European Journal of Computer Science and Information System
Vol.3, No.1, pp.73-86, March 2015
Published by European Centre for Research Training and Development UK (www.eajournals.org)

NEW HYBRID SVMS-BCOA ARCHITECTURE FOR IRAQI VEHICLES LICENSE PLATE RECOGNITION

Assist. Prof. Majida Ali Abed[1], Assist. Prof. Dr. Hamid Ali Abed Alasadi[2]
[1]College of Computers Sciences & Mathematics, University of Tikrit, Iraq
[2]Computers Sciences Department, Education for Pure Science College, University of Basra, Iraq

ABSTRACT: *License Plate Recognition system is one kind of a traffic monitoring systems and image-processing technology used to identify vehicles by their Iraqi license plates. This technology is used for many applications such as finding stolen cars, parking decks, border control, and solution to the problem of monitoring the tremendous number of vehicles for law enforcement, various security and traffic applications. A little work has been done for Iraqi license plate recognition systems. Our study proposes new architecture in License Plate Character Recognition (LPCR) based on Support Vector Machines (SVMs) with Bee Colony Optimization Algorithm (BCOA). This Algorithm is used to dynamically select the best training data set for SVMs throughout training. The experimental results show that SVMs reduce the size of training dataset and training time, with the parameters optimization by BCOA. Our proposed Architecture has a satisfactory performance in terms of being more accurate and strong.*

KEYWORD: Vehicle license plate recognition, Support Vector Machines SVMs,Bee Colony Optimization Algorithm BCOA

INTRODUCTION

The development of automated applications is becoming more and more a request in modern societies, due to the increasing needs for efficiency and fast decisions. The Vehicles Recognition System described in this study is one of such applications. The use of information systems by database systems techniques and intelligence techniques in the filed database for fast and automatic recognition of vehicles license plates is a result of nowadays technological development and innovation[1]. During the recent years, Intelligent Systems are having a wide impact in people's life as their scope is to improve transportation safety and mobility and to enhance productivity through the use of advanced technologies. The types of technology based systems. Intelligent Transportation Systems are divided into intelligent infrastructure systems and intelligent vehicle systems [2]. This study a computer vision and character recognition algorithm for license plate recognition is presented to be used as a core for intelligent infrastructure like electronic check systems (cars, motors). License plate remains the principal vehicle identifier and it's relying heavily on robust License Plate Recognition (LPR) systems. [3]. Where used for faster detection of Regions of Interest to an algorithmic bees sequence able to cope with plates of various sizes and positions. More than one license plate can be segmented. in the license number identification phase examined the determined license plate candidates in the previous stage. The character segmentation and character recognition are the two major tasks involved in the identification phase. After localizing the plate in the image a number of techniques to segment each character, such as feature vector extraction and mathematical morphology and Markov Random Fields . In this work [4]. They propose both a novel character segmentation approach and a new feature vector extraction based degraded images.The results are indicating that the method could be used for character segmentation in plates with not easily distinguishable characters during off-line operation. The algorithm cannot be proposed for real time license

plate recognition. The system performs well on various types of Iraqi plates, even on scratched, scaled plate numbers. In addition, it can deal with the multiple and unclear plates in the different types of vehicles [5]. Generally, the LPR system consists of four modules the structure of such systems is shown in Figure (1).

- image acquisition,
- license plate extraction,
- Segmentation of individual characters.
- Detection and Recognition of individual characters.

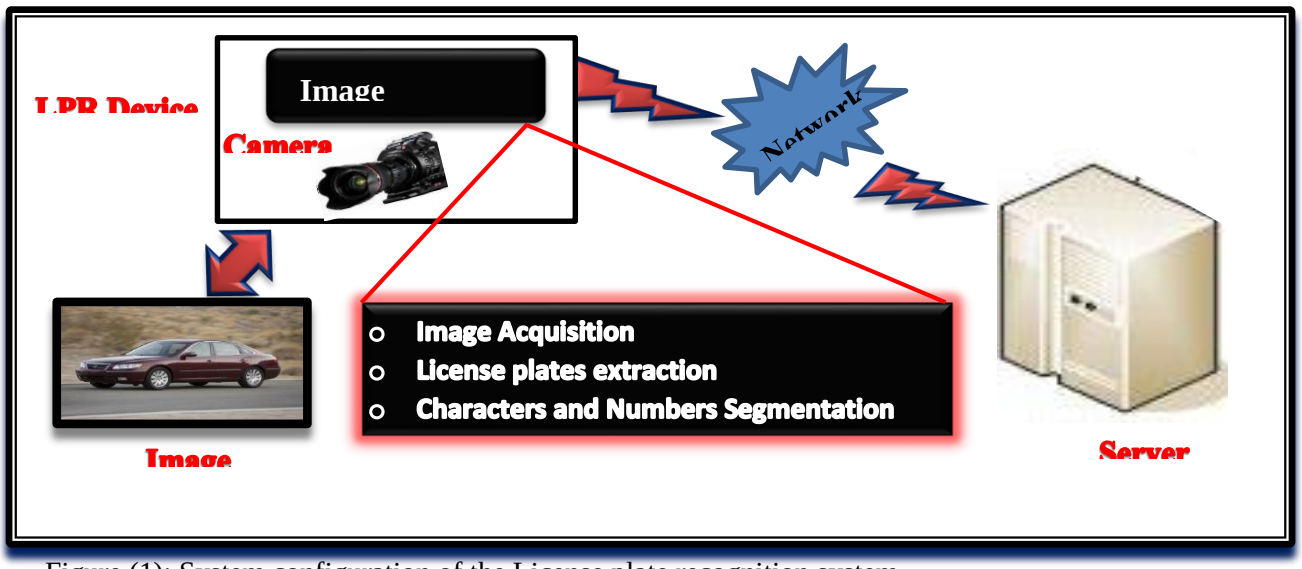


Figure (1): System configuration of the License plate recognition system.

