Available Online at www.ijcsmc.com

International Journal of Computer Science and Mobile Computing

A Monthly Journal of Computer Science and Information Technology

ISSN 2320–088X

IJCSMC, Vol. 3, Issue. 4, April 2014, pg.230 – 238

RESEARCH ARTICLE

DYNAMIC NUMBER PLATE RECOGNISATION USING GENETIC ALGORITHMS

M.Sudha[1] M.E, **E.Saranya**[2] M.E, **R.Karthika**[3] M.E, **R.Santhosh**[4] M.E., M.B.A (PhD)

[1,3]Student, [2,4]Assistant Professor

[1,2,3,4]Dept of Computer Science and Engineering

[1]Karpagam University, Coimbatore, [2]Sri Subramanya College of Engg & Technology Palani,

[3]Anna University Regional Office, Madurai, [4]Karpagam University, Coimbatore

Email: [1] sudhakce2009@gmail.com, [2] saran25.shine@gmail.com, [3] karthikamaha@gmail.com

Phone: 9942403942, 9788235660, 9944368057

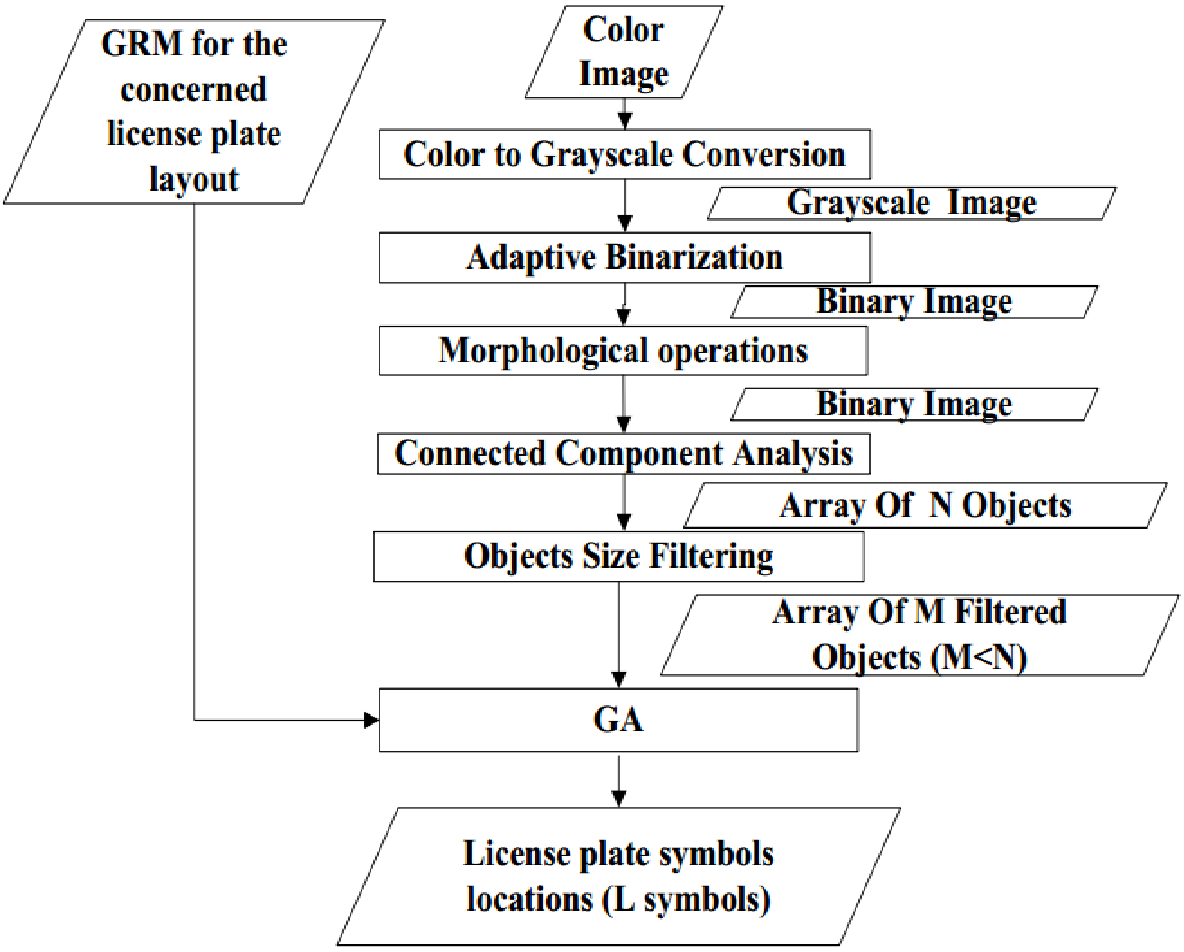
ABSTRACT-A new genetic algorithm (GA) is used to detect the locations of the License Plate (LP) symbols. Adaptive threshold method has been used to overcome the dynamic changes of illumination conditions when converting one image into binary. The detection stage of the LP is the most critical step in an automatic vehicle identification system Connected component analysis technique (CCAT) is used to detect candidate objects inside the unknown image. Encouraging results with 96.8% overall accuracy have been reported for two different datasets having variability in orientation, scaling, plate location, illumination and complex background.

