

Optical Character Recognition Method and System in Uncontrolled & Mobile Environment

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Field of the Invention

This invention relates to a method and a system for recognizing a license plate number of a vehicle from a captured image. More particularly, this invention relates to tuning the algorithms used to determine the license plate number of a vehicle from the captured image. Still more particularly, this invention relates to an efficient method and system of tuning or adjusting the algorithms used for recognizing the license plate number of the vehicle from the captured image.

Prior Art

Automatic license plate recognition systems are widely used by law enforcement, such as the traffic police, for identifying vehicles that violate certain regulations while driving on the roads. Commonly used license plate recognition systems include a camera for capturing an image and a computer running software applications for processing the image. Typical software applications include certain algorithms such as license plate localization algorithms; orientating and scaling algorithms; contrast enhancement algorithms; character segmentation algorithms; and character recognition algorithms. These algorithms are widely known in the art.

However, as known in the art, whenever a license plate recognition system fails to identify a license plate number correctly, the parameters of one or more of these algorithms must be adjusted in order to obtain the license plate number from the captured image. Such method of tuning each of the algorithms to adjust the parameters is usually process intensive and time consuming. Hence, it would be desirable to provide an improved and more effective method of adjusting the parameters of these algorithms.

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Summary of the Invention

The above and other problems are solved and an advance in the art is made by the method and system for adjusting the algorithms of a license plate recognition system in accordance with the present invention. A first advantage of a method and system in accordance with this invention is that the system can be easily implemented in a current license plate recognition system. A second advantage of a method and system in accordance with this invention is that the system adjusts image processing algorithms to adapt to different environmental conditions during the capturing of an image. A third

advantage of a method and system in accordance with this invention is that no additional hardware is required to implement this system in a current license plate recognition system since only the software applications need to be modified or updated. A fourth advantage of a method and system in accordance with this invention is that the system greatly improves the efficiency of adjusting parameters of image processing algorithms in a license plate recognition system. A fifth advantage of a method and system in accordance with this invention is that the system is most suited for optical character recognition in uncontrolled and mobile environments such as tracking and identification of mobile vehicles for applications such as surveillance and security applications.

In accordance with embodiments of this invention, a license plate number of a vehicle is provided in the following manner. An image of said vehicle is acquired. Based on the image acquired, the system conducts license plate recognition using a number of license plate recognition algorithms to determine the license plate number of the vehicle. The license plate number is then validated. If validation of the license plate number fails, the system determines a topology of the vehicle. Based on the topology of the vehicle, the system determines a type of vehicle and assigns an estimate of an initial character of the license plate. The system then adjusts a parameter of one of the license plate recognition algorithms for conducting license plate recognition. Using the adjusted algorithm, the system conducts license plate recognition to obtain an image of the initial character of the license plate number of said vehicle. The system then compares the estimate and the image of the initial character. In response to determining the estimate and the image of said initial character match, the system updates the parameter of the adjusted algorithm.

In accordance with embodiments with this invention, the algorithms include at least one selected from the group consisting of a license plate localization algorithm, a plate orientation and scale transformation algorithm, a contrast enhancement algorithm, a character segmentation algorithm, and a character recognition algorithm.

In accordance with embodiments with this invention, the adjusting of a parameter of one of the license plate recognition algorithms for conducting license plate recognition system is provided in the following manner. The system selects a first one of the algorithms. The parameter of the selected algorithm is then changed. The system then repeats the step of obtaining an image of the initial character and comparing the estimate and the image of the initial character. The changed parameter is then updated in response to determining that the estimate and the image of the initial character match. In accordance

with some of these embodiments, the first one of the algorithms is a character recognition algorithm. The system further selects and adjusts the algorithms in the following order: character segmentation algorithm, contrast enhancement algorithm, plate orientation and scale transformation algorithm, plate localization algorithm, and image acquisition parameter algorithm.

In accordance with embodiments with this invention, the step of determining a topology of the vehicle is provided in the following manner. The system determines an outer shape of the vehicle. The length of the bonnet of the vehicle is then determined. Based on the length of the bonnet of the vehicle, the system determines the vehicle is a private vehicle responsive to the length being greater than a threshold and the vehicle is a goods vehicle responsive to the length being less than the threshold. In accordance with some of these embodiments, the system compares the outer shape of said vehicle with a record stored in a medium to determine the vehicle type.

In accordance with embodiments with this invention, the step validating is provided in the following manner. The system determines a figure based on the characters other than the initial and the last character of the license plate number. The system then verifies if the determined figure corresponds to the last character.

In accordance with embodiments with this invention, the system determines a condition of a surrounding environment and adjusts a parameter of an image capturing module based on the determined condition of the surrounding environment.

In accordance with embodiments with this invention, the system determines the type of vehicle is a taxi and assigns an estimate of a second character of the license plate. The system then conducts license plate recognition using the license plate recognition algorithms from the image to determine an image of the second character of the license plate number of the vehicle. The image of the second character and the estimate of said second character are then compared. If the image of the second character and the estimate of said second character match, the system updates the parameter of the adjusted algorithm.