RELATED WORKS

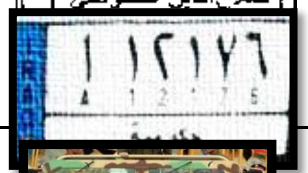
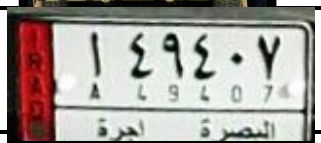
At the Police Scientific Development Branch in the UK, the first invention of the Automatic Number Plate Recognition (ANPR) was in 1976. The ANPR system for travel time measurement has been developed to suit with traffic environment in Malaysia by using different the technique that has been employed in processing algorithm. The development of the ANPR system consists of two parts: the processing part (vehicle detection, number plate localization and extraction) and the Optical Character Recognition (character segmentation and recognition). Little work has been done for developing country License Plate Recognition (LPR) is an image processing technology considerable interest as part of intelligent transport systems; while much work has been done for Iranian, Korean, and Chinese, European and US license plates, [6].A new method for the license plate extraction and recognition is presented. First, the segmentation technique, based on multiple threshold values determined by fuzzy entropy and the prior knowledge on license plate character, is used to extract the license plates, which has strong anti-noise capability, and is able to locate the license plates quickly in the varying backgrounds. Then, a recognition method combining several recognizers is proposed to recognize the license plate characters. The recognition rate of over 97% under various illumination conditions in real applications shows that the proposed method is effective and reliable for license plate recognition [7]. Many research works using only single technique to perform recognition of characters in license plates. Many researches have been done on license plate (LP) recognition. However, these are no sufficient number of works on Thai LP. The existing works on Thai LP have been focused on localization, extraction, and partial recognition (only for upper line) of the license plate. Generally, Thai LP has 2 lines (upper and lower). The upper line of Thai LP presents character category in 2-position formatted, following by running number. The lower line presents province

name. Thai words can be composed of 4 levels (top level, above level, base line and below level) for that the recognition of the lower line is a difficult task. This work presents an approach to recognize off-line entire Thai LP using Hausdorff Distance technique (HD) for similarity measurement. The recognition rate obtained by the proposed method is 92% [8]. One of the most important methods that use optical character recognition on images to read license plates is Automatic license plate recognition (ALPR). These systems basing on localization and recognition of the license plates shown in photos or camera picture as a attempt to facilitate the problem of identification of license plates[9]. There are many researchers discussed the locating methods, because it is very important for post process; but it need to be improved for better application. Various types of ANN had been used for license plate character identification such as Probabilistic Neural Networks (PNNs) for LPR. HD has been chosen as a technique to recognize Thai license plates [10] and proven to achieve high percentage of recognition accuracy. This proposed system was able to perform 92% for valid recognition but needed more research to get high performance in recognizing poor quality images and among groups of similar-pattern characters Hausdorff distance for LPCR obtained similar recognition rate to ANN but more slow and have computational burden .Many works designed a system implementing Support Vector Machines (SVMs) and evolutionary algorithms report an impressive average character recognition rate for license plates. The architecture, however, is strictly designed for Korean plates [11]. LPR problem originated as a narrowly defined problem in artificial intelligence therefore needed to improve the performance and efficiency of LPCR algorithm.

Features of Iraqi Vehicles License Plates (IVLP)

The Iraqi Vehicles license plate (IVLP) is divided into five sections; Arabic and English characters, Arabic and Hindi numbers, and vehicle type section which is color coded and includes the name and logo of Iraq. There are five color codes; white is for personal cars, yellow is for public transportation cars, blue is for government cars and green is for army and diplomatic cars. In our article, we give out an improved method to recognize for Iraqi Vehicles license plate, Table (1) shows the five different Iraqi Vehicles license plate (IVLP) types. The current license plates have the following characteristics.

Table (1): Five Types of Iraqi Vehicles License Plates IVLP

Type 1	***Iraqi personal license plate*** **Vehicles license plates of the personal and organized of Iraqi (license plate with white background, black Arabic, English characters & Arabic, Hindi numerals (0…9)).**	
Type 2	***Iraqi governmental license plate*** **Vehicles license plates of the governmental organizations of Iraqi (Vehicles license plate with white blue background, black Arabic, English characters & Arabic, Hindi numerals (0…9).**	
Type 3	***Iraqi Army Vehicles license plates*** **Vehicles license plates of Army of Iraqi (all background is green). Vehicles license plate with green background, black Arabic, English characters & Arabic, Hindi numerals (0…9).**	
Type 4	***Iraqi public transportation license plate*** **Vehicles license plates of the public transportation. Vehicles license plate with white red background, black Arabic, English characters &Arabic, Hindi numerals (0…9).**	
Type 5	***Iraqi load license plate*** **Vehicles license plates of public transportation (commercial, special economic and trade) of Iraqi. Vehicles license plate with the white yellow background, black Arabic, English characters &Arabic, Hindi numerals (0…9).**	

Support Vector Machines (SVMs)

