Character Recognition for Surveillance Involving Vehicle License Plates Using Image Processing and Machine Learning

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Optical character recognition (OCR) is studied for detecting objects or characters with machine learning and image processing. Image processing is the system to apply OCR by using tools to select useful information from the image. In this research project, a program takes an image and gets a character as an output related to that image. The project's idea is license plate character recognition (LPCR) to solve unusual activities such as stolen property, trespassing, hit and run cases, and other general violations of traffic rules. These activities can pose safety risk and have the potential to go unaccounted. Each state in the United States has a unique vehicle license plate format. These formats are periodically changing which can lead to license plate variation and as the environment changes, the plates' interpretation can be affected by poor image quality. Slowly, technology has created LPCR, which helps to minimize those unusual activities. The proposed project uses image processing to recognize the license plate and detect the plate's characters, which can identify violators. Promising outcomes have been gotten in the research with license plates, including the images of low quality. Also, the utilization of OCR has been considered with an accuracy rate of 90 percent.

It is using OCR that we can identify the characters of license plates entering areas of homes, businesses, and organizations. Duties that involve surveillance of license plate numbers can benefit from OCR. Here, the task is to recognize the text that is contained in an image and apply segmentation and feature extraction. A program of OCR is to categorize a character of alphabets and letters to develop and measure real results to find out how accurate the algorithm is in the OCR program. Also, the use of LPCR, which deals with unclear, small font, thicker font, tilted, and other hard to read plates. The method to detect vehicle license plate character as a representation of vehicle presence in an image to get the high-accuracy results.

An actual method that I used is machine learning, OCR, and artificial intelligence to read the image correctly for image processing. I also used Python as the main programming language while OpenCV and Scikit-learn pre-libraries were used to implement the k-nearest neighbor algorithm**.** This proposed method takes an image and applies the Gaussian thresholding technique, which returns a binarized version of the image. Binarized version images can be used as input for LPCR. Another part is applying contours for edge detection and reduction of noise. This part involves filtering contours that do not resemble license plates. It is easier to get accurate results to detect the license plate and run more efficiently by filtering unnecessary noise. Contours are filtered based on character features for the character's segmentation in the license plate and extract a region of interest. Once we are done with the image processing, we are ready to feed the image into a learning model, which gives us a character prediction. I used the K-nearest neighbor algorithm, which is efficient with hyper-parameter tuning for optimization.

Results for this project are derived from a set of images taken under various conditions. The conditions may range from clear and sunny to dark and foggy. The images will also be taken from various distances. Images are taken under these conditions to simulate real-world situations where surveillance is applied. Effectiveness under certain conditions may be valuable for places like Houston, where fog is known to impair visibility. Each character may be extracted from the license plate thanks to segmentation techniques, and a license plate number will be reconstructed from the extracted characters. By implementing the methods above, we can expect to see an accuracy score above 90 percent according to research detailed in my previous work. These numbers are possible through the image processing techniques, which have been used to clean the image before feeding it into the machine learning model. With the correct implementation of image processing techniques, we can expect to see similar accuracy scores even in conditions that may be unfavorable for visibility.

In conclusion, humans face many difficulties involving security as they go through every-day life. Unpleasant situations like stolen property, littering, hit and run cases, and unauthorized access to the property can cause distress among many property owners, industries, and organizations. To solve these kinds of problems, we use a character recognition technique, which can keep a record of these cases and attempt to identify participating individuals. Identifying individuals in this manner may not stop the unusual activity, but we hope to minimize the issues to alleviate property owners' concerns.

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