Brief Description of the Drawings

The above and other features and advantages in accordance with this invention are described in the following detailed description and are shown in the following drawings:

Figure 1 illustrating an image capturing module connected to a computer system in accordance with an embodiment of this invention;

Figure 2 illustrating an exemplary processing system such as those in a computer system in accordance with an embodiment of this invention;

Figure 3 illustrating a flow diagram of a process performed by a system in the computer system to adjust the parameters of image processing algorithms of the license plate recognition system in accordance with an embodiment of this invention;

Figure 4 illustrating a flow diagram of a process performed by the system to adjust the parameter of the image capturing module in accordance with an embodiment of this invention;

Figure 5 illustrating a flow diagram of a process performed by the system to determine a license plate number of a vehicle from an image in accordance with an embodiment of this invention;

Figure 6 illustrating a flow diagram of a process performed by the system to determine a vehicle type of a vehicle in a captured image in accordance with an embodiment of this invention; and

Figure 7 illustrating a flow diagram of a process performed by the system to adjust one or more parameters of a selected algorithm in accordance with an embodiment of this invention.

Detailed Description

This invention relates to a method and a system for recognizing a license plate number of a vehicle from a captured image. More particularly, this invention relates to tuning the algorithms used to determine the license plate number of a vehicle from the captured image. Still more particularly, this invention relates to an efficient method and system of tuning or adjusting the algorithms used for recognizing the license plate number of the vehicle from the captured image.

Figure 1 illustrates an embodiment of this invention in which system 100 includes a computer system 170 and an image capturing module 150. Computer system 170 is a typical processing system such as a desktop computer, laptop computer, or other computer system that is connectable with image capturing module 150 via a conventional wire connection, a wireless connection, or any other means. Computer system 170 executes applications that perform the required processes in accordance with this invention. One skilled in the art will recognize that although only one computer system 170 is shown, any number of computer systems may be connected without departing from this invention.

Further, computer system 170 may reside at the same location of the image capturing module 150 or at a location that is remote from the image capturing module 150.

Image capturing module 150 is a typical image capturing device such as a camera that takes still images or a video camera that captures a series of images to provide a video stream of moving images. Preferably, image capturing device captures digital images. However, a conventional camera and connected system for converting conventional images to digital images may be used without departing from this invention. Image capturing module 150 is connected to computer system 170 to transmit captured images to computer system 170. As shown in figure 1, image capturing module 150 is arranged to capture an image of a vehicle 180. Image capturing module 150 is able to adaptively adjust its own parameters based on the surroundings. Alternatively, image capturing module 150 is arranged such that its parameters are controllable by the computer system 170. For example, if the surrounding is dim, the aperture will be increased and if the surrounding is bright, the aperture will be reduced. One skilled in the art will recognize that more than one image capturing module 150 may be used for capturing the vehicle 180 at different angles and the exact configurations of system 100 are a design choice left to those skilled in the art.

Figure 2 illustrates an exemplary processing system 200 that represents the processing systems in computer system 170 that execute instructions to perform the processes described below in accordance with embodiments of this invention. One skilled in the art will recognize that the instructions may be stored and/or performed as hardware, firmware, or software without departing from this invention. One skilled in the art will recognize that the exact configuration of each processing system may be different and the exact configuration executing processes in accordance with this invention may vary and processing system 200 shown in Figure 2 is provided by way of example only.

Processing system 200 includes Central Processing Unit (CPU) 205. CPU 205 is a processor, microprocessor, or any combination of processors and microprocessors that execute instructions to perform the processes in accordance with the present invention. CPU 205 connects to memory bus 210 and Input/Output (I/O) bus 215. Memory bus 210 connects CPU 205 to memories 220 and 225 to transmit data and instructions between the memories and CPU 205. I/O bus 215 connects CPU 205 to peripheral devices to transmit and receive data between CPU 205 and the peripheral devices. One skilled in the art will recognize that I/O bus 215 and memory bus 210 may be combined into one bus or

subdivided into many other busses and the exact configuration is left to those skilled in the art.

A non-volatile memory 220, such as a Read Only Memory (ROM), is connected to memory bus 210. Non-volatile memory 220 stores instructions and data needed to operate various sub-systems of processing system 200 and to boot the system at start-up. One skilled in the art will recognize that any number of types of memory may be used to perform this function.

A volatile memory 225, such as Random Access Memory (RAM), is also connected to memory bus 210. Volatile memory 225 stores the instructions and data needed by CPU 205 to perform software instructions for processes such as the processes for providing a system in accordance with this invention. One skilled in the art will recognize that any number of types of memory may be used to provide volatile memory and the exact type used is left as a design choice to those skilled in the art.

