Automatic Number Plate Recognition (ANPR)

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Introduction

- Automatic number-plate recognition (ANPR) is a technology that uses digital image processing to recognize and store license plate numbers as data.
- ANPR has become a staple in modern tolling in not only the United States, but most countries around the world. Most other countries also use these for speed limit enforcement.
- Some cameras and programs will also save the pictures of the car or driver in addition to the license plate.
- It is also used for electronic toll collection on pay-per-use roads and as a method of analyzing traffic patterns,by highways agencies or other curious people.

- Automatic number plate recognition can be used to store any pictures captured by the special cameras used as well as the text from the license plate after being converted from picture to raw data. In addition, systems usually use infrared lighting to allow the camera to take a picture at any time of day. ANPR technology must also take into account plate variations from place to place.
- Some countries use “Average Speed Cameras”. This works by tracking vehicles' travel time between two fixed points, and calculating the average speed. These cameras are claimed to have an advantage over traditional speed cameras in maintaining steady legal speeds over extended distances, rather than encouraging heavy braking on approach to specific camera locations and subsequent acceleration back to illegal speed.

Algorithms

- Uses Line detection and de-blurring to form a proper image, and adds contrast to easily distinguish the characters on the plate
- Plate Localization – responsible for finding and isolating the plate on the picture
- Plate Orientation and Sizing – compensates for the skew of the plate and adjusts the dimensions to the required size

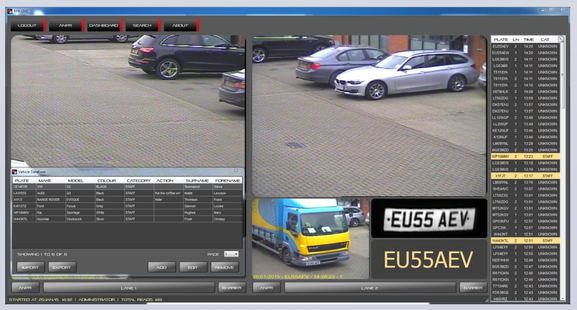
- Normalization – adjusts the brightness and contrast of the image
- Character Segmentation – finds the individual characters on the plates.
- Optical Character Recognition - Takes images of license numbers and converts it to computer-readable data
- Syntactical/Geometrical analysis – check characters and positions against country-specific rules.

- Algorithms must be able to compensate for all the variables that can affect the ANPR's ability to produce an accurate read, such as time of day, weather and angles between the cameras and the license plates.
- Infrared sensors are often used so that the algorithms are effective in any time of day or weather condition.

Difficulties

- Early ANPR systems were unable to read certain colored letterings on top of certain colored backgrounds on a plate
- Poor file resolution, due to the license plate being too far away or the use of a low-quality camera.
- Blurry images, specifically motion blur but could also come from intense winds moving the structure the camera is on.

- Poor lighting or low contrast which can result from reflections or shadows.
- An object obscuring the plate such as truck nuts, a tow bar, etc.
- Reading license plates that are different at the front and the back because of towed trailers, campers, etc.
- Vehicle lane change in the camera's angle of view during license plate reading.
- Certain vanity plates may also disrupt the reading, but most commonly are banned.
- Lack of coordination between countries or states. Two cars from different countries or states can have the same number but different design of the plate.



Hardware

- A camera that makes use of active infrared imaging (with a normal colour filter over the lens and an infrared illuminator next to it) benefits greatly from this as the infrared waves are reflected back from the plate.

- To avoid blurring it is ideal to have the shutter speed of a dedicated camera set to 1/1000 of a second. It is also important that the camera uses a global shutter, as opposed to rolling shutter, to ensure that the taken images are distortion-free.

- License plate capture cameras can produce usable images from vehicles traveling at up to 120 mph (190 km/h).

Conclusion

- ANPR has become a staple for modern day tolling, law enforcement, and traffic monitoring.

- With technology only progressing further, these systems will become more accurate and trustworthy.

- Some difficulties with ANPR may always be present until a new form of technology is adapted, such as possibly a computer chip in every car used for tolling, speed regulation, or more.

Lietrature Cited

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