***Keywords*—**Genetic algorithms, image processing, image representations, license plate detection, machine vision, road vehicle identification, sorting crossover

I. INTRODUCTION

The detection stage of the LP is the most critical step in an automatic vehicle identification system [1]. A numerous research has been carried out to overcome many problems faced in this area but there is no general method that can be used for detecting license plates in different places or countries, because of the difference in plate style or design. All the developed techniques can be categorized according to the selected features upon which the detection algorithm was based and the type of the detection algorithm itself. Color-based systems have been built to detect specific plates having fixed colors [2], [3], [4]. The applied detection algorithms ranged from window-based statistical matching methods [18] to highly intelligent-based techniques that used neural networks [19], [20] or fuzzy logic [21]. GAs has been used rarely because of their high computational needs. Different researches have been tried at different levels under some constraints to minimize the search space of Gas Another group of researchers tried to manipulate the problem from the texture perspective to differentiate between text and other image types [26], [27]. The main drawback of these segmentation techniques was their intensive computational demand and also sensitivity to the presence of other text such as bumper stickers or model identification. a new technique is introduced in this paper which detects LP symbols without using any information associated with the plate's outer shape or internal colors to allow for the detection of the license numbers in case of shape or color distortion either physically or due to capturing conditions such as poor lighting, shadows and camera position and orientation. a new genetic algorithm has been designed with a new flexible fitness function. Image processing is carried out at first to prepare for the GA phase.

II. SYSTEM OVERVIEW



III. IMAGE PROCESSING PHASE

An input color image is exposed to a sequence of processes to extract the relevant two dimensional objects that may represent the symbols constituting the LP. These processes that are carried out in different stages.

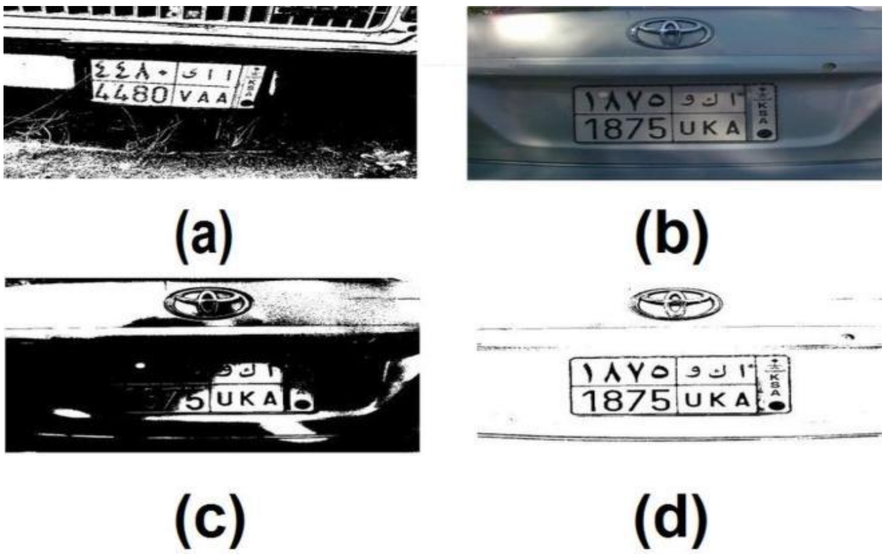
A.Color to grayscale conversion

Color (*RGB*) to grayscale (*gs*) conversion is performed using the standard NTSC method by eliminating the hue and saturation information while retaining the luminance as follows