I/O device 230, keyboard 235, display 240, memory 245, network interface 250, image capturing module 150 and any number of other peripheral devices connect to I/O bus 215 to exchange data with CPU 205 for use in applications being executed by CPU 205. I/O device 230 is any device that transmits and/or receives data from CPU 205. Keyboard 235 is a specific type of I/O device that receives user input and transmits the input to CPU 205. Display 240 receives display data from CPU 205 and displays images on a screen for a user to see. Memory 245 is a device that transmits and receives data to and from CPU 205 for storing data to a media. Network interface 250 connects CPU 205 to a network for transmission of data to and from other processing systems. Network interface 250 may be any devices that connect computer system 170 to a remote station via PSTN, the Internet, WIFI, etc. Image capturing module 150 is a module that acquires and transmits motion or still images to computer system 170.

Figure 3 illustrates a flow diagram of process 300 performed by a system in computer system 170 in accordance with an embodiment of this invention. The system is provided by processes stored in software, firmware, or hardware that performs the processes described. Process 300 begins in step 310 in which an image is received from the image capturing module 150. In step 320, the captured imaged is processed to obtain the license plate number using various license plate recognition algorithms. The various license plate recognition algorithms will be described further with reference to figure 5 below.

After the license plate number is determined, verification is performed in step 330. One possible verification method is via using the last character of the license plate number as a checksum letter. For example, in Singapore, the checksum letter for a license plate number of a private vehicle is calculated in the following manner. The initial letter of the prefix "S" is excluded for a three-letter prefix. The following two letters are converted into numbers in which A=1 and Z=26. Each individual number is then assigned a fixed number (i.e. 14, 2, 12, 2, 11, 1) to be multiplied. These are then added and divided by 19. The remainder will correspond to one of the 19 letters (i.e. A, Y, U, S, P, L, J, G, D, B, Z, X, T, R, M, K, H, E, C), with "A" corresponding to a remainder of 0. For a license number plate of SBC1234X, the checksum letter (i.e. last character of the license plate number) is X. See below on how the checksum letter is derived.

S/N	Description of Steps	Workings of the steps					
1	Discard initial character and list out the remaining character	B	C	1	2	3	4
2	Assign number	2	3	1	2	3	4
3	Fixed number	14	2	12	2	11	1
4	(2) x (3)	28	6	12	4	33	4
5	Total	87					
6	Divided by 19	4 with remainder of 11					
7	Assigned last character	X (which corresponds to 11)					

One skilled in the art will recognize that other methods of verifying the authenticity of a license plate number can be used and the exact configuration is left to the skilled in the art.

In step 340, the checksum is verified. If checksum is the same as the last character of the license plate number, process 300 repeats from 310 and a next image is received from the image capturing module 150. If checksum is not the same as the last character of the license plate number, this means that the license plate number obtained at step 320 is in error and process 300 proceeds with step 350. A possible situation where the system is unable to determine the correct license number plate is where the vehicle has too many wordings on the vehicle visible in the captured image. For example, for an ambulance vehicle, the word "ambulance" is usually in front of the vehicle and above the license plate. Hence, the system may have mistakenly determined the wordings "ambulance" as the license plate number. Further, it is common that vehicles have other wordings on their

vehicles as advertisements. These further prevent the license plate recognition system from correctly identifying the license plate number.

In step 350, the vehicle type and the first initial character of license plate number of the vehicle are determined. The determination of vehicle type will be described further with reference to figure 6 below. In step 360, the processing system 170 selects one or more of the license plate recognition algorithms and adjusts parameters of the selected algorithm(s). Process 300 then updates the adjusted parameters of the selected algorithm(s) in step 370 and repeats from step 310.

Figure 4 illustrates a flow diagram of process 400 performed by a system in computer system 170 in accordance with an embodiment of this invention for controlling the image capturing module 150. Process 400 begins with determining conditions of surrounding in step 410. Some conditions of surrounding include, but not limited to, brightness and time of the day. Based on the determined conditions of the surrounding environment, process 400 adjusts the parameters of the image capturing module 150. For example, during daytime where brightness is at maximum, the aperture size of the image capturing module 150 is reduced. When night falls or amount of light is at minimum, the aperture size of the image capturing module 150 is increased. In step 420, computer system 170 transmits a signal to adjust that aperture parameter of the image capturing module 150 according to the determined conditions of the surrounding environment. Process 400 then ends. One skilled in the art will recognise that other parameters such as, but not limited to, shutter speed can also be adjusted and the exact parameters of the image capturing module 150 that are adjusted and the amount of the adjustment are left as a design choice to the skilled in the art.

Figure 5 illustrates a flow diagram of process 500 performed by the system in computer system 170 in accordance with an embodiment of this invention to perform license plate number recognition. Process 500 is an embodiment of a process for performing step 320 in process 300. Process 500 begins with license plate localization in step 510 for finding and isolating a portion of the captured image that includes the license plate. Process 500 then proceeds with step 520 for orientating the portion of the image including the license plate in a specific manner and scaling the transformation of the isolated portion. In step 530, the contrast of the portion of the image including the license plate is enhanced so that the characters appear more prominent. In step 540, the portion of the image including the license plate is segmented accordingly in order for each character

to be extracted. Process 500 then determines the characters of the license plate in step 550 before the license plate number is validated in step 330 of process 300. One skilled in the art will recognize that the above processes are widely known processes, and are therefore briefly described for brevity. Further, other algorithms for license plate number
5 recognition that are not described above may also be used. Still further, the sequence or order of the processes may be different and is left to the skilled in the art.

