V-Metrics White Paper

Introduction

V-Metrics is software designed to perform vehicle recognition[1] from digital images. Vehicle recognition uses characteristics of a car, sport-utility vehicle, van, truck, golf cart or other conveyance to create an indexed database of vehicles, and to initiate the appropriate action as defined by the business rules of the application. V-Metrics is designed to accomplish this under real-world conditions, with no special environmental engineering or lighting and with very little setup or configuration. V-Metrics uses characteristics of the vehicle beyond the license plate, which introduces several powerful features and benefits that have been unavailable to date in the area of vehicle recognition and license plate reading. These new capabilities alleviate many of the difficulties inherent in using mere license plate recognition to reliably identify vehicles, including:

1. Partially occluded plates
2. License plate masking devices
3. Difficulties due to lighting and weather conditions
4. Interoperability with other security systems
5. Stolen plate detection
6. Reliability across different license plate fonts and character groups

LPR – Current state

The technology for systems that attempt to automatically read license plates is still in a very early stage. There are three main technological challenges that face the industry:

1. Finding the plate: The first challenge for this technology is to automatically recognize that there is a vehicle in the video image and to select the most favorable shot from which to identify the vehicle. This is especially difficult if the vehicle is moving rapidly since clarity and lighting directly affect the ability to correctly read the plate. In addition to selecting the correct image to use, the technology must reliably find the license plate in the image. It needs to differentiate license plates from other objects on the vehicle that may be rectangular in shape such as tail-lights or bumper stickers.

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[1] "License plate recognition" or "LPR" is a subset of vehicle recognition that uses only the license plate characteristics of the vehicle to perform vehicle recognition.

2. Reading the plate: Particularly in the US market, this is no easy task. Every state has different types of license plates using different fonts, different character spacing, different production technology and different rulesets. In order to scale, the technology must be able to account for this in a reliable way, especially in areas such as Las Vegas, where vehicles from many different states will be presented to the same system.
3. Lighting and Weather: These systems need to operate during both night time and day time, in varying lighting and weather conditions. It is not trivial to train a system to operate the same way in different lighting and weather conditions. Many LPR vendors have resorted to requiring complex, expensive environmental engineering to stabilize the image the system receives.

The leading systems in this area operate almost exclusively in the European market where license plates throughout the region share identical shape, color, font and vehicle placement characteristics, and the systems impose environmental engineering constraints. V-Metrics addresses the demanding US market where states may have 25 or more different types of license plates.

Many European vendors have attempted to gain access to the US marketplace with little success. The technical problem of reading license plates that are non-standard in size, font and color cannot be accomplished using the base technology developed to read standardize plates.

The other factor that has slowed the advance and acceptance of ANPR[2]/LPR technology is that it is inherently inaccurate. In the US, a certain number of plates cannot be read because the plates are partially or fully occluded by objects such as trailer hitches. In addition, since there is no standardization of either plate characters used, fonts or rules for creating plates, character recognition algorithms have difficulty differentiating between certain characters, such as (8, B) and (O,0 and D). As processing power increases and video image capture technology improves, the success rate will improve, yet it will never be perfect.

Finally, license plates are nothing more then security tokens, affixed to or carried on the vehicle. Tokens are inherently insecure unless they have other confirming information. Tokens can be lost, stolen, duplicated or shared.

V-Metrics attempts to address both of these issues by performing true vehicle recognition. V-Metrics reads the license plate and performs LPR, but only as part of the process of vehicle identification. V-Metrics matches the license plate to the shape and color of the vehicle. This provides greater surety that it is the vehicle that is being granted access, not just the plate, and provides a significant percentage increase in vehicle recognition since partially occluded plates, matched to the correct shape and color of vehicle, can be granted access with a greater level of security. V-Metrics, by gathering

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[2] "ANPR" stands for "Automatic Number Plate Reading", the European phrasing for LPR.

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and indexing shape and color data, also enables users of the system to query on vehicle color and car, and not merely on license plate numbers.

V-Metrics Operation

Surveillance Mode

V-Metrics can be used in surveillance mode to find vehicles of interest in images presented to the system. In surveillance mode, V-Metrics performs vehicle recognition and sends an appropriate alarm, in real time, when a vehicle of interest is recognized. In addition, V-Metrics also creates a log of every vehicle that passes that can be searched later for investigative purposes.

Surveillance mode has a wide array of potential applications.

