License Plate location Determination by Using Case-Based Reasoning

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Abstract

The license plate recognition system is part of the intelligent transportation system. In the intelligent transportation system, the vehicle image is used as the system input. The first step is to improve the image, after the edge detection, a series of morphological operations are performed to identify the plaque. The main purpose of this research was to increase the importance of plate recognition in unusual conditions, such as color change of the plaque, which is used to achieve this case-based reasoning adaptive power. The results showed that the proposed method has had an accuracy level of 84.5% plaque recognition and it was more accurate than the existing systems.

Keywords: license plate recognitions systems, case-based reasoning.

1. Introduction

The license plate recognition system is part of the intelligent transportation system. In the intelligent transportation system, the vehicle image is used as the system input. The first step is to improve the image, after the edge detection, a series of morphological operations are performed to identify the plaque. The main purpose of this research was to increase the importance of plate recognition in unusual conditions, such as color change of the plaque, which is used to achieve this case-based reasoning adaptive power. The results showed that the proposed method has had an accuracy level of 84.5% plaque recognition and it was more accurate than the existing systems.

There are very important and considerable issues concerning the ecological and geographical, political, economic, cultural, social, knowledge and innovation, laws and regulations (such as those concerning the installation and application of plaques), and the written form of the rules within the region or country where a person is living conditions and the functionality of the system designed to achieve a certain goal and many other parameters are required to recognize the complicatedness of the issue and the presentation of certified and appropriate algorithms seems absolutely important to recognize plaques of the automobiles. A license plate recognition system mainly consists of 3 major sections of plate recognition, isolating the elements, and the recognition of the characters. In the present research we have dealt with identifying the different methods' characteristics proposed till now to recognize plate location. Then, the

complexities and problems existing in each part would be presented and finally the case-based reasoning method would be recognized. Finally case-based reasoning would be proposed and its accuracy will be compared with morphological operations used in license plate recognition.

2. Current methods in license plate recognition

Among license plate recognition system, the recognition of plate location is highly sensitive and it is known as one of the most difficult stages of the trend. This is due to the presence of different conditions regarding imaging such as the different surroundings' light conditions, low quality of images received due to the movement of automobiles, the distance and angle of license plate from the optical axis of the camera, dirt surrounding the plate or it maybe worn out, the background is either complicated or dark. There are several different methods utilized to recognize the location of license plates on vehicles, some of which are as follows: color, edging, huff change, and the use of morphological operators.

3. The problems and complexities of license plate location recognition

The disadvantage of color-based plate location recognition methods is due to the fact that when light condition changes, the color loses its consistency and it is changed either. Colorful license plates require more time to be processed in comparison with grey level license plates. Edging is not much functional in its own because many points

outside the license plates are recognized as the edges. The advantage of such a method is its high speed. Huff change to find the lines would be beneficial when we want to recognize the plate through its sidelines. The problem with such a method is that it needs much time and high processing. Edge based methods mainly use huff change to reveal license plates. Huff change is utilized in order to locate certain figures and lines. To be able to use huff change, we should extract edges present on the whole image through one of edge recognition methods. Histogram analysis is not useful for noisy images and images through which the license plate has been revolved. Morphology operations can not be used in immediate systems because they are comparatively time consuming. Some other methods were proposed based on color data of the license plates. In such methods light conditions are very important and principal.

What is case-based reasoning?

Basically case-based reasoning is related to solving a new problem through reminding a similar previous status or through the reuse of the data and knowledge related to it.

4. Case-based problem solving

Reasoning based on previous experiences is known as a powerful and common method to solve problems by human beings. This claim can be approved through results gained from psychological research. A part of case-based method foundation deals with its reasonability regarding psychology. Lots of studies have prepared experimental proofs to approve the importance of using

previously experienced states in solving problems that human beings have had. Shank proposed a theory regarding training and reminding based on preserving experiences within a dynamic and reasoning structure. Anderson showed how human beings solve the problems when they learn if they use past states as a model.

Considering case-based reasoning, the state and conditions of a problem is known as a case. Also a previously experienced position, in a way that it has led to learning, can be reused in solving future problems and it can be known as past, previous, saved, or held status. Equally, a new or unsolved state, describes a novel problem. Case-based reasoning is basically known as a cycle approach and evolutionary way to solve the problem through which new experiences are learnt and new problems are solved.