The Support Vector Machines (SVMs) possess great potential and superior performance as is appeared in many previous researches for efficiently training linear learning machines in kernel-induced feature spaces. SVMs are a pattern recognizer that classifies data without making any assumptions about the fundamental process by which the explanations were granted. In SVM data can be seen in the form of P-dimensional vector [12]. The SVMs use hyper- planes to separate the different classes. Many hyper- planes are fitted to separate the classes, but there is only one optimal separating hyper- plane. The optimal hyper-plane is determined only by support vectors, which are ideally distributed near class boundaries. The hyper- plane is constructed so as to maximize a measure of the 'margin' between classes. For character recognition after normalization a data sample is classified by the SVM according to the decision boundary defined by the hyper- plan SVM. The Limitations of SVM are performance of SVMs largely depends on the choice of kernels**,** the choice of kernel functions, which are well suited to the specific problem, is very difficult, Speed and size is another problem of SVMs both in training and testing. In terms of running time, SVMs are slower than other neural networks for a similar generalization, performance. For given training data, it is believed that SVS will perform well for when the patterns to be classified are no separable and the training data are noisy. On the other hand, applications of SVS **Error! Reference source not found.**, such as face detection, verification, and recognition, object detection and recognition, handwritten character and digit recognition, text detection and categorization, speech and speaker verification, recognition, information and image retrieval, prediction have been successfully applied. The SVMs given a set of data point $\{(x_1, y_1),....,(x_\ell, y_\ell)\}$, where each $x_i \subset R^n$ denotes the input vector consisting of N training pattern has a corresponding output value $y_i \subset R$ for *i=1,..., l* where *l* corresponds to the size of the data point. SVM approximate the function using the following:

$$f(x) = (w \cdot \Phi(x)) + b \quad (1)$$

$$R_{SVM}(c) = c\frac{1}{N}\sum_{i=1}^{N} L_\varepsilon(y_i, y_i^\wedge) + \frac{1}{2}w^T.w \quad (2)$$

$$L_\varepsilon(y.\ y') = |y - y'| - \varepsilon \quad |y - y'| \geq \varepsilon$$
$$= 0 \qquad otherwise$$

$$^\wedge y = f(x) = \sum_{i=1}^{N}(\propto_i - \propto_i^*)k(x_i, x) + b \quad (3)$$

$$k(x_i, x) = \exp(\frac{-1}{\delta^2}\left(x_i - x_j\right)^2)$$

Where

$\phi(x)$ **:** is the non-linearity high dimension feature space which mapped from the input space *x.*

w : is the modifiable model parameter.

b : is the threshold value.

w and *b :* are estimated by minimizing.

$\propto_i \ and \ \propto_i^*$: are the Lagrange multipliers, which are positive real constants. The data points corresponding to non-zero value for $(\propto_i - \propto_i^*)$ are called support vectors.

$k(x_i, x)$: is the inner product kernel function (Gaussian Kernel).

δ^2 : is the Gaussian kernel factor (the width of the kernel function).

C: positive real constant controls the trade-off between training error and generalization ability and its value is chosen by means of a validation set..

ε:parameter for SVMs

Each SVMs is a maximal margin hyper- plane in a feature space built using a Kernel function, and each SVM is based on mathematical foundations concerning optimization theory [14] are the main advantages of SVMs. We summarize the steps of SVM based algorithm for number recognition of Iraqi Vehicle License Plate (IVLP).in our study as shown in Figure (2) below.

Step1. Pre-process the image of number Iraqi Vehicles license plate.
Step2. Segment the IVLP image into several parts. Each part contains only a single character.
Step3. Normalize each character or digit on the number of IVLP.
Step4. Extract the feature vector of each normalized applicant.
Step5. Recognizes the single number by the set of SVMs trained in advance.
Step6. If there are no more unclassified samples, then STOP. Otherwise, go to Step 5.
Step7. The test samples are adding into their corresponding database for further training.
Step8. Recognize number Iraqi Vehicles license plate by bringing all numbers used together.

Figure (2): Steps of SVM algorithm for number recognition of Iraqi Vehicle License Plate(IVLP).

Bee Colony Optimization Algorithm (BCOA)

The Bees Colony Optimization Algorithm is a natural phenomenon of bee colony, population-based search algorithm inspired by the natural foraging behaviour of honey bees to find the optimal solution. The idea behind the BCO is to create the multi agent system (colony of artificial bees) capable to successfully solve difficult combinatorial Optimization problems., the algorithm performs a kind of neighbourhood random search. There are three types of bees [15].

Queen Bee

There is one queen bee in the bee colony. She is responsible to lay eggs which are used to build new colonies.

Male Drone Bees

There are many male drone bees in the ant colony; these are responsible for mating with the queen bee.

Worker Bees

There are thousands worker bees in the ant colony ,these bees perform all the preservation and management jobs in the colony and the scout behavior and forager behavior respectively are collectively responsible for the working of the honey bee colonies. There are two types of worker bees, scout bees and Forager bees. In execution of the Bee Colony Optimization algorithm following three paths will be formed as PSB, PFB and PS.

Path Construction (PSB)

The Scout behavior consists from the following steps which constitutes the first step of the BCOA process called the “Path Construction:[16]

- The scout bees start from the colony in search of food source randomly.
- They keep on this search process until they are out of energy/tired and return back to the colony.
- When they return back to the colony, they share their experience and knowledge with the forager bees by performing the mechanism called “waggle dance”. This dance repeated again and again by a bee. Its intensity and direction gives the idea of food source quality and food source location respectively to other bees.
- It is the means by which the bees transmission. It is used to carry the parameters like foods Source Quality, distance of food source from colony, Location of food source , to guide the path to the available forager bees.

Path Restructuring (PFB)

In the Forager behavior, the forger bees do the following action which represents the second step of the Bee Colony Optimization algorithm BCOA process called the “Path Restructuring”:

- The Forager bees observe and learn the steps done by the scout bees while waggling so as to simplicity their journey.
- The scout bees to feat guided forager bees go to the food sources

Path Selection (PS)

Path selection is the final step of the Bee Colony Optimization algorithm BCO done by the forger bees. From the PFB select the Path Restructuring with minimum Total Execution time of test case ET. BCO employs four different selection processes:

- global selection process used by onlookers bees
- local selection process carried out in a region by employed and onlooker bees
- greedy selection process used by all bees
- random selection process used by scouts bees

The main Bee Colony Optimization algorithm parameters are given in Table (1). The flowchart of the Bees Colony Optimization Algorithm is shown in Figure (3).

