TECHNOLOGY USED IN LPR

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History of license plate recognition

England has the highest CCTV camera deployment rate per government municipality and commercial enterprise, with estimated calculations showing nearly five million CCTV cameras currently in use. Not surprisingly, license plate recognition has its roots in the UK. The British Police Scientific Development Branch first invented License Plate Recognition Technology in 1976. Earlier prototypes were premature with low accuracy readings and only functioned under restrictive laboratory conditions that made real world application nearly impractical.

An Overview of LPR

LPR systems generally consist of a high speed camera with an infrared ("IR") filter or two cameras—one high resolution digital camera and one IR camera—to capture images of license plates; a processor and application capable of performing sophisticated optical character recognition (OCR) to transform the image of the plate into alphanumeric characters; application software to compare the transformed license plate characters to databases of license plates of interest; and a user interface to display the images captured, the results of the OCR transformation, and an alert capability to notify operators when a plate matching an agency's "hot list" is observed. The precise configuration of LPR systems varies depending on the manufacturer of the equipment and the specific operational deployment. LPR systems are able to capture up to 1,800 plates per minute at speeds up to 120-160 miles per hour. Systems range in cost from $10,000 - $22,000, depending on the manufacturer and the specific configuration specified.

Cameras

Camera hardware is significant to the front-end component of any LPR system. Since the initial image capture forms a critically important part of the LPR system and will often determine the overall performance, ALPR systems typically use still or video cameras specialized for the task. Currently, many of the LPR systems include a set of high resolution digital and IR illuminated cameras which allow the LPR system to capture images under a variety of light and weather conditions.

Figure 1 – Examples of Trunk and Lightbar Mounted Mobile LPR Cameras

User Interface

In vehicle-mounted LPR systems, captured images are displayed on a user interface—either a dedicated computer for the LPR system, or use of the in-field computer already installed in the police vehicle—so the officer can be alerted when a vehicle on one of the hot lists has been observed in the vicinity of the officer.

Figure 2 – An Example of LPR User Interface

The user interface allows the officer to compare the LPR OCR interpretation of the license plate number to ensure the accuracy of the "read," and to see the larger, contextual image to help the officer in identifying which specific vehicle has the plate of interest. In addition, the user interface also typically enables the officer to manually enter plates on vehicles of interest, manage hot list information, deal with alert queues, and run reports.

Software

As vehicles pass through the field of view of the LPR camera a picture is taken of license plate and the vehicle. A series of algorithms are performed on the image to isolate the plate and render the alphanumeric characters into an electronically readable format. The sophistication and complexity of each of these algorithms determines the accuracy of the system.

There are six primary algorithms that the software requires for identifying a license plate:

1. Plate localization – Finding and isolating the plate on the picture
2. Plate orientation and sizing – Compensates for the skew of the plate and adjusts the dimensions to the required size
3. Normalization – Adjusts the brightness and contrast of the image
4. Character segmentation – Finds the individual characters on the plates
5. Optical character recognition (OCR) – Translation of images of text into an electronically readable format

6. Syntactical/Geometrical analysis – Check characters and positions against state-specific rules to identify the state of issuance for the license plate.

Algorithm Technology

Perhaps the core dependence of any License Plate Recognition system is the effectiveness of its algorithms. The algorithms are quite meticulous and typically require hundreds of thousands lines of software code to compensate for such complexities. Large mathematical models are constructed and computer modeling may be done using super computer systems to account for multiple scenarios. As a whole, a series of six primary algorithms are necessary for a License Plate Recognition system to be successful.

License Plate Localization

Localizing is an algorithmic function that determines what aspect of the vehicle's image is the license plate.

Localization – Locating identifying a license plate

This variance can further compound the complexity for an algorithm to ascertain what area of a vehicle constitutes a license plate and what area is not. For example, the algorithm must rule out a vehicle's mirror, grill, headlight, bumper, sticker, etc. In general, algorithms look for geometric shapes of rectangular proportion. However, since a vehicle can have many rectangular objects on it, further algorithms are needed to validate that the identified object is indeed a license plate. To accomplish this, key components of the algorithm look for characteristics that would indicate that the object is a license plate. The algorithm searches for a similar background color of unified proportion and contrast as a means to differentiate objects on a vehicle.

Figure 3 – Getting potential plate location

Figure 4 – Identifying the License plate

License Plate Sizing and Orientation

Components of algorithms that adjust for the angular skew of the license plate image to accurately sample, correct, and proportionally recalculate to an optimal size.

Figure 5 – Getting the license number in the right order

Normalization

Algorithm for regulating the contrast and brightness of the captured license plate image.

Figure 6 – Creating a color and brightness balance

Character segmentation

Algorithm that locates the separate alpha numeric characters on a license plate

Figure 7 – Character seperation

Algorithms also look for characters of equal color and equidistance, with similar font structures to break apart each individual character. This sequential congruency of the characters embodies a characteristic set that is typically uniform, regardless of the type of license plate. Character Segmentation separates each letter or number where it is subsequently processed by optical character recognition(OCR) algorithms.

Figure 8 – Picture to character conversion

Optical character recognition (OCR)

Algorithm for Translating the captured image into an alpha numeric text entry.

Figure 9 – Steps of character recognition

Syntactical/Geometrical analysis

Algorithm to verify alpha numeric information and arrangement with a specific rule set. The algorithms operate sequentially with instructions being executed in milliseconds. The successful completion of each algorithm is required before subsequent algorithms can be operational.

Figure 10 – Final stage after realization

Список использованных источников

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