It should be noted that the item known as problem solving is a broad concept and is related to an effort in knowledge-based systems. This means that problem solving is not necessarily a real solution for an applied problem, but it can be known as a newly proposed problem by the user. For example, approving or criticizing is known as a proposed solution by a user or it can refer to the achievement of observed data to solve the problem.

5. Case-based reasoning cycle

In the most common form, a case-based reasoning cycle can be described regarding four approaches mentioned below:

1) Case retrieval

2) Case reuse – reuse of the present data and knowledge to solve the problem

3) Case revision

4) Case retainment-learning

The cycle has been represented in the figure below:
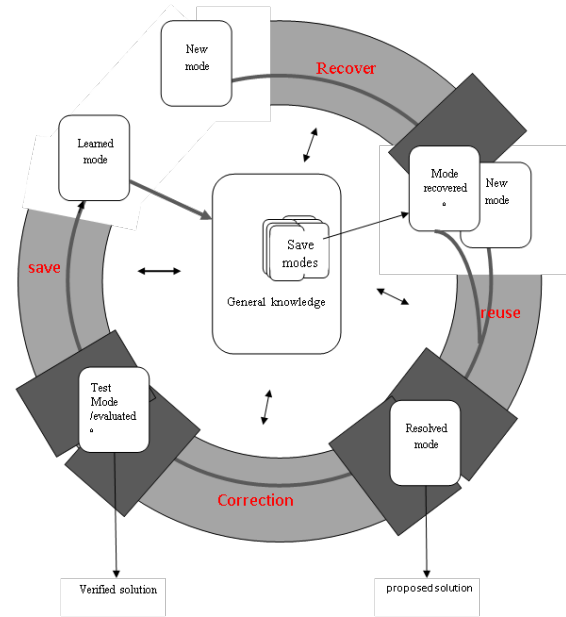

Fig.1. case-based reasoning cycle

The primary description of a problem can describe a new status. This new status is used to retrieve a state from among the past states' set. The retrieved case is integrated with the new status – within the reuse stage- and a resolved state is created.

This means that a new resolution has been proposed for the primary problem. During the revision stage, the proposed resolution is tested. For example, it is applied in real world or is assessed by a teacher and if it can not pass the test successfully, it is revised. Within the holding stage, the useful experience is kept for future uses and the

database holding the states is updated with the newly learnt state or with the revision of some parts of the states. From among the present approaches, revision is among the most important ones because the efficiency and performance of case-based reasoning system depends on states retrieved as the most similar states.

As it has been represented in the figure, the overall knowledge usually plays a role in the cycle and it supports case-based reasoning approaches. This support can be based on the type of case-based reasoning method of very weak (nothing), or very strong. Here by the overall knowledge, we mean the overall knowledge depending on the area, unlike specific knowledge present in the states. For example, in recognizing the illness of a person we use retrieval and reuse of the previous state (previous patient) to form a model of anatomy along with the causative relationships between illness states present in case-based reasoning systems. A set of regulations can perform a similar role.

6. Automatic license-plate recognition system

In automatic recognition system, the number of the license plate of a vehicle will be considered as the major goal of the recognition of automobile plaque in a real digital image to read the number and to change it into an equivalent ASCII code. One of the most important effective parameters within the realm of automobile license plate number recognition refers to the presence of standards to design plates. Usually there exist a varied set of standards all over the world, but such variety is not extremely considerable throughout the whole countries in the world.

Our proposed algorithm to produce such a system has been represented in figure 2. In producing such a system we have utilized several different techniques and tactics and some of the most important ones are known as: processing and image quality enhancement, image categorization, differentiating the forms of characters, recognition of video characters, and artificial neural networks.