Figure 6 illustrates a flow diagram of process 600 performed by the system in computer system 170 to determine the type of vehicle in the image in accordance with an
10 embodiment of this invention. Process 600 is an embodiment of a process for performing step 350 in process 300. Process 600 begins with obtaining the topology of the vehicle in the captured image in step 610. One skilled in the art will recognize that there are many known methods of obtaining topology of a vehicle based on a captured image and, in accordance to some embodiments of the invention, one such method of obtaining topology
15 of the vehicle is via edge detection methodology. Based on the topology of the vehicle, the process will be able to determine the vehicle type in step 620. For example, one distinct difference between different vehicles is the length of the bonnet. A private vehicle typically has longer bonnet compared to goods vehicles. Further, identifying the width of a vehicle will be able to differentiate a vehicle over a motorcycle. In accordance with some other
20 embodiments, the dimensions of the vehicles may be used to distinguish the vehicles. In particular, it is known that heavy vehicles such as lorries and buses have much greater dimensions than private vehicles and goods vehicles. Hence, the dimension of a vehicle can be used to differentiate different types of vehicles. In accordance with some embodiments, a taxi may be differentiated from private vehicle in the following manner. A
25 taxi typically has a display unit on top of the vehicle as shown in figure 1. A software application may determine whether an image of the vehicle includes such a display unit on the top of the vehicle. If so, the vehicle may be determined to be a taxi. One skilled in the art will recognize that other distinct features may be used to determine the vehicle type and the exact methodology used is left to the skilled in the art. One skilled in the art will also
30 recognize that there are many known methods of vehicular recognition algorithms, and the above is therefore briefly described for brevity. For purposes of this discussion, topology of a vehicle may include, but is not limited to, a vehicle outline, vehicle dimension and any specific feature(s) of a vehicle in the captured image.

35 Once the vehicle type is determined, process 600 proceeds to step 630 for assigning an estimated initial character of the license plate number accordingly. For

example, in Singapore, if the vehicle is determined to be a goods vehicle, the first initial character assigned is "G". If the vehicle is determined to be a private vehicle, the first initial character assigned is "S" or "E". If the vehicle is determined to be a motorcycle, the first initial character assigned is "F". If the vehicle is determined to be a taxi, the initial characters assigned are "SH". The record of the first initial character with the associated vehicle type is stored in a medium of computer system 170. One skilled in the art will recognize that the first initial character assigned is dependent on the prefix that is allocated according to the regulation in the respective jurisdictions and the above provided is based on some of the more common vehicle types on the roads of Singapore.

Figure 7 illustrates a flow diagram of process 700 performed by the system in computer system 170 to adjust parameters of license plate recognition algorithms in accordance with an embodiment of this invention. Process 700 is an embodiment of a process for performing step 360 in process 300. Process 700 begins with step 710 in which an algorithm from one of the license plate recognition algorithms is selected. One or more parameters of the selected algorithm are then adjusted in step 720. After adjusting the parameter, the process extracts and obtains an image of the initial character of license plate in step 730. The process of extracting and obtaining the image of initial character of license plate is similar to process 320 of process 300. However, the algorithms used for such extraction of the image of initial character are only performed for the initial character. The rest of the characters will be ignored. In doing so, the amount of time for adjusting the algorithms will be greatly reduced. Thus, the system speed is greatly improved and resources of the computer system 170 are more efficiently used. One skilled in the art will recognize that if the vehicle is determined to be a taxi, process 700 may be modified to obtain the image of the initial two characters of the license plate number instead of just the initial character since the prefix of a taxi is known to be "SH".

In step 740, the estimated initial character obtained in step 630 of process 600 is compared with the image of the initial character obtained in step 730. If image of initial character matches the estimate of the initial character, process 700 proceeds to step 370 as the algorithm has been adjusted correctly. If image of the initial character does not match the estimate of the initial character, process 700 proceeds to step 760 to determine if another algorithm is available for adjusting. If another algorithm is available for adjusting, process 700 repeats from step 710 and selects another license plate recognition algorithm for adjusting. Otherwise, process 700 proceeds to step 410 of process 400 to adjust the parameter of the image capturing module 150. One skilled in the art will recognize that

modifications to the steps 730 and 740 are possible. Particularly, instead of obtaining an image of the initial character, a further process to obtain the character such as Optical Character Recognition (OCR) may be implemented. Hence, the comparison in step 740 is between two characters instead of a known character to an image of a character. One skilled in the art will recognize that if the vehicle is determined to be a taxi, process 700 may be modified to compare the image of the initial two characters of the license plate number instead of just the initial character since the prefix of a taxi is known to be "SH" in accordance with some embodiments of this invention.