$$gs=0.299*R+0.587*G+0.114*B$$

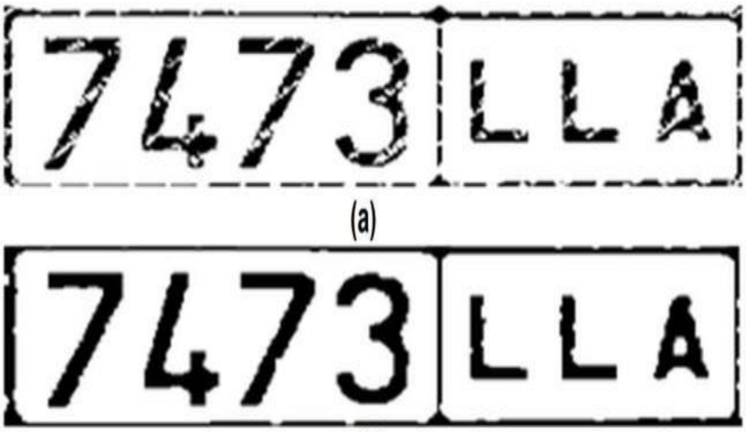
B.Gray to binary using a dynamic adaptive threshold

A 30x30 window has been applied on the first set of image samples used in this research, which resulted in a high accuracy rate in different illumination conditions as will be presented in the results section. Although some images can be binarized successfully using Otsu's global threshold method [29] as shown in Fig. 3(a), others as that shown in Fig. 3(b) may produce incorrect results as shown in Fig. 3(c). On the other hand, local adaptive binarization will give satisfactory output as shown in Fig. 3(d) for the same image in Fig. 3(b)



Morphological Operations

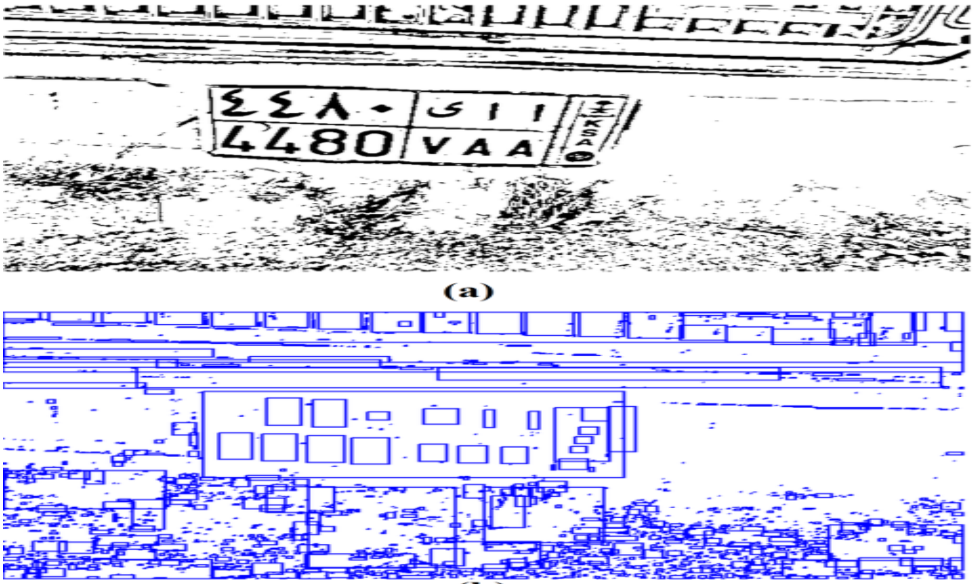
Morphological operations such as dilation and erosion are important processes needed for most pattern recognition systems to eliminate noisy objects and retain only objects expected to represent the targeted patterns. In LP detection, closing operation (dilation followed by erosion) is performed to fill noisy holes inside candidate objects and to connect broken symbols. On the other hand, opening (erosion followed by dilation) is applied to remove objects that are thinner than the LP symbols.