The proposed algorithm consists of seven stages as follows:

1) Pre-processing and image preparation

2) Plaque location recognition

3) Studying and validating plaque candidates (using case-based reasoning)

4) Isolating the elements of the license-plate

5) Normalizing and preparing neural network inputs

6) Recognition of writing patterns by the neural network
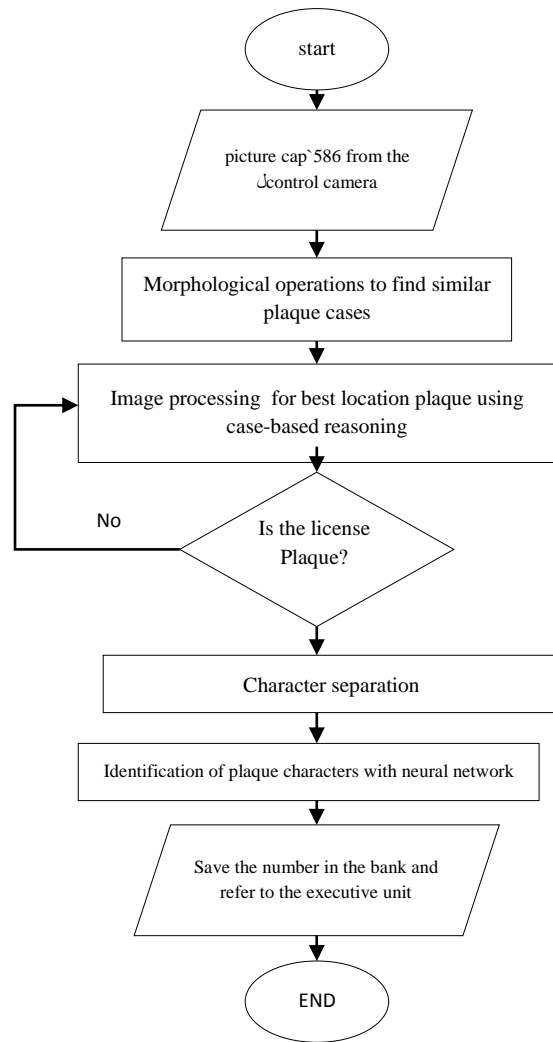
7) Post-processing and final number recognitions

start

picture cap`586 from the ل control camera

Morphological operations to find similar plaque cases

Image processing for best location plaque using case-based reasoning

Is the license Plaque?

No

Character separation

Identification of plaque characters with neural network

Save the number in the bank and refer to the executive unit

END

Fig. 2. The proposed algorithm in license-plate recognition system

7. Locating automobile license-plate through complicated images based on morphology operations

The recognition of the location of vehicle license-plate is known as the most important stage in license-plate recognition in smart transportation systems. In this part an immediate and rapid method has been introduced to locate vehicle license-plate in the images. In the proposed algorithm first we use the operator to find the vertical edges of the image. Then, using histogram analysis and a combination of morphologic operators we can extract the vehicle license-plate from the image. In this algorithm, after the enhancement of the image we can extract vertical edges through the operator. Then, using a certain algorithm we delete noisy edges related to the background and finally using a rectangular window we start a search to find the license-plate in the remaining areas. But the question is that is the identified location the real license-plate location? The size of license-plates is fixed,

therefore through the identification of the length or width of the blue ribbon along with the edges of the plates we can calculate the length and width of the total license-plate and using this information we can locate the plate in the image.

But in most cases the candidates selected for the license-plate location do not possess such characteristics or they differ from them greatly. Thus, to solve this problem we have used case-based reasoning method. The most common features of a case-based reasoning cycle can be described as the four approaches below to recognize the location of license-plates:

1) Retrieval of the most similar or the probable states for the license-plate location

2) Reuse of the information and knowledge present in the state to resolve the problem of license-plate location recognition

3) Revision of the proposed license-plate location

4) Holding the data related to the location of the recognized license-plate
   (such as the location of the license-plate in comparison with the main image) which is probably useful to resolve future problems.

Table .1. The comparison of performances of the two methods to recognize license-plate location

		correct license-plate extraction	area larger than license-plate extraction	area smaller than license-plate extraction	incorrect license-plate extraction	lack of license-plate extraction from a certain area
Number	the proposed method	338	14	22	16	10
	Number of morphology operations method	321	32	21	13	13
Percentage of recognition	the proposed method	84.5	3.5	5.5	4	2.5
	morphology operations method	80.25	8	5.25	3.25	3.25

Table .2. The comparison of processing time of the two methods to recognize license-plate location

	the proposed method	morphology operations method
processing time (milliseconds)	498	824

To achieve the practical results of the database including 400 colorful images of the vehicles have been utilized. These images are varied regarding view angle, optimal light amount, different distances, varied backgrounds. The proposed method was implemented using MATLAB software on Pentium 4 2.2GHz computer. The proposed method is compared using the vehicle license-plate location through complicated images based on morphology operations and the results were stored in

tables 1 and 2. According to the results represented in the tables below, the proposed method has had a better performance.

