Project Proposal

Vehicle License Plate Recognition

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1.   Research Background and Motivation

Vehicle License Plate Recognition (VLPR) is an image Recognition technology that automatically locates the License Plate area and extracts License Plate information from one or a series of digital images. VLPR, based on digital image processing, pattern recognition, and computer vision, is an essential part of the modern intelligent transportation system. This technology is widely used in daily life, including parking fee management, vehicle access management, automatic release, traffic flow control measurement, auto theft, highway speed supervision, electronic police, highway toll booths, and so on.

Commonly used VLPR systems usually include vehicle detection, image acquisition, and license plate recognition. Its hardware base includes trigger equipment (such as ground sensor coil, infrared ray), camera equipment, lighting equipment, image acquisition equipment, processing machine (such as computers) for recognizing license plate numbers, etc. The core of the software includes license plate location algorithms, character segmentation algorithms, and optical character recognition algorithm. Its basic principle is that when the vehicle arrives, the vehicle detection part triggers the image acquisition unit to collect the current video image. The license plate recognition unit processes the image, locates the license plate position, and then divides and recognizes the characters in the license plate to generate license plate information output. The design and implementation of VLPR can provide an in-depth understanding of various image processing technologies.

2.   Methodology

Localization
License plate localization is the process through which license plate areas extract from images. This stage includes three steps: image preprocessing, extraction of possible license plate areas, and filtering of non-license plate areas. Since license plates may be anywhere in images, in order to reduce the computation, the area where license plates may exist needs to be obtained through the feature. There are some feature extraction algorithms that can be applied, such as Hough transform, Connected Component Analysis, and Haar-like features. According to the different features extracted, the license plate locating methods are different. Boundary features, texture features, or character features are commonly used.

Segmentation
Once the exact image of license plates is extracted, the next step is to segment this

image into several pieces character by character in order for the process of character recognition which will implement next. As the license plate image could inevitably have problems of tilt, uneven lighting, and containing useless background, preprocessing is needed to improve the success rate of character segmentation. In general, character segmentation in license plate areas is based on binary images. In order to overcome the problem of weak threshold processing effects caused by uneven illumination, image enhancement algorithm and adaptive algorithm are widely used. The typical image enhancement methods include low-pass filtering, histogram equalization, and contrast enhancement. The background area contained in the binary image can be removed by projection analysis and changing the value of gray-level in the horizontal direction.

Recognition

Character recognition is the process of converting segmented character images into license plate Numbers. Recognition methods can be divided into two types: based on raw data and based on classifiers. Common algorithms for analyzing raw data include template matching, Mahalanobis distance, Bayes estimator, Hausdorff distance, and Hamming distance. Generally, for binary image sets with fixed size and font as well as no broken or distorted characters, simple template matching can achieve good recognition results. As for classifier-based recognition, common methods are mostly based on machine learning, such as support vector machine, Adaboost, artificial neural network, hidden Markov model and so on. In recent years, the method of machine learning has been well applied to license plate recognition. Compared to traditional classifiers, new classifiers represented by convolutional neural network can directly take pictures as input and automatically extract data features by training feature extraction layer, thus eliminating the need to define features manually.

3. References

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