International Journal of Hybrid Information Technology
Vol.8, No.7 (2015), pp.207-214
http://dx.doi.org/10.14257/ijhit.2015.8.7.19

Performance Analysis for Recognition of Image With Alphanumeric Characters Under Different Environmental Conditions

Paramvir Singh, Rashpinder Kaur and Gurjinder Singh

School of Electronics and Electrical Engineering
paramvir.singh@chitkara.edu.in
rashpinder.kaur@chitkara.edu.in
gurjinder.singh@chitkara.edu.in

Abstract

In this recent era of technological development, innovation advances in every aspect of life can be easily seen. Automatic systems were developing at very fast pace. Automatic license late recognition is one of the systems that help in developing intelligent transport system in a city or country. This also finds application in the areas of vehicle surveillance, border security, toll tax management etc. This paper evaluates the performance analysis for recognition of image with alphanumeric characters under different environmental conditions. The overall performance recognition rate was 97.57%

Keywords: *image extraction, segmentation, contrast, night*

1. Introduction

In the world of image processing alphanumeric character recognition has achieved a lot of fame. This recognition system is used as intelligent security area. The most experimental example of alphanumeric character recognition is license plate recognition system. In previous work, the different algorithms have been designed for different types of number plates like Arabic, Korean, and Chinese license number Plates.

In the world of security system, this technology has achieved an eminence. A lot of research work is going on License number plate recognition systems with improved accuracy the accuracy of number plate recognition depends on capture image quality. The high quality of captured image will increases the accuracy rate of recognition. Mostly LPR systems are used to recognize motionless vehicle. These systems are unable to recognize the license plate in hit and run, theft cases etc. The demand to modern era is to design a LPR system for moving Vehicle (Real time), a robust system which can recognize the license number plate in bad environment (fog, rain, dark etc.).

2. Component of Designed System

2.1. Image Capturing

The initial step for alphanumeric character recognition is image acquisition. The quality of an image depends upon image capturing hardware like high resolution camera, vocal IR cameras. As per current literature, there are lots of ways to acquire an image using different methods. For example, acquiring an image by using a scaffold gabber card, [5] [11] which is image acquisition card and it is used to convert video signal to digital image by using hardware based image pre-processing.

ISSN: 1738-9968 IJHIT

2.2. Number Plate Extraction

In alphanumeric character recognition system, the main important part is image extraction. In license plate extraction through dynamic programming based method. The height, width and center position of license plate (LP) is determined. After this the vertical and horizontal distance of two neighboring character is minimized and then the permitted distance is calculated [1]. [2] Used morphological filtering for license plate extraction. Dilation and erosion operator concept is used in this method. The dilation and erosion is used to find out shape of the region and then extract the object of interest from the image. [15] Used a histogram method for extraction of license plate (LP). [12] Presented a combination of two filters, first is post processor and second is two type neural networks based. In this vertical and horizontal filters have been used in two neural networks and also in this method two small windows were open and these window will decide the result of extraction.[6] uses two methods for improving the image quality i.e. intensity variance and edge density. In intensity variance, the image is enhanced by using enhancement function i.e. local variance. The following equation represents the function of enhanced image:

$$I'_{ij} = f(\sigma_{\omega ij})(I_{ij} - \bar{I}_{\omega ij}) + \bar{I}_{\omega ij} \quad (1)$$

I_{ij} is the intensity of gray scale image I'_{ij} which also represents the intensity of enhanced image.

Weight function is denote as $f(\sigma_{\omega ij})$ and $\bar{I}_{\omega ij}$ represents the average luminance. The second option method is used to find out the edge information by using edge density function.

2.3. Image Segmentation

There are various algorithm used for the image segmentation. First is horizontal and vertical correction algorithm used for image segmentations . In this method, the value of each column is determined and the sum of the first and second pixel of image is evaluated and if the sum exceeds the threshold value then its difference will be added to total sum [13]. [7] Uses PDE base technique and the neural and fuzzy network is used to for segmentation process. [5] Use segmentation which is based on Gabor transforms and vector quantization. The finite value of vector is used to allocate the pixel value. Now moving towards the binary slit tree, in this approach vector value is acquired in such a way that the quantized error should be minimized.