1. Stolen Vehicle Interdiction: V-Metrics can be placed near the side of a road and can automatically read the plates of passing vehicles. When a vehicle on the NCIC stolen vehicle list passes, V-Metrics sounds an alarm and provides both the color and infrared image of the vehicle to the officer for verification.
2. Premises Security: Lists of vehicles of interest can be created and placed in categories within the V-Metrics database. When those vehicles are recognized, alarms are created.   Alarms can be set up to do different things by each category of suspects. For instance, a stolen vehicle may sound an immediate audible alarm, store the image, and send the image to an investigator's PDA or computer. In a retail environment, a security guard may be notified to watch for a shoplifter whose image is associated with a vehicle.
3. Gate Security Enhancement: Most gate systems are operated through some kind of token, frequently RFID or card technology. Unfortunately, most of these systems are more a convenience application then a security application. V-Metrics can turn these convenience applications into security applications by automatically matching the vehicle shape, color and license plate to the RFID tag or card ID that is passing the camera to verify the identify of the entire vehicle, and to provide investigative data.
4. Investigative Management: In many cases, if an event occurs, it would be very useful to be able to search back through the database to see if the vehicle that was involved in the event has been near the site. In addition, while complete license plates are rarely remembered by witnesses, color and make of the vehicle along with a partial plate often is. The V-Metrics database can be searched by a combination of these parameters to help investigators locate a suspect vehicle.

Access Control Mode

V-Metrics can operate the same way in an access control mode. The major difference is that for access control, a much higher degree of accuracy is required to validate the identity of a vehicle and the system must usually interface with a gate control system of some kind. Additionally, a profiled group of vehicles to be admitted must be created and stored.

To achieve the level of accuracy required for access control the following additional requirements must be fulfilled:

1. Vehicle must be registered with the system by allowing the system to generate reference images of the vehicle and associating the reference images with the access control list. This process can be performed automatically over a couple of weeks or manually by having each car pass in front of the cameras to be registered.
2. V-Metrics must be installed with both a color and infrared camera.
3. The level of accuracy required, or degree of certainty to be maintained, needs to be configured by the end-user.

System Specification

The V-Metrics system consists of cameras, a computer and software. The software can receive images from the Internet or from a digital video recorder, also. For surveillance purposes, V-Metrics can use an infrared camera, a color camera or both. For access control, an infrared and a color camera are required.

Cameras can be connected to the computer's capture cards via any standard connection (twisted pair, coaxial cable or fiber).

V-Metrics can support either fixed or portable cameras. The setup and configuration process is fairly simple.

1. Determine the type of shot that will be taken. V-Metrics supports both front plate and back plate shots.
2. Point the camera at the lane that is to be recorded.
3. Use the software to select the area in the shot where you believe the back or the front of the vehicle will be in view.
4. Begin operation.

V-Metrics automatically configures itself to the current lighting and weather conditions and will continue to adjust its configuration as required by the external conditions.

V-Metrics can be integrated with most existing applications through standardized SOAP interfaces or through a programmatic API.   The underlying software is componentized and can be distributed throughout a network for performance or security reasons. V-Metrics can accept digital video or images directly through a video card, over an IP network or from video that is stored in industry accepted formats.

Conclusion

V-Metrics is a powerful, accurate and flexible Vehicle Recognition System that was designed from the ground up for use in North America. Active Recognition Systems, Inc., the owner and creator of V-Metrics, sells the software through reseller partners to be imbedded into their applications or with their hardware solutions. Comtact i-Cube for more info.

The capabilities of V-Metrics mean that US customers can purchase powerful, flexible vehicle and license-plate recognition systems for the first time.

ABOUT ACTIVE RECOGNITION TECHNOLOGIES ➤

Formed in July 2003, Active Recognition Technologies' (ART) mission is to become a leader in security enhancement by creating smart systems using its license plate, vehicle and object recognition software.

Seeing the need in the North American market for a reliable product, ART refined general purpose object recognition software into a product focused on license plate and vehicle recognition. ART has proven that its patented software works through initial installations in a major Las Vegas casino, parking garages in Texas and trials of a mobile unit with the National Insurance Crime Bureau.

ART's strategy is to license their software technology to other software companies and hardware manufacturers to resell through their own channel networks. These reseller partners can utilize the product as it exists, or customize it and brand it as their own product line. I-CUBE represents Africa.

Individual partners target a wide variety of industries, with initial interest and success arriving from access control and surveillance for parking garages and gated communities markets. Additional markets include stolen car recovery, interstate traffic (e.g. Amber alert), automated law enforcement, and retail opportunities such as demographic data collection and liability control. Long term opportunities of the underlying object recognition software include airport screening, freight container recognition, behavioral recognition, people or car counting and video search engine.