The order of sequence of the selection of license plate recognition algorithms for adjusting is as follows in accordance with this described embodiment:

1. Character recognition algorithm
2. Character segmentation algorithm
3. Contrast enhancement algorithm
4. Plate orientation & scale transformation algorithm
5. Plate localization algorithm

For a character recognition algorithm, the syntax, the background, the expected character font types and the expected colour of characters can be adjusted to improve the algorithm for determining the characters of the license plate. For a character segmentation algorithm, the size of the filter, the number of times that filtering operation is performed for identifying the position of each of the characters can be adjusted. For a contrast enhancement algorithm, based on the intensity histogram distribution, the extreme bright spots which can be caused by specular highlights (strong reflection from sun lights or car headlights) can be removed. This can be done by applying an additional algorithm for filtering out the extreme bright spots appearing in the intensity histogram distribution. For a plate orientation & scale transformation algorithm, the thresholds for finding the correct left and right border of the license plate can be adjusted to more accurately retrieve the region of interest. For a plate localization algorithm, the position and size variations parameters can be adjusted so that the correct peak that corresponds to the license plate in the saliency or feature map, such as a Hough Transform Array, can be correctly identified.

One skilled in the art will recognize that the parameters to be adjusted for each of the algorithms are widely known and the above has been described briefly for brevity. Further, the number of iterations is dependent on the number of algorithms the designer of

the system so chooses. Based on historical records, the algorithm that requires the tuning more often should be tuned first. One skilled in the art will recognize the above processes are widely known processes and that each of the above processes may further include sub-processes. For example, plate localization algorithm may comprise sub-processes such as edge detection, Hough transform, etc. Hence, the above algorithms have been briefly described for brevity. Further, one skilled in the art will recognize that other algorithms for license plate number recognition that are not described above may also be used. Still further, although the above description discusses the changing of parameters of license plate recognition algorithms, one skilled in the art will recognize that such changes of parameters may also be modified to change the parameters of the sub-processes of the selected license plate recognition algorithm. One skilled in the art will also recognize that different license plate recognition systems may use different sets of license plate recognition algorithms. Hence, the exact configurations, the number of algorithms, and the order or sequence in which the algorithms and/or the respective sub-processes are selected to be adjusted are left as a design choice for the skilled in the art.

The above is a description of a manner for providing a system in a computer system for efficiently adjusting license plate recognition algorithms. It is envisioned that those skilled in the art can and will design alternative systems that infringe upon this invention as set forth in the following claims.

Claims

1. A method for determining a license plate number of a vehicle:
 - (i) acquiring an image of said vehicle;
 - 5 (ii) conducting license plate recognition using a plurality of license plate recognition algorithms to determine said license plate number of said vehicle from said image;
 - (iii) validating said license plate number;
 - (iv) determining a topology of said vehicle in response to a failure of validating of said license plate number;
 - 10 (v) determining a type of vehicle based on said topology of said vehicle;
 - (vi) assigning an estimate of an initial character of said license plate based on the determined type of vehicle;
 - (vii) adjusting a parameter of said one of said plurality of license plate recognition algorithms for conducting license plate recognition;
 - 15 (viii) conducting license plate recognition using said plurality of license plate recognition algorithms to obtain an image of said initial character of said license plate number of said vehicle;
 - (ix) comparing said estimate and said image of said initial character; and
 - (x) updating said parameter of said one of said plurality of algorithms in response to
 - 20 determining that said estimate and said image of said initial character match.
2. The method according to claim 1 wherein said step (vii) comprises:
 - selecting a first one of said plurality of algorithms;
 - changing said parameter of said selected first one of said plurality of algorithms;
 - 25 repeating steps of (viii) and (ix); and
 - updating said parameter of said first one of said plurality of algorithms in response to determining that said estimate and said image of said initial character match.
3. The method according to claim 1, wherein said plurality of algorithms include at least
30 one selected from the group consisting of a license plate localization algorithm, a plate orientation and scale transformation algorithm, a contrast enhancement algorithm, a character segmentation algorithm, and a character recognition algorithm.
4. The method according to claim 2 wherein said selected first one of said plurality of
35 algorithms is a character recognition algorithm.

5. The method according to claim 2 wherein said step (vii) comprises:
selecting a second one of said plurality of algorithms;
changing said parameter of said selected second one of said plurality of algorithms;
repeating steps of (viii) and (ix); and

5 updating said parameter of said second one of said plurality of algorithms in response to determining that said estimate and said image of said initial character match.

6. The method according to claim 5 wherein said selected second one of said plurality of algorithms is a character segmentation algorithm.

10 7. The method according to claim 6 wherein step (vii) comprises:
selecting a third one of said plurality of algorithms;
changing said parameter of said selected third one of said plurality of algorithms;
repeating steps of (viii) and (ix); and

15 updating said parameter of said third one of said plurality of algorithms in response to determining that said estimate and said image of said initial character match.