2.4. Optical Character Recognition (OCR)

The last step of ACR system is optical character recognitions. OCR is basically used to classify the alphanumeric character on the number plate. [14] Used the probability model and the statistical model for recognizing a character. [8] Used an efficient approach to recognize the characters. This approach depends upon the row and column values of the black pixel and these values are compared with the set of template values. [9] and [110] has adopted template matching method. In this approach, the best result is determined by comparing the current character with each template. [3] Used a different technique for recognition. Structural approaches were used in this technique. To classify the character into differential classes, these conversions depend upon the detection of holes and concavities in the different area of mage. [4] Have used a machine vision system for recognizing the character on the vehicle number plate.

3. Performance Analysis for Recognition

An image is a function of the light intensity f (p q) where f is the brightness of the point (p, q), and p and q represent the spatial coordinates of a picture element, or pixel.

Some factor like low contrast, overexposure, high contrast and night vision etc. are affecting the quality of an image, if automation process is combining with image processing. So removing these type of factor and extract the main region of interest on the image by using different algorithms for different cases.

3.1. Normal Image

Those images which are used to create the equilibrium between overexposure and under exposure are known as normal image. The aim of the hybrid algorithm is to extract the alphanumeric character on the normal image. Initial step of this algorithm is capturing an image by using normal USB camera. After capturing processes, the next process is image enhancement. The types of noise can be reduced by using the image enhancement. Image enhancement is an image processing technique used to enhance the quality of an image under different light conditions and weather conditions image is captured. The third stage is color plane extraction. In this process, colored image can be transformed to binary image because to extract the important information from an image in case of binary intensity and color image is inadequate to obtain the main information. The binary image can be obtained by using different image plane like RGB (Red Green Blue) for red plane, green plane and blue plane, HSL (hue- saturation-lightness) for hue plane, HSL for saturation plane and HSL for luminance plane, HSV (hue-saturation-value) for value plane and HSI (hue saturation-intensity) for Intensity plane. The fourth stage is filtering. The most important process of this algorithm is filtering. In vision assistant, the various types of filter are given to remove the different types of noises, cumulative sharpness, and removing huge frequency component from the image. Low pass filter is used in the circumstance of normal image because inconsiderable noises are present in an image.

After filtering process, the next stage is segmentation process. The segmentation is process which is used to extract the region of interest from the captured image. The thresholding and look up table is important parts of segmentation. According to the intensity value, image is separated into the foreground and background pixels in the segmentation process. In vision builder, two types of thresholding is available i.e. manual and auto thresholding. Basically the process of thresholding is used to select the range of pixel value of gray scale image. So to extract the license plate characters from the acquired image, the thresholding range is selected. The range defined for different type of images for thresholding and intensity value.

The second part of segmentation is look up table. The look up table is used for changing the contrast and brightness value of threshold image. To calculate the hit and miss transformations by using look up table and also to regenerate the output pixel for various available neigh hood configurations. The different types of look up tables are given in the vision assistant like reverse, exponential, logarithmic, square, square root. To change the large values of gray scale image into small values gray scale image by using reverse look up table. So, different look up tables are used for different conditions. The Lookup table (LUT) transformations are also used to enhance the image. In LUT, transformation is used to change the input gray level values in the transformed image. Improve the resolution of an image by adjusting the maximum and minimum values of Brightness, contrast, and gamma.

