between characters. The second phase of the segmentation is an enhancement of segments. The segment of a plate contains besides the character also undesirable elements such as dots and stretches as well as redundant space on the sides of character. There is a need to eliminate these elements and extract only the character.

FEATURE EXTRACTION

To recognize a character from a bitmap representation, there is a need to extract feature descriptors of such bitmap. As an extraction method significantly affects the quality of whole OCR process, it is very important to extract features, which will be invariant towards the various light conditions,

used font type and deformations of characters caused by a skew of the image. The first step is a normalization of a brightness and contrast of processed image segments. The characters contained in the image segments must be then resized to uniform dimensions (second step). After that, the feature extraction algorithm extracts appropriate descriptors from the normalized characters (third step).

Global Thresholding: The global thresholding is an operation, when a continuous gray scale of an image is reduced into monochrome black & white colors according to the global threshold value. Let $0,1$ be a gray scale of such image. If a value of a certain pixel is above the threshold t , the new value of the pixel will be zero. Otherwise, the new value will be one for pixels with values above the threshold t .

RESULTS

The Table 1 shows recognition rates, which has been achieved while testing on various set of number plates. According to the results, this system gives good responses only to clear plates, because skewed plates and plates with difficult surrounding environment causes significant degradation of recognition abilities.

	Number of Plates	Number of Characters	Weighted Score
Clear Plates	48	480	95.52
Blurred Plates	36	258	53.2
Skewed Plates	29	143	63.98
Average Plates	115	1056	89.71

Table 1: Recognition rates of the ANPR system

CONCLUSION

The objective of this thesis was to study and resolve algorithmic and mathematical aspects of the automatic number plate recognition systems, such as problematic of machine vision, pattern recognition, OCR and pattern recognition or template matching. The process involved can be concluded as: (a) **Segmentation:** This is the process were characters are being segmented or divided into more manageable task that could easily be worked on better that the full image. (b) **Grayscale:** This the process were the 24bit image color is being reduced or converted to 8bit color that could be used and accepted by the number plate system. (c) **Image Enhancement:** This is the process of increasing the contrast on the image, if the image is unclear this method can be used to increase or make it better to read or be able to see the image with better quality. The table represents the ANPR recognition rates as 89.71 for Average Plates and a special case of 95.52 as recognition rate for clear number plates.

REFERENCES

- [1] A hierarchically combined classifier for license plate recognition Lihong Zheng; Xiangjian He; Qiang Wu; Wenjing Jia; Samali, B.; Palaniswami, M.; Computer and Information Technology, 2008. CIT 2008. 8th IEEE International Conference on 8-11 July 2008 Page(s):372 - 377 Digital Object Identifier 10.1109/CIT.2008.4594704
- [2] A high performance license plate recognition system based on the web technique Dai Yan; Ma Hongqing; Liu Jilin; Li Langang; Intelligent Transportation Systems, 2001. Proceedings. 2001 IEEE 25-29 Aug. 2001 Page(s):325 – 329 Digital Object Identifier 10.1109/ITSC.2001.948677
- [3] A Macao license plate recognition system Cheokman Wu; Lei Chan On; Chan Hon Weng; Tong Sio Kuan; Kengchung Ng; Machine

Learning and Cybernetics, 2005. Proceedings of 2005 International Conference on Volume 7, 18-21 Aug. 2005 Page(s):4506 - 4510 Vol. 7 Digital Object Identifier 10.1109/ICMLC.2005.1527732

[4] A Simple Method for Chinese License Plate Recognition Based on Support Vector Machine Xiaojun Chi; Junyu Dong; Aihua Liu; Huiyu Zhou; Communications, Circuits and Systems Proceedings, 2006 International Conference on Volume 3, 25-28 June 2006 Page(s):2141 – 2145 Digital Object Identifier 10.1109/ICCCAS.2006.284922

[5] A versatile low-cost car plate recognition system Lopez, J.M.; Gonzalez, J.; Galindo, C.; Cabello, J.; Signal Processing and Its Applications, 2007. ISSPA 2007. 9th International Symposium on 12-15 Feb. 2007 Page(s):1 - 4 Digital Object Identifier 10.1109/ISSPA.2007.4555412

[6] An Algorithm for License Plate Recognition Using Radial Basis Function Neural Network Bo Li; Zhi-yuan Zeng; Jian-zhong Zhou; Hua-li Dong; Computer Science and Computational Technology, 2008. ISCSCT '08. International Symposium on Volume 1, 20-22 Dec. 2008 Page(s):569 - 572 Digital Object Identifier 10.1109/ISCSCT.2008.272

[7] Plate detection and recognition by using color information and ANN, Ziya TELATAR, Emre ÇAMASIRCIOĞLU, Electronic Engineering Department, Ankara University, ANKARA, 2007

[8] Distance and Color Invariant Automatic License Plate Recognition System Khan, N.Y.; Imran, A.S.; Ali, N.; Emerging Technologies, 2007. ICET 2007. International Conference on 12-13 Nov. 2007 Page(s):232 - 237 Digital Object Identifier 10.1109/ICET.2007.4516349