8. The method according to claim 7 wherein said selected third one of said plurality of algorithms is a contrast enhancement algorithm.

20 9. The method according to claim 8 wherein step (vii) comprises:
selecting a fourth one of said plurality of algorithms;
changing said parameter of said selected fourth one of said plurality of algorithms;
repeating steps of (viii) and (ix); and

25 updating said parameter of said fourth one of said plurality of algorithms in response to determining that said estimate and said image of said initial character match.

10. The method according to claim 9 wherein said selected fourth one of said plurality of algorithms is a plate orientation and scale transformation algorithm.

30 11. The method according to claim 10 wherein step (vii) comprises:
selecting a fifth one of said plurality of algorithms;
changing said parameter of said selected fifth one of said plurality of algorithms;
repeating steps of (viii) and (ix); and

35 updating said parameter of said fifth one of said plurality of algorithms in response to determining that said estimate and said image of said initial character match.

12. The method according to claim 11 wherein said selected fifth one of said plurality of algorithms is a plate localization algorithm.

13. The method according to claim 12 wherein step (vii) comprises:
selecting a sixth one of said plurality of algorithms;
changing said parameter of said selected sixth one of said plurality of algorithms;
repeating steps of (viii) and (ix); and
updating said parameter of said sixth one of said plurality of algorithms in response
to determining that said estimate and said image of said initial character match.

14. The method according to claim 13 wherein said selected sixth one of said plurality of algorithms is an image acquisition parameter algorithm.

15. The method according to claim 1 wherein step (iv) comprises:
determining an outer shape of said vehicle;
determining a length of a bonnet of said vehicle; and
determining said vehicle is a private vehicle responsive to said length being greater
than a threshold and said vehicle is a goods vehicle responsive to said length being less
than said threshold.

16. The method according to claim 15 wherein step (v) comprises:
comparing said outer shape of said vehicle with a record stored in a medium to
determine said vehicle type.

17. The method according to claim 1 wherein step (iii) comprises:
determining a figure based on the characters other than said initial and the last
character of said license plate number; and
verifying said determined figure corresponds to said last character.

18. The method according to claim 1 further comprising:
determining a condition of a surrounding environment; and
adjusting a parameter of an image capturing module based on said determined
condition of said surrounding environment.

19. The method according to claim 1 further comprising:

assigning an estimate of a second character of said license plate in response to determining said type of vehicle is a specific type of vehicle;

conducting license plate recognition using said plurality of license plate recognition algorithms from said image to determine an image of said second character of said license plate number of said vehicle;

comparing said image of said second character and said estimate of said second character; and

updating said parameter of said one of said plurality of algorithms in response to determining that said image of said second character and said estimate of said second character match.

20. The method according to claim 19 wherein said specific type of vehicle is a taxi.

21. A system for determining a license plate number of a vehicle:

circuitry configured to acquire an image of said vehicle;

circuitry configured to conduct license plate recognition using a plurality of license plate recognition algorithms to determine said license plate number of said vehicle from said image;

circuitry configured to validate said license plate number;

circuitry configured to determine a topology of said vehicle in response to a failure of validating of said license plate number;

circuitry configured to determine a type of vehicle based on said topology of said vehicle;

circuitry configured to assign an estimate of an initial character of said license plate based on the determined type of vehicle;

circuitry configured to adjust one of said plurality of license plate recognition algorithms for conducting license plate recognition from said image;

circuitry configured to conduct license plate recognition using said plurality of license plate recognition algorithms from said image to determine an image of said initial character of said license plate number of said vehicle;

circuitry configured to compare said image and said estimate of said initial character; and

circuitry configured to update said parameter of said one of said plurality of algorithms in response to determining that said image and said estimate of said initial character match.

22. The system according to claim 21 wherein said circuitry configured to adjust said one of said plurality of algorithms comprises:

circuitry configured to select a first one of said plurality of algorithms;

circuitry configured to change a parameter of said selected first one of said plurality of algorithms;

circuitry configured to reapply said circuitry configured to conduct license plate recognition to determine said image of said initial character, compare said image and said estimate of said initial character; and

circuitry configured to update said parameter of said selected first one of said plurality of algorithms.

23. The system according to claim 21, wherein said plurality of algorithms include at least one selected from the group consisting of a license plate localization algorithm, a plate orientation and scale transformation algorithm, a contrast enhancement algorithm, a character segmentation algorithm, and a character recognition algorithm.

24. The system according to claim 22 wherein said selected first one of said plurality of algorithms is a character recognition algorithm.

25. The system according to claim 22 wherein said circuitry configured to adjust said one of said plurality of algorithms comprises:

circuitry configured to select a second one of said plurality of algorithms;

circuitry configured to change a parameter of said selected second one of said plurality of algorithms;

circuitry configured to reapply said circuitry configured to conduct license plate recognition to determine said image of said initial character, compare said image and said estimate of said initial character; and

circuitry configured to update said parameter of said selected second one of said plurality of algorithms.