In the end, Last step of this algorithm is Optical character recognition system. The result of whole operation is based upon optical character recognition. In this process, an OCR result depend upon two things first horizontal and vertical sides of number plates and second is format of characters on a number plates. In vision builder, the OCR is used to train the character, important information and recognized the same corresponding character in different image. The algorithm was tested for 30 normal images out of which 29 images were recognized accurately and thus resulting in accuracy of 99.2%.The result of normal image is shown in given Figure 1 and Figure 2

Figure 1. (A) Normal Image (B) Normal Image Get Passed and Recognized

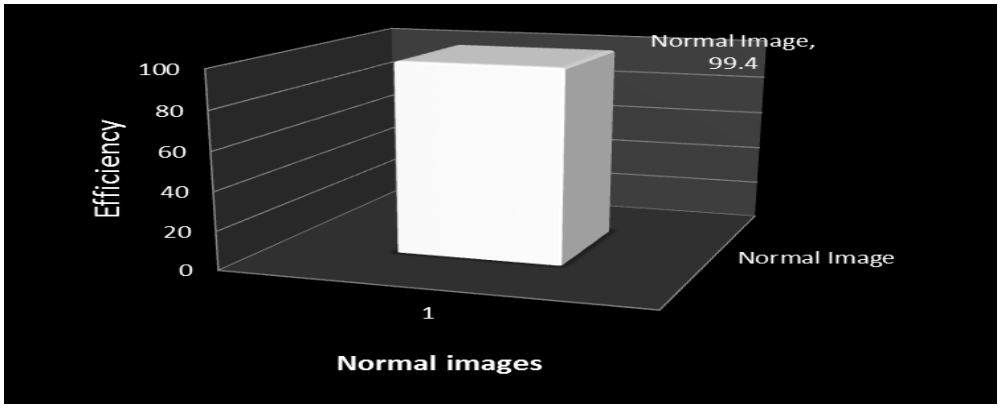

Figure 2. Performance Analyses For Normal Image

3.2. Low Contrast Image

The same algorithm system is designed especially for low contrast image. The similar steps are used to create the algorithm for recognized the alphanumeric character but types of color extraction and filter are different and also the thresholding values are different. The algorithm was tested for 30 normal images out of which 28 image were recognized accurately and thus resulting in accuracy of 93.35 %.The result of normal image is shown in given Figure 3 and Figure 4.

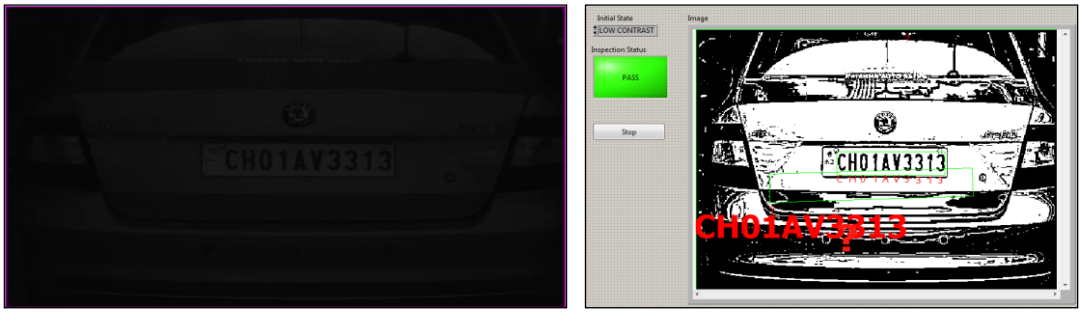

Figure 3. (A) Low Contrast Image (B) Low Contrast Image Get Passed and Recognized