Table (1) : Basic parameters of the Bees Colony Algorithm.

No.	*Parameters*	*Explanation*
1	*Ns*	*Number of scout bees*
2	*Ne*	*Number of selected sites*
3	*Nb*	*Number of best sites*
4	*nre*	*Employed bees for selected sites*
5	*nrb*	*Employed bees for remaining best sites*
6	*ngh*	*Initial size of neighborhood and stopping criterion*
7	*stlim*	*Limit of stagnation cycles for site desertion*

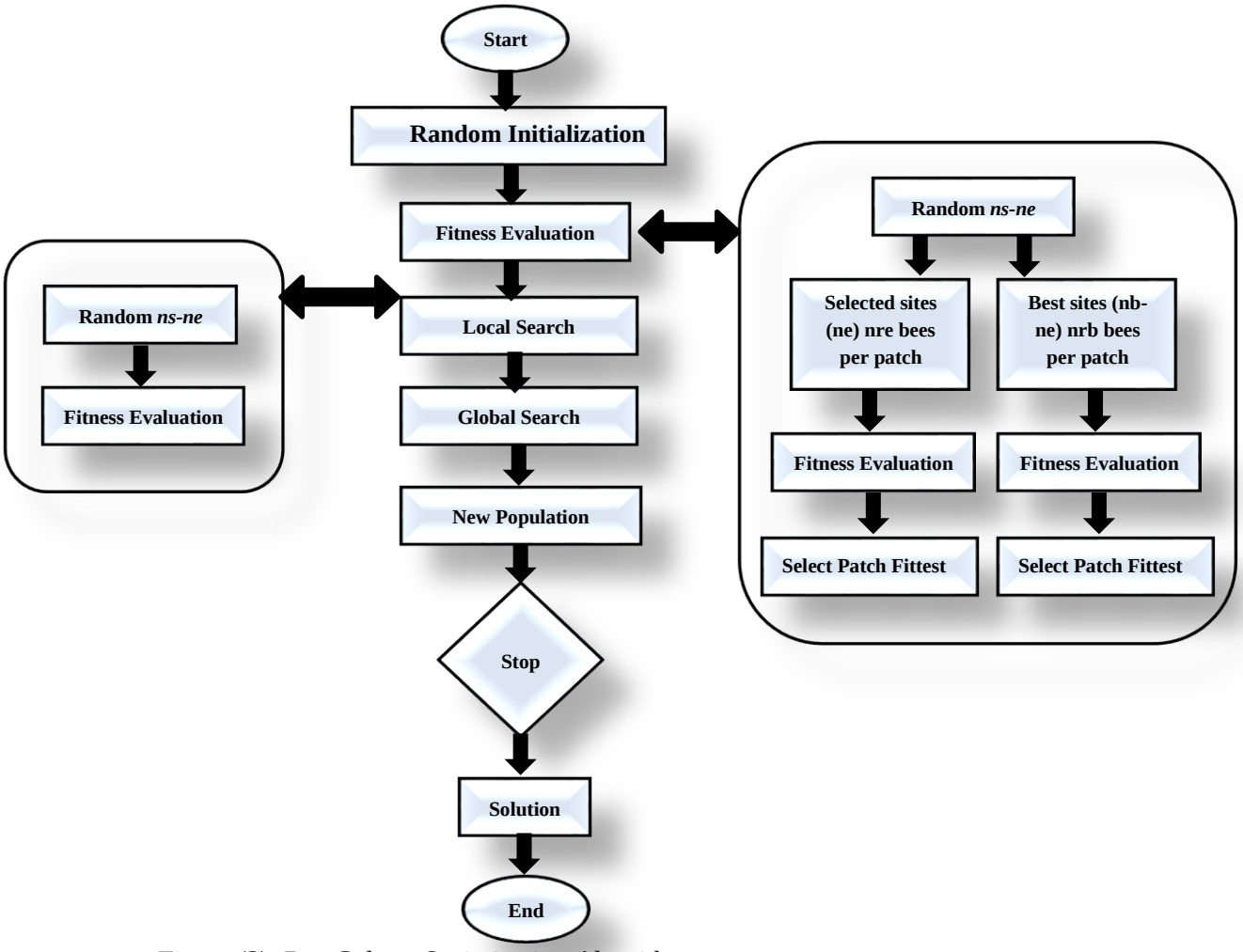


Figure (3): Bee Colony Optimization Algorithm

Proposed System

Iraqi vehicle license plates system in our article is using a combination of JavaScript 2010 and SQL Server 2008. The combination of JavaScript 2010 and SQL Server 2008 has provided two new techniques, and using both techniques result in significant advantages. Those techniques use language integrated query [17]. The first technique provides the ability to write queries and object to orientate the database directly within the JavaScript with SQL database codes. Meanwhile, the second technique provides object models which are new and powerful, in which it has new features and tools to make the databases freer [18]. Besides, cars plate's check system is also supported with JavaBeans model as well as My Eclipse 6.0 developmental environment to programming website. They are used to build dynamic parts. Also, it uses JDK compilers in order to implement dynamic pages with background information and interactive functions, and build of a complete cars plate's check system. A short description on the software and specification are shown in Table (2).

Table (2):The software involved in System.