26. The system according to claim 25 wherein said selected second one of said plurality of algorithms is a character segmentation algorithm.

27. The system according to claim 26 wherein said circuitry configured to adjust said one of said plurality of algorithms comprises:

circuitry configured to select a third one of said plurality of algorithms;

circuitry configured to change a parameter of said selected third one of said plurality of algorithms;

circuitry configured to reapply said circuitry configured to conduct license plate recognition to determine said image of said initial character, compare said image and said estimate of said initial character; and

circuitry configured to update said parameter of said selected third one of said plurality of algorithms.

28. The system according to claim 27 wherein said selected third one of said plurality of algorithms is a contrast enhancement algorithm.

29. The system according to claim 28 wherein said circuitry configured to adjust said one of said plurality of algorithms comprises:

circuitry configured to select a fourth one of said plurality of algorithms;

circuitry configured to change a parameter of said selected fourth one of said plurality of algorithms;

circuitry configured to reapply said circuitry configured to conduct license plate recognition to determine said image of said initial character, compare said image and said estimate of said initial character; and

circuitry configured to update said parameter of said selected fourth one of said plurality of algorithms.

30. The system according to claim 29 wherein said selected fourth one of said plurality of algorithms is a plate orientation and scale transformation algorithm.

31. The system according to claim 30 wherein said circuitry configured to adjust said one of said plurality of algorithms comprises:

circuitry configured to select a fifth one of said plurality of algorithms;

circuitry configured to change a parameter of said selected fifth one of said plurality of algorithms;

circuitry configured to reapply said circuitry configured to conduct license plate recognition to determine said image of said initial character, compare said image and said estimate of said initial character; and

circuitry configured to update said parameter of said selected fifth one of said plurality of algorithms.

32. The system according to claim 31 wherein said selected fifth one of said plurality of algorithms is a plate localization algorithm.

33. The system according to claim 32 wherein said circuitry configured to adjust said one of said plurality of algorithms comprises:

circuitry configured to select a sixth one of said plurality of algorithms;

circuitry configured to change a parameter of said selected sixth one of said plurality of algorithms;

circuitry configured to reapply said circuitry configured to conduct license plate recognition to determine said image of said initial character, compare said image and said estimate of said initial character; and

circuitry configured to update said parameter of said selected sixth one of said plurality of algorithms.

34. The system according to claim 33 wherein said selected sixth one of said plurality of algorithms is an image acquisition parameter algorithm.

35. The system according to claim 21 wherein said circuitry configured to determine a topology of said vehicle comprises:

circuitry configured to determine an outer shape of said vehicle;

circuitry configured to determine if a specific configuration on a top of said vehicle is present; and

circuitry configured to determine said vehicle is a private vehicle responsive to said length being greater than a threshold and said vehicle is a goods vehicle responsive to said length being less than said threshold

36. The system according to claim 35 wherein said circuitry configured to determine a topology of said vehicle comprises:

circuitry configured to compare said outer shape of said vehicle with a record stored in a medium to determine said vehicle type.

37. The system according to claim 21 wherein said circuitry configured to validate said license plate number comprises:

circuitry configured to determine a figure based on the characters other than a last character of said license plate number; and

circuitry configured to verify said determined figure corresponds to said last character.

38. The system according to claim 21 further comprising:

5 circuitry configured to determine a condition of a surrounding environment; and
circuitry configured to adjusting a parameter of an image capturing module based on said determined condition of said surrounding environment.

39. The system according to claim 21 further comprising:

10 circuitry configured to assign an estimate of a second character of said license plate in response to determining said type of vehicle is a specific type of vehicle;

circuitry configured to conduct license plate recognition using said plurality of license plate recognition algorithms from said image to determine an image of said second character of said license plate number of said vehicle;

15 circuitry configured to compare said image of said second character and said estimate of said second character; and

circuitry configured to update said parameter of said one of said plurality of algorithms in response to determining that said image of said second character and said estimate of said second character match.

20 40. The system according to claim 39 wherein said specific type of vehicle is a taxi.

41. A system for determining a license plate number of a vehicle:
a processing unit;

25 instructions for directing a processing unit to:

acquire an image of said vehicle,

conduct license plate recognition using a plurality of license plate recognition algorithms to determine said license plate number of said vehicle from said image,

validate said license plate number,

30 determine a topology of said vehicle in response to a failure of validating of said license plate number,

determine a type of vehicle based on said topology of said vehicle,

assign an estimate of an initial character of said license plate based on the determined type of vehicle,

35 adjust a parameter of said one of said plurality of license plate recognition algorithms for conducting license plate recognition,

conduct license plate recognition using said plurality of license plate recognition algorithms to obtain an image of said initial character of said license plate number of said vehicle,

compare said estimate and said image of said initial character,

5 update said parameter of said one of said plurality of algorithms in response to determining that said estimate and said image of said initial character match, and a media readable by said processing unit that stores said instructions for directing said processing unit.