(a) (b)

Connected component analysis (CCA) and objects extraction

CCA is a well known technique in image processing that scans an image and groups pixels in labeled components based on pixel connectivity [30]. An 8-point CCA stage is performed to locate all the objects inside the binary image produced from the previous stage. The output of this stage is an array of N objects. Fig. 5 shows an example of the input and output of



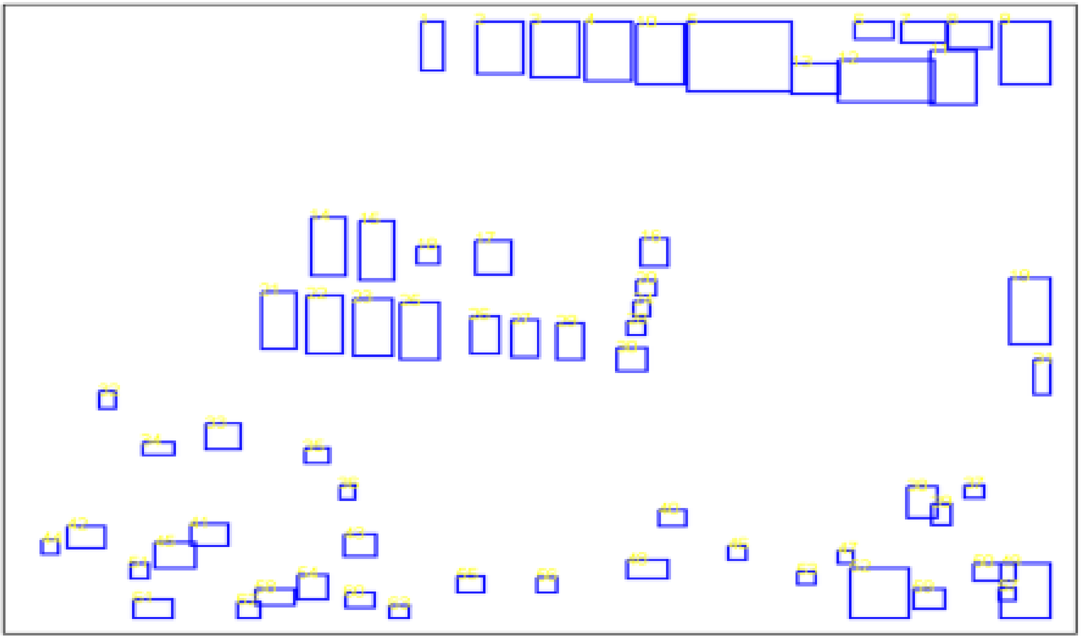
(a) (b)

Size filtering

The objects extracted from the CCA stage are filtered on the basis of their widths *Wobj* and heights *Hobj* such that the dimensions of the LP symbols lie between their respective thresholds as follows:

Wmin ≤ *Wobj* ≤Wmax and Hmin ≤*Hobj* ≤ Hmax (2)

Where Hmin and Wmin are the values below which a symbol cannot be recognized (8 pixels for example) and Wmax can be set to the image width divided by the number of symbols in the license number. Hmax is calculated as Wmax divided by the aspect ratio of the used font



IV. GA PHASE

GA phase to resolve the 2D compound object detection problem will be introduced in details, indicating the encoding method, initial population setup, fitness function formulation, selection method, mutation and crossover operator design and parameters setting.

a. chromosome encoding

Encoding of a compound object such as the LP is accomplished based on the constituting objects inside it.

An integer encoding scheme has been selected where each gene *i* is assigned an integer *j* which represents the index to one of the *M* objects output from the size filtering stage. The information that will be used for each object *j* is as follows:

- The upper left corner coordinates (*X*, *Y*) of the rectangle bounding the object.

- The height (*H*) and width (*W*) of the rectangle bounding the object

b. Defining the Fitness Function

$$RH_{2,1} = (H_2 - H_1)/H_1$$

$$RW_{2,1} = (W_2 - W_1)/H_1$$

The geometric relationships between the rectangles bounding the objects, it does not represent the objects' shapes because they are unknown in case of an unknown plate.