Prototype Development Environment	
Program language	***JavaScript 2010***
Server	***Java JDK compiler***
Database	***SQL 2008 Server***
Computer Laptop	***Core i5***
Operating System	***Windows (Vista or 7) 2010***

And the database design by SQL Server 2008 because it provides various features, including:

- The SQL Server allows users to compose tables, queries, forms, reports, pages, and models.
- Tables are grids that store related information.
- Queries ask questions to the database to help locating specific information.
- It supports a variety of data formats.

Figure (4) below show the flowchart which explain the steps of our sy

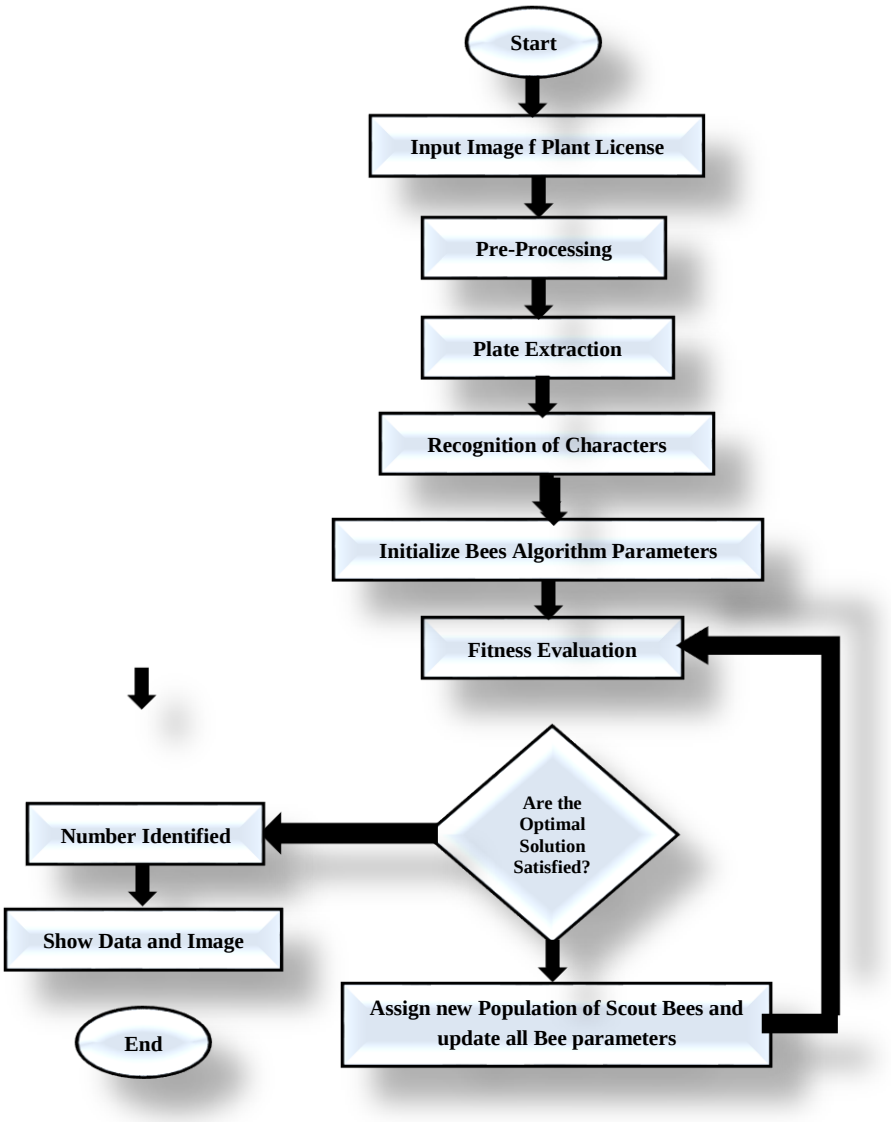


Figure (4): Architecture flowcharts.

The proposed architecture presented is designed to recognize Iraqi vehicle license plates from the front and back of the vehicle. In this system, a high resolution digital camera takes the image of a vehicle. The taken image is passed through a license plate extractor, which in turn gives its output to the segmentation stage. The segmented characters are then input to the recognition stage for the final result**.**

Image Acquisition

There are different models of Iraqi cars with old and new vehicle license plates figure (5) explain some of them since the current number of Iraqi vehicle license plate from the old number of Iraqi vehicle license plate.

Figure (5): Some different models of Iraqi cars with old and new vehicles license plate.

A standard Iraqi vehicle license plate has three levels of characters, the first level character is an Arabic characters and Indian numerals, the second level is an English capital character and numerals, the third one is an Arabic characters which represents province and the type of cars, In addition to vertical rectangle in the left side of the license plate where the State of Iraq, a common name for all cars provinces. [19]. Figure (6) shows an example of Iraqi vehicle license plate

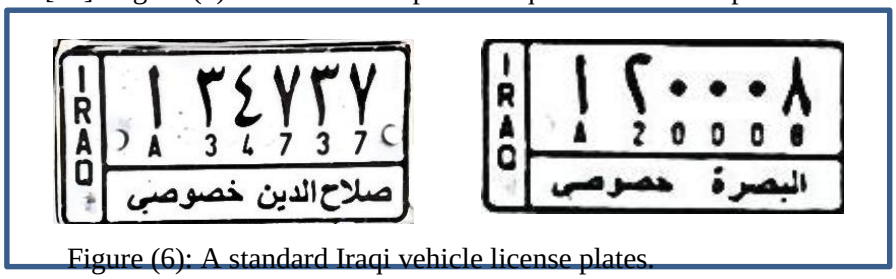


Figure (6): A standard Iraqi vehicle license plates.