According to the graphs below, it can be observed that case-based reasoning method with a precision of %84.5 has had a better performance in locating vehicle license-plates and it has had %4.25 more precision in comparison with using morphology operations method.
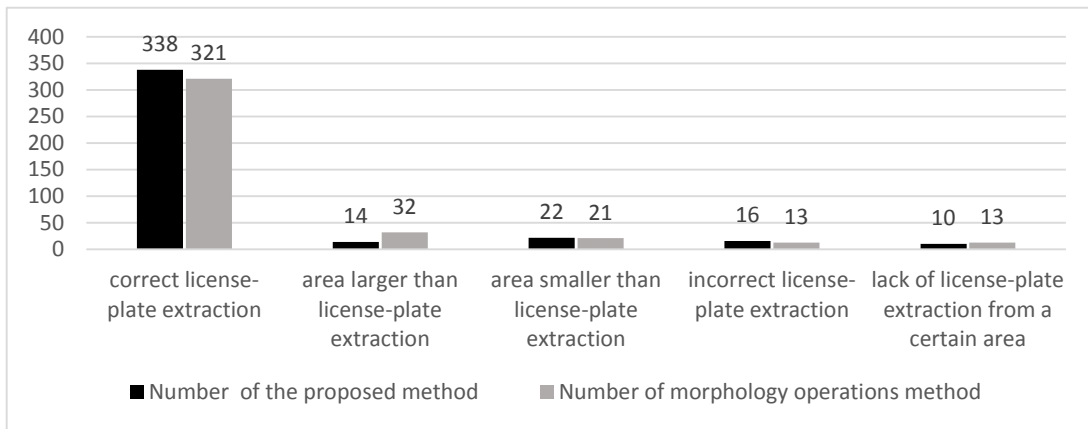

Fig. 3-1. A comparison of the performance of case-based reasoning
method and mophology operations method to recognize the location of license-plates
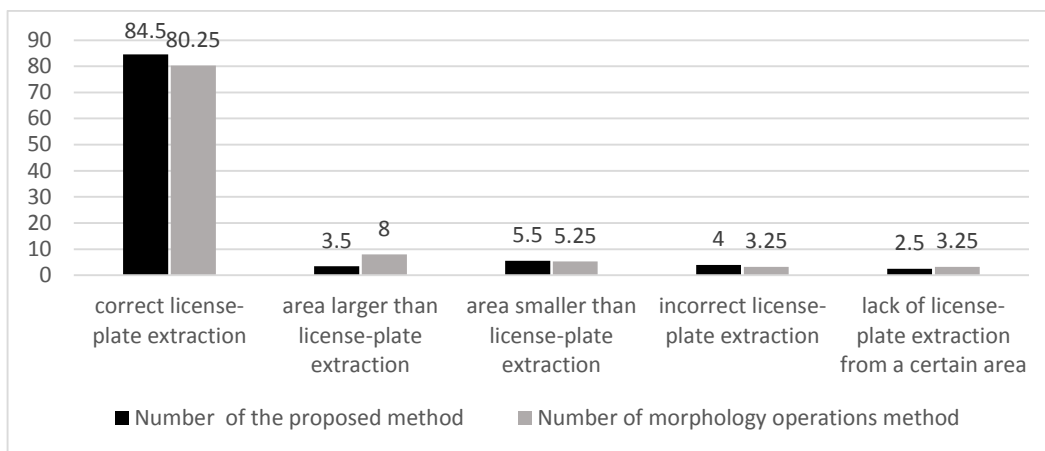

Fig.3-2. A comparison of the precision of the performance of case-based reasoning method and
mophology operations method to recognize the location of license-plates

Conclusion

The present research dealt with the specific application of vehicle recognition and a new integrative technique to recognize and identify the license-plates of the vehicles using a neural network and case-based reasoning. The image of the vehicle is used as the system input. Of course, here we have presupposed that the image quality has been appropriate and the license-plates are all new national plaques. As the first step, the image quality is enhanced. After recognizing the edges, some morphologic operations are performed to recognize the candidates for license-plate locations. Then, using case-based reasoning method, the exact location of the license-plate is identified. Case-based reasoning method has had a better performance with a precision of %84.5 than morphology operations method with %4.25 better performance than it.

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