10 42. The system according to claim 41 wherein said instruction to adjust said one of said plurality of algorithms comprises:

instructions for directing a processing unit to:

select a first one of said plurality of algorithms;

change a parameter of said selected first one of said plurality of algorithms;

15 repeat said instructions to conduct license plate recognition to determine said image of said initial character, compare said image and said estimate of said initial character; and

update said parameter of said selected first one of said plurality of algorithms.

20 43. The system according to claim 41, wherein said plurality of algorithms include at least one selected from the group consisting of a license plate localization algorithm, a plate orientation and scale transformation algorithm, a contrast enhancement algorithm, a character segmentation algorithm, and a character recognition algorithm.

25 44. The system according to claim 42 wherein said selected first one of said plurality of algorithms is a character recognition algorithm.

45. The system according to claim 42 wherein said instruction to adjust said one of said plurality of algorithms comprises:

30 instructions for directing a processing unit to:

select a second one of said plurality of algorithms;

change a parameter of said selected second one of said plurality of algorithms;

35 repeat said instructions to conduct license plate recognition to determine said image of said initial character, compare said image and said estimate of said initial character; and

update said parameter of said selected second one of said plurality of algorithms.

46. The system according to claim 45 wherein said selected second one of said plurality of algorithms is a character segmentation algorithm.

47. The system according to claim 46 wherein said instruction to adjust said one of said plurality of algorithms comprises:

instructions for directing a processing unit to:

select a third one of said plurality of algorithms;

change a parameter of said selected third one of said plurality of algorithms;

repeat said instructions to conduct license plate recognition to determine said image of said initial character, compare said image and said estimate of said initial character; and

update said parameter of said selected third one of said plurality of algorithms.

48. The system according to claim 47 wherein said selected third one of said plurality of algorithms is a contrast enhancement algorithm.

49. The system according to claim 48 wherein said instruction to adjust said one of said plurality of algorithms comprises:

instructions for directing a processing unit to:

select a fourth one of said plurality of algorithms;

change a parameter of said selected fourth one of said plurality of algorithms;

repeat said instructions to conduct license plate recognition to determine said image of said initial character, compare said image and said estimate of said initial character; and

update said parameter of said selected fourth one of said plurality of algorithms.

50. The system according to claim 49 wherein said selected fourth one of said plurality of algorithms is a plate orientation and scale transformation algorithm.

51. The system according to claim 49 wherein said instruction to adjust said one of said plurality of algorithms comprises:

instructions for directing a processing unit to:

select a fifth one of said plurality of algorithms;

change a parameter of said selected fifth one of said plurality of algorithms;

repeat said instructions to conduct license plate recognition to determine said
5 image of said initial character, compare said image and said estimate of said initial
character; and

update said parameter of said selected fifth one of said plurality of algorithms.

52. The system according to claim 51 wherein said selected fifth one of said plurality of
10 algorithms is a plate localization algorithm.

53. The system according to claim 52 wherein said instruction to adjust said one of said
plurality of algorithms comprises:

instructions for directing a processing unit to:

15 select a sixth one of said plurality of algorithms;

change a parameter of said selected sixth one of said plurality of algorithms;

repeat said instructions to conduct license plate recognition to determine said
image of said initial character, compare said image and said estimate of said initial
character; and

20 update said parameter of said selected sixth one of said plurality of
algorithms.

54. The system according to claim 53 wherein said selected sixth one of said plurality of
algorithms is an image acquisition parameter algorithm.

55. The system according to claim 41 wherein said instruction to determine a topology
of said vehicle comprises:

instructions for directing said processing unit to:

determine an outer shape of said vehicle,

30 determine if a specific configuration on a top of said vehicle is present, and

determine said vehicle is a private vehicle responsive to said length being
greater than a threshold and said vehicle is a goods vehicle responsive to said
length being less than said threshold.

56. The system according to claim 55 wherein said instruction to determine a topology
of said vehicle comprises instruction for directing said processing unit to:

compare said outer shape of said vehicle with a record stored in a medium to determine said vehicle type.

57. The system according to claim 41 wherein said instruction to validate said license plate number comprises instructions for direction said processing unit to:

determine a figure based on the characters other than a last character of said license plate number; and

verify said determined figure corresponds to said last character.

58. The system according to claim 41 further comprising instructions for direction said processing unit to:

determine a condition of a surrounding environment; and

adjusting a parameter of an image capturing module based on said determined condition of said surrounding environment.

59. The system according to claim 41 further comprising instructions for direction said processing unit to:

assign an estimate of a second character of said license plate in response to determining said type of vehicle is a specific type of vehicle;

conduct license plate recognition using said plurality of license plate recognition algorithms from said image to determine an image of said second character of said license plate number of said vehicle;

compare said image of said second character and said estimate of said second character; and

update said parameter of said one of said plurality of algorithms in response to determining that said image of said second character and said estimate of said second character match.

60. The system according to claim 59 wherein said specific type of vehicle is a taxi.