Image Acquisition is the first and important phase in the License Plate Recognition (LPR) system. In our article high resolution digital camera used to get an input image of license plate. Images are taken in different Background, lighting conditions, and at various distances from the camera to vehicle License Plate as shown in Figure (7).The obtained image is first converted into gray scaled image then converted to the binary image consisting of only 1's and 0's ..The aim of gray scale image processing is to modify the three components with red, green, yellow and blue for color image Conversion to gray scale image simplifies the extraction of the license plate

Figure (7): Iraqi vehicle license plates converted into gray scaled image.

Pre-Processing Image of Licenses Plate

Preprocessing is mainly used to enhance the processing image, improve the contrast of the image and to reduce the noise in the image because any license plate recognition systems are applied in outside areas , they are affected by weather and lighting conditions, as well as the complex backgrounds. This may bring noise to the taken images. The median filtering technique is used to remove noise effectively. It often does a better work than the other filter of preservative useful detail in the image [20]. The median filter considers each pixel in the image in turn and compares with its close neighbors to decide whether or not it is characteristic of its surroundings. In the pre-processing method, firstly the gray scale image which is obtained from the previse phase, the phase pre-processing is applied to make the background of the image more clear than the gray scale image, become white. Image is divided into sub-image, each sub-image of a character or numbers is normalized into a certain size which is 20 pixels in width and 36 pixels in length.

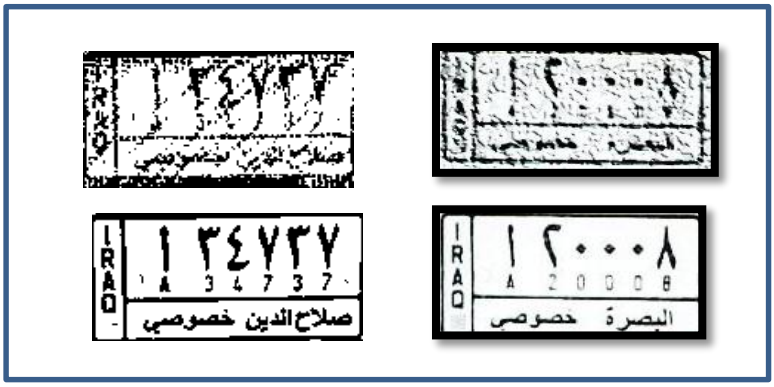


Figure (8): Iraqi vehicle license plates before and after median filtering technique

Licenses Plate extraction

Feature extraction is a key step in the character recognition. How to select features to improve effectiveness and correctness of recognition is feature extraction problem to be solved .This technique can be characterized into three sorts [21]:

- Statistical methods
- Structural methods
- Global Transformation and Series Expansion Features.

In feature extraction stage every character is allocated a feature vector to recognize it is used to differentiate the character from other characters. Our article are used Statistical methods to describe the license plate characters and the principle of "one to many", and SVM classifier with the nearest neighbor distance separation combined to achieve optimal classification performance [22].

Support Vector Machine (SVM)

SVM is a new statistical learning theory part (a linear method in a very high dimensional feature space), and it is mainly used to solve the case of a limited number of Samples pattern recognition problem[23]. The feature space is nonlinearly related to the input space. Classification is achieved by realizing a linear or non-linear separation surface in this space. Our article are applied, the vertical and horizontal histogram projection methods for character segmentation after a number plate region is extracted[24]. The number plate is segmented and the images containing individual characters (numbers and letters) forming the number plate are obtained. Each image of a character is normalized into size of 20x36. Then the support vectors are calculated directly from the normalized sub-images. The high dimensional feature vectors are stored of database, for digital numbers, Figure (9). The above feature vectors are used to train SVMs with kernel. 720 dimensional feature vectors are input

into SVMs which have been trained successfully. Then, which character a given applicant should be can be obtained in according to the outputs of SVMs. Then all digits on a number plate are recognized.

Figure (9): Samples of patterns used.

Bee Colony Optimization Algorithm (BCOA)

Bee Colony Optimization Algorithm BCOA is used to solve the parameters optimization problem for SVMs by choosing the best value for δ^2 , C, and ε the parameters of SVMs algorithm .We can summary the basic steps of the executing the Bee Colony Optimization in figure (10) which are explain the proposed algorithm's main steps:

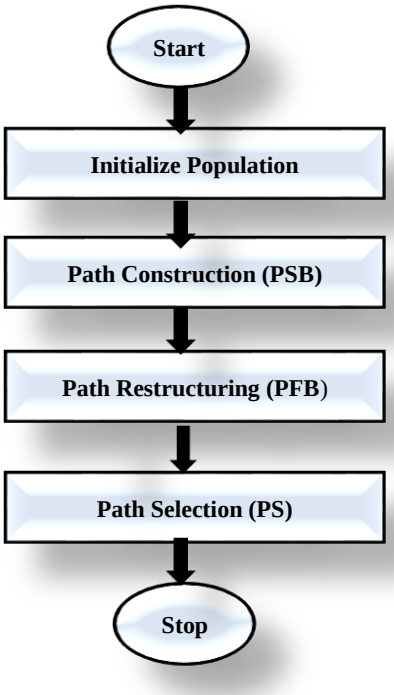
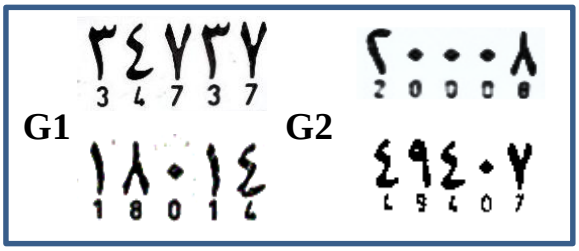


Figure (10): Basic steps of BCOA.

