A Proposal to Research and Implement a Method for Image Object Recognition Catering to License Plate Applications

To:
Professor Mohit Gupta
CS 534

From:
Carter Steffen
csteffen3@wisc.edu
NetID:csteffen3

Ben Farley
bjfarley@wisc.edu
NetID: bjfarley

Chan Hyeok Yun
cyun4@wisc.edu
NetID: cyun4

Computer Sciences Department
University of Wisconsin, Madison
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License plates are a staple of the modern car and find many uses in modern society. There are currently 272.1 million vehicles on the road today in the United States [1]. Every single one is legally required to have a license plate. This makes it easy for law enforcement to identify each individual car, who owns it, and to verify that it is on the road legally. Outside of the US government, other groups make use of the license plate. Insurance companies use the license plate to track the vehicles which they are insuring. Hotels, landlords, and businesses often use it to mark which cars are allowed to park in their private spaces.

The ability to easily identify the license plate is crucial to obtaining the information associated with it. Doing this electronically from an image or video feed, would be even more beneficial. It would allow for the data associated with the plate to be accessed instantaneously. This could give the receiver the ability to identify the owner of the car, check if it was stolen, or determine if it is allowed to be in its current spot.

Video and photo identification software for license plates already exists, however it is often very narrow in its use. The majority of the software has been built for specific applications. The most well known, and potentially most disliked, is to identify a car on a tollway and to charge the owner a fee for passing through. Specific and effective, this is a proven use case for the technology. However, there is nothing stopping the same technology from being used by landlords. Tenants have to register their cars for the space in which they park. Identifying illegally parked vehicles would save tenants the trouble and time of waiting for a tow truck to remove the vehicle. Moreover, businesses could use license plates to identify which cars to allow into their parking lot and which to prevent.

The purpose of this project then is twofold. First, to prove that we as undergraduate students are capable of developing a software similar to those trusted heavily out on the Illinois tollways. This will serve as an excellent learning opportunity surrounding the implementation of a solution to a real world problem. Second, it will give us an opportunity to modify our own code to be capable of things currently unutilized in current applications. Scanning a parking lot for license plates puts the plate at a brand new perspective. Some will invariably be tilted, or at distances much farther away. These challenges present interesting learning opportunities.

Our goal to accomplish throughout the semester is to be able to extract the license plate number and code from a variety of images of cars. To accomplish this task we have broken it down into smaller modules of steps to complete. These steps can be completed in any order or distributed to different team members. Each dark bullet point below corresponds to a module that is crucial to getting to our end goal. Following the statement is a parenthetical excerpt denoting the expected timetable for the module. Each light bullet point provides more details about the dark bullet point above it and provides specifics of what types of images we are working with.

- Extract the license plate of the car from the image (3-4 weeks)
    - Need to search whole image and find the license plate, zoom in/reduce noise around the license plate

- Accommodate for license plate translations (3-4 weeks)
    - Rotation
    - Reflection
    - Dilation
    - Depth
- Detect Letters from image of license plate (~2 weeks)
- Detect Numbers from image of license plate(~2 weeks)
- Accommodate for various fonts, colors, and styles of different license plates.(~1 week)

In completing these tasks we hope to produce a code capable for use in a variety of different environments. The code could be used for other potential types of object identification within an image. However, the use case our code will specifically target will be for license plate identification in parking lots. Solving this unique challenge will be both difficult and helpful in gaining a better understanding of image processing. Furthermore, a code like this would be valuable in the real world.

If we have extra time after we complete these modules, we have prepared other ideas of how to extend the project. Other potential ideas are to extract brands to find brand recognition. Another is to dehaze an image or to reduce the noise of images of moving cars. Pursuit in these endeavors will depend on the progress made on the original goal.

Work Cited

[1] "U.S. - Vehicles in Operation 2018 | Statistic." *Statista*, 2018, www.statista.com/statistics/859950/vehicles-in-operation-by-quarter-united-states/.