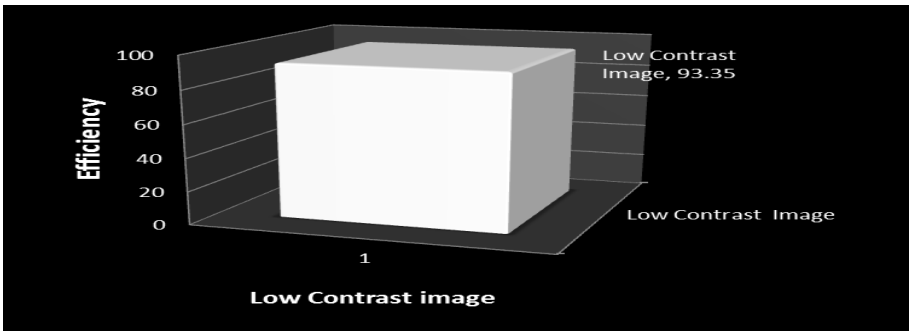

Figure 4. Performance Analyses For Normal Image

3.3. Night Vision

The images which are capture in darker area are known as night vision images. In order to recognize the character from the night vision image the discussed algorithm is applied and also algorithm was tested for 40 normal images out of which 39 images were recognized accurately and thus resulting in accuracy of 98.32%.The result of night vision image is shown in given Figure 5 and Figure 6.

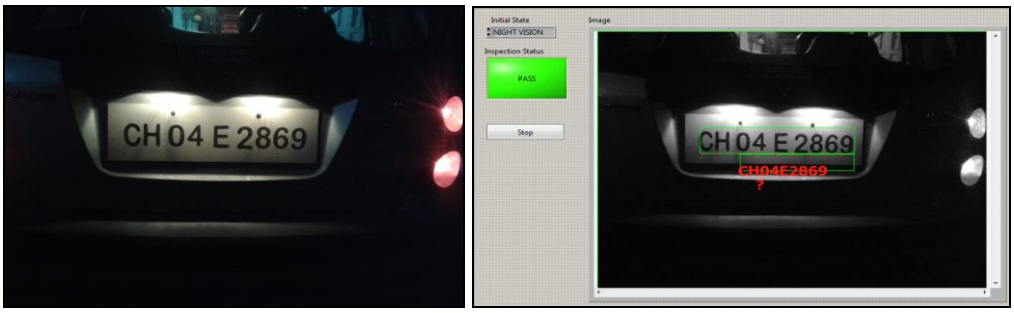

Figure 5. (A) Night Vision Mode Image (B) Night Vision Image Get Passed and Recognized

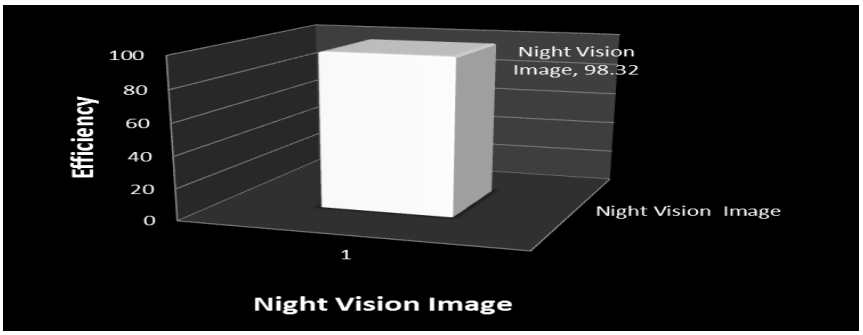

Figure 6 Performance Analyses For Night Vision

In below Table 1, Important factor are used for different modes are shown:

Sr. no	Types of image	Color extraction	Filtering	Recognition rate
1	Normal image	Luminance	Low pass filter	99.4%

2	Night vision image	Red plane	Convolution filter	98.32%
3	Low contrast image	Red plane	Convolution filter	95%

4. Acknowledgements

The primary aim of this era is to evaluate the performance of recognition of alphanumeric characters of license plate. The hybrid algorithm was tested on 100 images for different environmental condition like normal, contrast, and night vision. Experimental results have shown the overall performance recognition rate is 97.57%.