RESULTS AND DISCUSSION

In our article, Iraqi license plate recognition system based on new hybrid architecture (SVMs-BCOA). In order to realize a high recognition rate and accuracy of Iraqi license plate vehicle information using concealed dataset. The image processing algorithms (Acquisition, Detection, Extraction, and Recognition) that recognize each character on the plate correctly are important keys as well as the images that are high definition enough to distinguish each character. Now we are

investigating recognition of plates in Iraq with combination of the Bee colony optimization algorithm proposed in this article Support Vector Machine approach. Based on the hybrid architecture we described above, we did experiments for License plate of car park consisted of 700 samples that will be used for training. License plate of road and street containing 250 samples to test the performance of the system, numbers extracted (Indian or Arabic) from license plate of car park, License plate of road and street has 10 classes (0 to 9).The major advantages of SVMs are that each SVM has much more effectiveness when applied to sets with perfect segmentation, but the proposed algorithm has more effectiveness in order to recognize one of the tested cases and each SVM is based on firm statistical and mathematical foundations concerning generalization and optimization theory. The proposed hybrid architecture average of sensitivity at the database is greater than the SVM's. From the experimental results, it is obvious that SVMs based on BCOA perform better due to its properties described in above sections. In our article, Iraqi license plate recognition system based on SVMs with Bee Colony Optimization Algorithm BCOA is used to solve the parameters optimization problem for SVMs by choosing the best value for δ^2 , C, and ε the parameters of SVMs algorithm in order to achieve higher accuracy. The values of δ^2 ,C and ε are 0.945, 1.001, and 0.00112 which produced the best possible results according to the validation set by running the BCOA 30 times independently.. The searching ranges For δ^2, C and ε are [0 5], [0, 5], [0, 1]. Improvement can be further achieved by dividing the license plate Indian and Arabic number into G1 and G2. Figure (11(a) and (b)) presents the results for our system method and the standard SVMs. The results show our system method produced 20% better accuracy for both numbers Indian and Arabic.



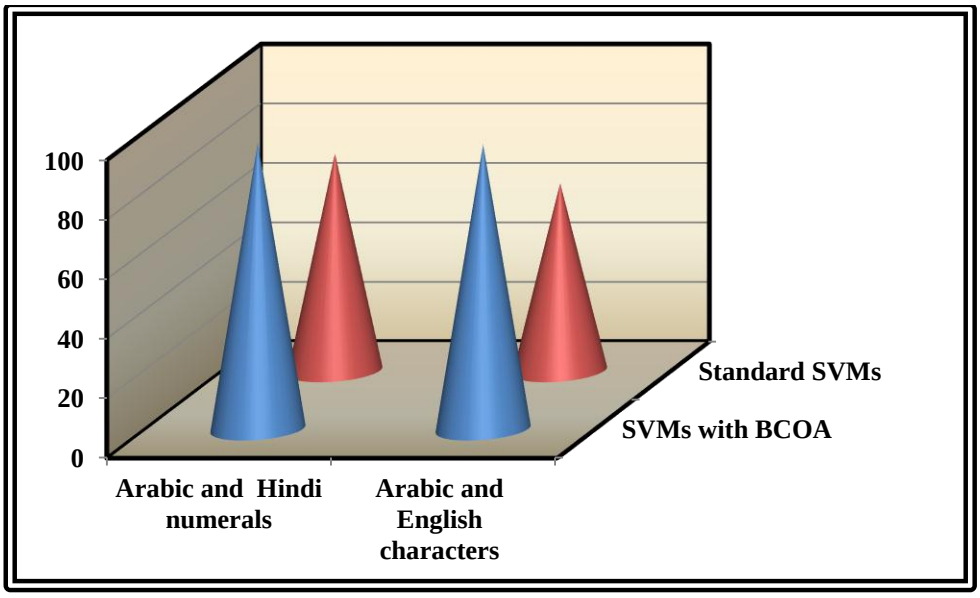


Figure (11): SVMs result with & without BCOA.

Figure (12) presents the results testing (C=correct, I=Incorrect) for our Iraqi vehicles license plate character recognition.

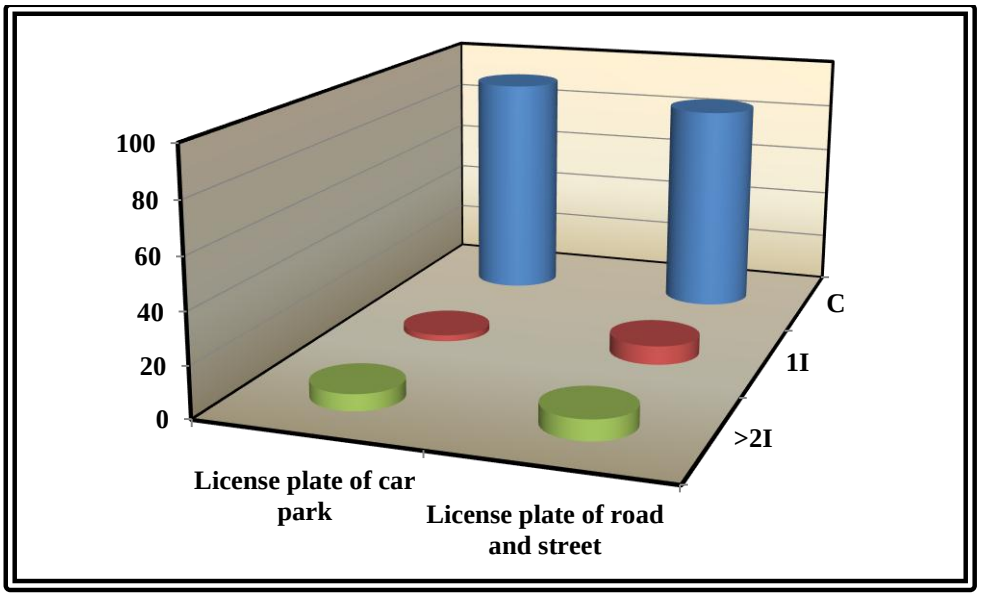


Figure (12): Testing results for SVMs with BCOA.