Objective Distance (od) and Fitness Formulation

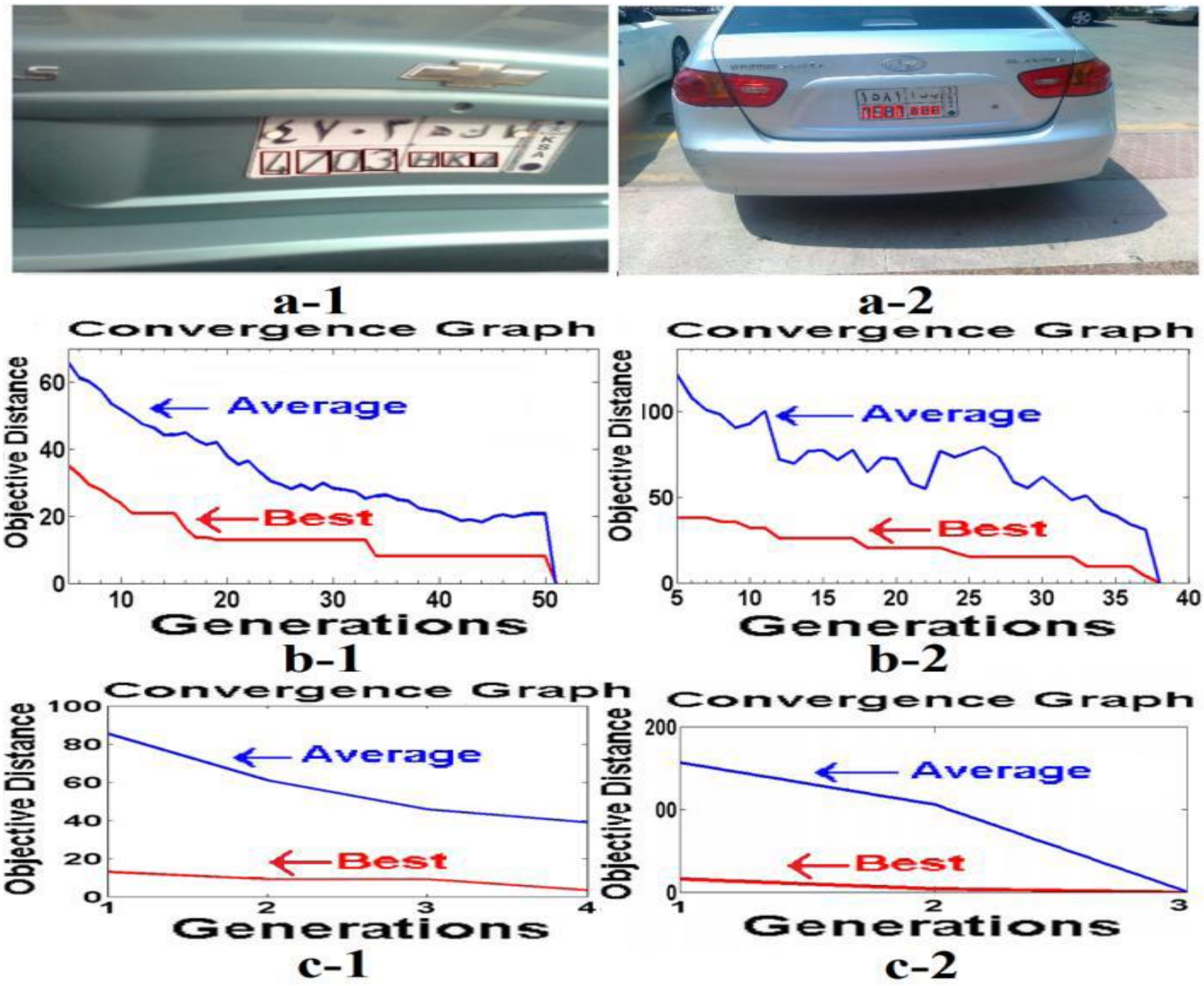
Considering the distance between the prototype chromosome *p*, corresponding to the input GRM, and any chromosome *k*, five distance alues can be defined as follows:

$$\Delta RX_{k,p} = \sum_{j=1}^{L-1} \left| \left(RX_{j+1,j}\right)_k - \left(RX_{j+1,j}\right)_p \right|$$

$$\Delta RY_{k,p} = \sum_{j=1}^{L-1} \left| \left(RY_{j+1,j}\right)_k - \left(RY_{j+1,j}\right)_p \right|$$

$$\Delta RW_{k,p} = \sum_{j=1}^{L-1} \left| \left(RW_{j+1,j}\right)_k - \left(RW_{j+1,j}\right)_p \right|$$

$$\Delta RH_{k,p} = \sum_{j=1}^{L-1} \left| \left(RH_{j+1,j}\right)_k - \left(RH_{j+1,j}\right)_p \right|$$



V. CONCLUSION

A new genetic based prototype system for localizing 2-D compound objects inside plane images has been introduced and tested in the localization of LP symbols. The results were encouraging and a new approach for solving the LP detection problem relying only on the geometrical layout of the LP symbols has been experimentally proved. Also, a flexible system has been introduced that can be simply adapted for any LP layout by constructing its GRM matrix. The system proved to be invariant to object distance (scaling), insensitive with respect to perspective distortion within a reasonable angle interval, and immutable to a large extent to the presence of other types of images in the vehicle background. Due to the independency on color and the adaptive threshold used for binarization, the proposed system possessed high immunity to changes in illumination either temporarily or spatially through the plate area. Furthermore, our experiments proved that although leaving some features in the compound object representation due to the variable nature of the internal objects such as the aspect ratios and the relative widths, a high percentage success rate was achieved with the aid of the adaptability aspect of the GAs. The ability of the system to differentiate between LP text and normal text has been proved experimentally. A very important achievement is overcoming most of the problems arising in techniques based on CCAT by allowing the GA to skip gradually and randomly one or more symbols to reach to an acceptable value of the objective distance. Moreover, an enhancement in the performance of the developed GA has been achieved by applying the new USPS crossover operators, which greatly improved the convergence speed of the whole system. Finally, a new research dimension for GAs has been opened to allow for the detection of multiple plates and even multiple styles in the same image and to increase the performance in terms of speed and memory and to apply the same technique in other problem domains analogous to the LP problem.

REFERENCES

[1] A. Ahmadyfard and V. Abolghasemi,“ Detecting License Plate Using Texture and Color Information,” IST 2008, International Symposium on Telecommunications, pp. 804–808, 2008.

[2] G. Li, R. Yuan, Z. Yang, and X. Huang, “A Yellow License Plate Location Method Based on RGB Model of Color Image and Texture of Plate,” Second Workshop on Digital Media and its Application in Museum & Heritages, pp. 42–46, 2007.

[3] X. Shi, W. Zhao, Y. Shen, and O. Gervasi, "Automatic License Plate Recognition System Based on Color Image Processing," Lecture Notes on Computer Science, Springer-Verlag, vol. 3483, pp.1159 -1168, 2005.

[4] O. Villegas, D. Balderrama, H. Domínguez and V. Sánchez, ” License Plate Recognition Using a Novel Fuzzy Multilayer Neural Network,” International Journal of Computers”, Issue 1,vol. 3, 2009.

[5] S. Z. Wang and H. M. Lee, "Detection and Recognition of License Plate Characters With Different Appearances," Proc. Conf. Intell. Transp. Syst., vol. 2, pp.979 -984, 2003.

[6] L. Carrera, M. Mora, J. Gonzalez and F. Aravena, “License Plate Detection Using Neural Networks,” In Proceedings of IWANN vol.2, pp. 1248-1255, 2009.

[7] M. I. Chacon and A. Zimmerman, "License Plate Location Based on a Dynamic PCNN Scheme," Proc. Int. Joint Conf. Neural Netw., vol. 2, pp.1195 -1200, 2003.

[8] S.-L. Chang, L.-S. Chen, Y.-C. Chung, and S.-W. Chen, "Automatic License Plate Recognition," IEEE Trans. Intell. Transp. Syst., vol. 5, no. 1, pp. 42 -53, 2004.

[9] S. K. Kim , D. W. Kim and H. J. Kim "A Recognition of Vehicle

