CPMS446 - Image Processing and computer vision

Enhanced License Plate Recognition and Gate Access System

Project Proposal

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Project idea and needs

License plates are used mainly for the identification of registered vehicles. It contains a sequence of some alphabets and some numbers. We can use image processing technology to identify vehicles by their license plate, performing license plate recognition. It is very important in security and in many applications like stolen car identification, traffic control and gate access. The input to the License plate recognition system is a colored image of a license plate and the output is the registration number of the vehicle, and this can be done in 4 steps. These are image acquisition, plate extraction, character segmentation and character recognition.

Block Diagram
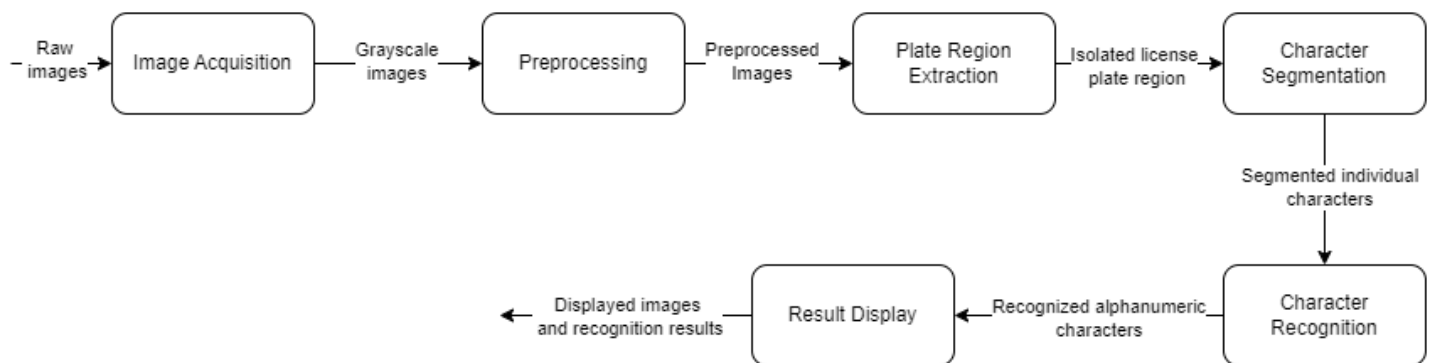
Modules

Image Acquisition Block

- ❖ Input: Raw images captured by a high-resolution digital camera.
- ❖ Output: Grayscale images.

➢ Methods:

- Capture images.
- Conversion of RGB images to grayscale.

Preprocessing Block:

- ❖ Input: Grayscale images from the Image Acquisition block.
- ❖ Output: Enhanced and noise-filtered images.

➢ Methods:

- ▪ Noise Removal:
  - Iterative Bilateral Filter.
  - Median Filter.

- ▪ Contrast Enhancement:
  - Histogram Equalization.
  - Adaptive Histogram Equalization.

- ▪ Morphological Operations:
  - Opening operations for noise reduction.
  - Contrast enhancement through morphological operations.

Plate Region Extraction Block:

- ❖ Input: Preprocessed images.
- ❖ Output: Isolated license plate region.

➢ Methods:

- ▪ Binarization:
  - Adaptive thresholding for black and white conversion.

- ▪ Edge Detection:
  - Canny Edge Detector for accurate edge localization.

- ▪ Hough Transform:
  - Identification and extraction of lines representing plate edges.

- ▪ Blob Detection and Smearing Algorithm:
  - Detection of irregularities for text area extraction.

Character Segmentation Block:

- ❖ Input: Isolated license plate region.
- ❖ Output: Segmented individual characters.

➢ Methods:

- ▪ Character Segmentation Algorithm:
  - • Segmentation of characters without feature loss.
- ▪ Thinning and Area Thresholding:
  - • Thin characters and select areas based on pixel thresholds.

Character Recognition Block:

- ❖ Input: Segmented characters.
- ❖ Output: Recognized alphanumeric characters.

➢ Methods:

- ▪ Template Matching:
  - • Pixel-by-pixel comparison for character recognition.
- ▪ Optical Character Recognition (OCR):
  - • Correlation-based matching against a database.

Result Display Block:

- ❖ Input: Recognized alphanumeric characters and processed images.
- ❖ Output: Displayed images and recognition results.

➢ Methods:

- • Visualization of processed images at different stages.
- • Displaying the recognized characters and the final result.

Non-primitive functions

- Canny.
- Dilation.
- Erosion.
- Contouring.
- Convolution.

Included libraries

- Skimage.
- Numpy.
- Matplotlib.

Research papers

https://www.researchgate.net/publication/363892739_An_Application_of_Image_Processing_-License_Plate_Recognition