5. References

5.1. Journal Article

[1] D. J. Kang, "Dynamic Programming-based Method for Extraction of License Plate Numbers of Speeding Vehicles on the Highway", International Journal of Automotive Technology, vol. 10, no. 2, (**2009**), pp. 205−210.
[2] M. Latha, G, and G. Chakravarthy, "An Improved Bernsen Algorithm Approaches For license Plate Recognitions", IOSR Journal of Electronics and Communication Engineering, vol. 3, no. 5, (**2012**), pp. 1-5.
[3] L. Hamami and D. Berkani, "Recognition System for Printed Multi-Font and Multi-Size Arabic Characters", the Arabian Journal for Science and Engineering, vol. 27, (**2002**), pp. 57-72.
[4] Kuldeepak, M. Kaushik and M. Vashishath, "License plate recoginition system based on Image processing using labview", International journals of electronics communication and computer technology, vol. 2, (**2012**) July, pp. 183-188.
[5] M. K. Hu, "Visual Pattern Recognition by Moment Invariant", IRE Transactions on Information theory, vol. IT-8, (**1962**), pp. 179-187.
[6] M. A. Lalimi and S. Ghofrani, "An Efficient Method for Vehicle License Plate Detection in Complex Scenes", Circuits and Systems, (**2011**), pp. 320-325.
[7] J. Morel and S. Solemini, "Variational Methods in Image Segmentation", Birkhauser, Boston, (**1995**).

5.2. Conference Proceedings

[8] J. Cowell, and F. Hussain, "A Fast Recoginisation System for isolated Arabic Characters", in Proc. Sixth International Conf. on Information and Visualizations, IEEE Computer Society, London, England, (**2002**), pp. 650-654.
[9] M. Yu and Y. D. Kim, "An approach to Korean license plate recognition based on vertical edge matching", IEEE International Conference on Systems, Man, and Cybernetics, vol. 4, (**2000**), pp. 2975-2980.
[10] T. Naito, T. Tsukada, K. Yamada, K. Kozuka, and S. Yamamoto, "Robust recognition methods for inclined license plates under various illumination conditions outdoors", Proceedings IEEE/IEEJ/JSAI International Conference on Intelligent Transport Systems, (**1999**), pp. 697-702.
[11] Y. Dai, H. Ma, J. Liu and L. Li, "A high performance license plate recognition system based on the web technique", Proceedings IEEE Intelligent Transport Systems, (**2001**), pp. 325-329.
[12] K. K. Kim, K. I. Kim, J. B. Kim, and H. J. Kim, "Learning based approach for license plate recognition", Proceedings of IEEE Processing Society Workshop on Neural Networks for Signal Processing, vol. 2, (**2000**), pp. 614-623.

5.3. Workshop

[13] C. Nieuwoudt and R. Nieuwoudt, "Automatic number plate segmentation and recognition", Seventh annual South African workshop on Pattern Recognition, (**1996**), pp. 88-93.
[14] H. Hansen, A. W. Kristensen, M. P. Kohler, A. W. Mikkelsen, J. M. Pedersen and M. Trangeled, "Automatic recognition of license plates", Institute for Electronic System, Aalhorg University, (**2002**), May.

5.4. M.tech thesis

[15] Koura, car plate recognition system, M.tech thesis in Atilim University, (**2009**) July.

Authors

Paramvir Singh is pursuing M.E. Fellowship in Electronics and Communication (2012-2015) from Chitkara University, Rajpura. He received his B.Tech in Electronics and Communication from Punjab technical university and has been teaching in Chitkara University since 2012. His field of interest is Image Processing, Automation, Microwave and satellite communication and LabVIEW programming.

Rashpinder Kaur is working as an assistant professor in Chitkara University, Rajpura since 2008. She received the B-Tech and M-Tech degree in Electronics and Communication Engineering from Punjab technical University, Jalandhar. Her field of interest is Digital Signal Processing, Wireless Communication, Digital Communication, LabVIEW Programming and Image Processing

Gurjinder Singh received the B-Tech and M-Tech degree in Electronics and Communication Engineering from Punjab technical University, Jalandhar and He is currently pursuing Ph.D. degrees in Electronics and Communication Engineering from Chitkara University, Rajpura .He is currently Assistant Professor at the Faculty of Electronics and Communication Engineering, Chitkara University. His research interests include Robotics, Automation, Image processing, LabVIEW programming, Digital Communication.