CONCLUSION

In this article, new hybrid architecture (SVMs-BCOA) based Support Vector Machines SVMs with Bee Colony Optimization Algorithm BCOA is used for Iraqi vehicles License Plate detection and recognition. The process of VLP recognition requires a highest degree of accuracy when we are working on a very busy park car or road and street. Our research work develops an accurate character plate detection and recognition system. The setup has been tested for Iraqi vehicles license plates containing different number plates from different Provinces. In this work we showed that their extracted features were linearly separable features over a large set of training data in a highly non-linear domain by using linear single SVM classifier**.** Experimental results show the effectiveness of license plate recognition using hybrid architecture SVMs-BCOA.

REFERENCES

[1] T. D. Duan, T. L. Hong Du, T. V. Phuoc, Hoang, N.,(2005), " Building an automatic vehicle license plate recognition system," in Proc. Int. Conf. Computer. Sci. RIVF, pp. 59–63
[2] Danian Zheng, Yannan Zhao, Jiaxin Wang,(2005), "An efficient method of license plate location", Pattern Recognition Letters (2005), Volume 26, Issue 15.
[3] Zhi-li Chen, Wei Zhao,(2008), "A fast and efficient location algorithm of dynamic vehicle license plate," machinery design & manufacture. vol.11.
[4] S. Nomura, K. Yamanaka, O. Katai, H. Kawakami, and T. Shiose,(2005), "A novel adaptive morphological approach for degraded character image segmentation," Pattern Recognition, vol. 38, no. 11.
[5] Ni-na Zhou, Min Wang and Xin-han Hang,(2003), "Pretreatment Algorithm of Auto Plate Characters' Recognition," computer engineering and applications. vol.39(15).
[6] Al Hussain Akoum and Bassam Daya ,(2010)," Automatic System Recognition of Lebanese License Plates", Lebanese University, Institute of Technology, Saida ,Lebanon.

[7] Norazhar Abu Bakar1 , Mohamad Riduwan Md Nawawi1 (2012)," Malaysian Vehicle License Plate Recognition Using Double Edge Detection",IEEE International Conference on Control System, Computing and Engineering .

[8] Shangqin Mao, Xinhan Huang and Min Wang ,(2010)," An Adaptive Method for Chinese License Plate Location", Proceedings of the 8th World Congress on Intelligent Control and Automation, chine.

[9] Yasser M. Alginahi, ,(2011), " Automatic Arabic License Plate Recognition", International Journal of Computer and Electrical Engineering, Vol. 3, No. 3.

[10] Juntanasub, R.; Sureerattanan, N.,(2005), "Car License Plate Recognition through Hausdorff Distance Technique", Tools with Artificial Intelligence,. ICTAI05. 17th IEEE International Conference on Volume, Issue, 14

[11] Abdelmalek Zidouri and Mohammed Deriche ,(2008)," recognition of Arabic license plates using NN",IEEE, Image Processing Theory, Tools & Applications.

[12] R. Huang, H. Tawfik, and A.K. Nagar,(2009),"Licence Plate Character Recognition based on Support Vector Machines with Clonal Selection and Fish Swarm Algorithms", Deanery of Business and Computer Sciences, Liverpool Hope University.

[13] Hyeran Byun1 and Seong-Whan Lee2, (2002)," Applications of Support Vector Machines for Pattern Recognition: A Survey", Korea University.

[14] Amninder Kaur* Sonika Jindal Richa Jindal, (2012)," License Plate Recognition Using Support Vector Machine (SVM) ", international journal of advanced research in computer science and software engineering.

[15] Hemant Nagpure#, Rohit Raja, (2012),"The Applications Survey on Bee Colony Optimization",(IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 3 (5).

[16] DT Pham∗ and MCastellani,(2009)," The Bees Algorithm: modeling foraging behavior to solve continuous optimization problems", Manufacturing Engineering Centre, Cardiff University, Cardiff, UK.

[17] Navdeep Koundal1, Ankur Shukla2, Mohsin Rashid Mir,(2012) ," Test Case Selection Using Bee Colony Optimization", International Journal of Science and Research (IJSR).

[18] Liang, Y. D. (2009). Introduction to Java programming: Comprehensive version, Prentice Hall.

[19] Mitrovic, A. (2003). "An intelligent SQL tutor on the web.", International Journal of Artificial ntelligence in Education 13.

[20] Yong-li Ma, Qiu-hua Xia,(2008), "Algorithmic Research of License Plate Location Based on Mathematics Morphology," control & automation. vol.24(1).

[21] Carlos A.B.Mello and Diogo C. Costa, (2009),"A Complete System for Vehicle License Plate Recognition". Polytechnic School of Pernambuco University of Pernambuco Recife, Brazil.

[22] Kim, K. I., K. Jung, Kim, J., ,(2002) "Color texture-based object detection: An application to license plate localization," in Lecture Notes on Computer Science, vol. 23 .

[23] Bai, H. -L., & Liu, C. -P. (2004)," A hybrid license plate extraction method based on edge satistics and morphology",. In Proceedings of the 17th international conference on pattern recognition, Vol. 2, Pittsburgh, Pennsylvania, USA.

[24] R. Huang, H. Tawfik, and A.K. Nagar,(2009) ,"Licence Plate Character Recognition based on Support Vector Machines with Clonal Selection and Fish Swarm Algorithms", UK Sim. 11th International Conference on Computer Modeling and Simulation