Vehicle License Plate Automatically Recognition

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Summary:
Recognizing the American license plate and extracting the information on it. Accurate separation of digits and letters from the image is the major focus of this project. The final output should be the correct plate number from the image presented.

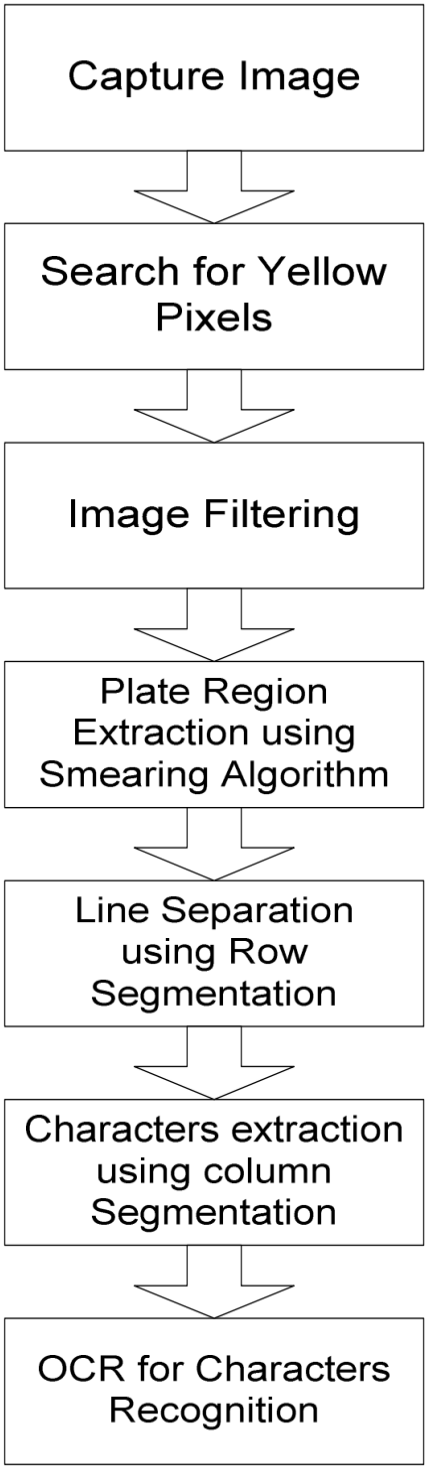
Introduction:
The license plate number can usually be utilized by law reinforcements as evidence. Especially in the world filled with pictures taken by cell phones, being able to recognize the information from these rather low quality images could make the evidence collection more efficient. We are prone to develop an algorithm that could successfully recognize the license plate from a random cell phone image and extract useful information such as license plate's issue state, the number of the license plate, etc.

Aims & Research Strategy:

1. **Separation of license plates from the original image.** The input image would be the picture of the whole car. Then we first need to locate the license plate in the image and extract that part of the picture from the whole input image.
    a. *Search for specific color pixels. Set specific color pixel value to 1, otherwise pixel value is 0. Then we would get a black/white image with white license plate. (Alan Jin, Nolan Chen)*
    b. *Plate region extraction using the Smearing algorithm. Use the smearing algorithm to crop the vehicle number plate. (Ran Liu, Yuchen Wang)*

2. **Recognition of text from the selected region of the license plate.** After locating the license plates, we need to extract the text and numbers from them for future recognition. Due to the noises and uneven backgrounds in the images, we need to apply filters in order to make the numbers clear enough to be read.
    a. *Apply flat-field correction to the plate.(Alan Jin, Nolan Chen)*
    b. *Line separation using row segmentation. Separate each row on the license plate then we would separate the state name and numbers. (Ran Liu, Yuchen Wang)*
    c. *Character extraction using column segmentation. Separate each character from a line. (Ran Liu, Yuchen Wang)*
    d. *OCR for character recognition. Recognize the characters from the clean image we got after the above actions. (Alan Jin, Nolan Chen)*
3. **Recognition of license plate's issue state(optional).** Due to the fact that each state in the US has a different visual presentation of the license plate, we are curious to see if an algorithm could be implemented to identify these differences.
    a. *OCR for characters recognition (Ran Liu, Yuchen Wang, Nolan Chen, Alan Jin)*
    b. *Feature matching between the classic plate and the input plate. (Alan Jin, Nolan Chen)*
    c. *Identification of font (Ran Liu, Yuchen Wang)*

The recognition process from the paper we referenced, and we would also try to follow this workflow for our aims.



Timeline:

Week of March 27: General research on background and historical implementation.

Week of April 10: Finish Aim 1.

Week of April 17: Finish Aim 2a. 2b.

Week of April 24: Finish Aim 2c. 2d.

Week of May 1: Optimize, train, and test Aim 1&2

Week of May 8: Implement Aim 3 as much as possible

Week of May 15: Finalize the code and prepare for presentation

Week of May 22 till June 1: Finish the project report.

References:

1. https://www.researchgate.net/publication/224565257_Automatic_Number_Plate_Recognition_System_for_Vehicle_Identification_Using_Optical_Character_Recognition
2. https://www.researchgate.net/publication/357793507_Automatic_Vehicle_Number_Plate_Recognition_Using_Structured_Elements
3. https://www.insider.com/every-us-state-license-plate-2018-4