License Plate Detection and Recognition System

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Problem Statement

Problem Statement

As time passes, new cars are released into the highways every day. With the exponentially increasing number of vehicles, traffic violations appear more frequently in public traffic, such as fraud tolls on roads or parking, speeding, and theft of cars. Hence, there is a need to identify vehicles with their respective license plates for safety. Getting the information from a License plate can be used in different scenarios, such as access to flow control, monitoring border interchanges, highway toll stations ,and to fight crime by searching suspicious or registered vehicles.

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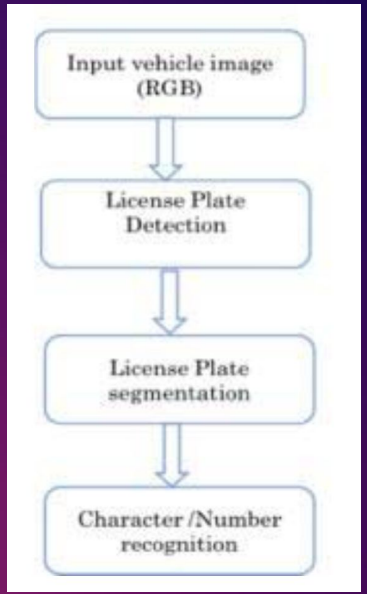
Proposed Solution

Proposed Solution

Our proposed solution for the License Detection and Recognition System is divided into three distinct subcategories:

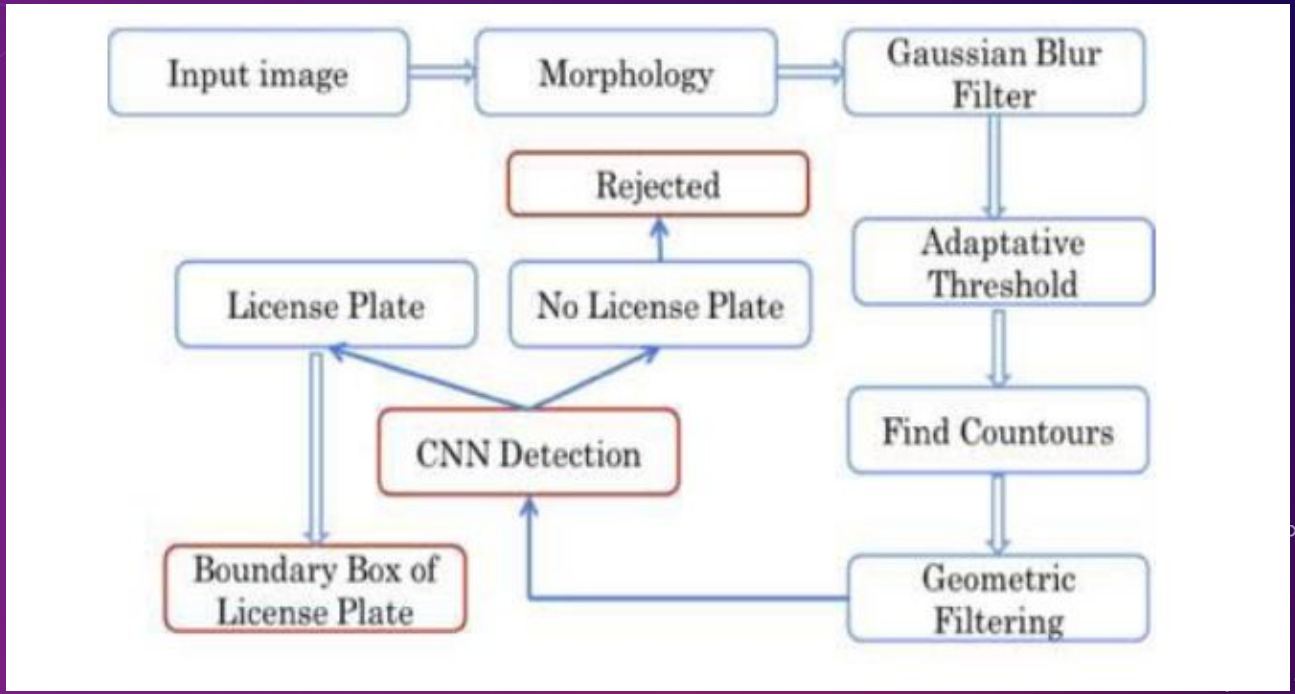
- License plate detection: Get the ROI (Region of interest) rectangle that indicates the license plate and cropped image of a license plate.
- Character segmentation: After getting the license plate image cropped we proceed to identify each character.
- Character recognition: After getting each character we start making predictions on what letter could be.



03

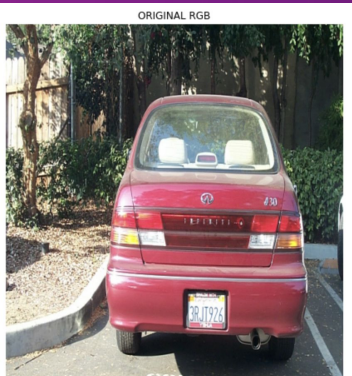
License Plate Detection

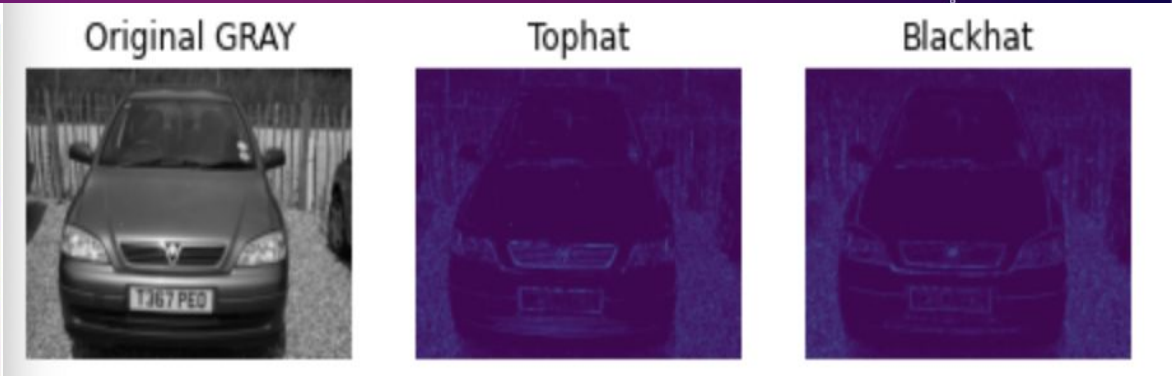
License Plate Detection



License Plate Detection

- Convert the input image from RGB to HSV:
- Morphology filtering to contrast maximization:
  - White top hat: is used to enhance bright objects of interest in a dark background.
  - Black black hat: is used to do the opposite, enhance dark objects of interest in a bright background.





License Plate Detection

Tophat

Blackhat

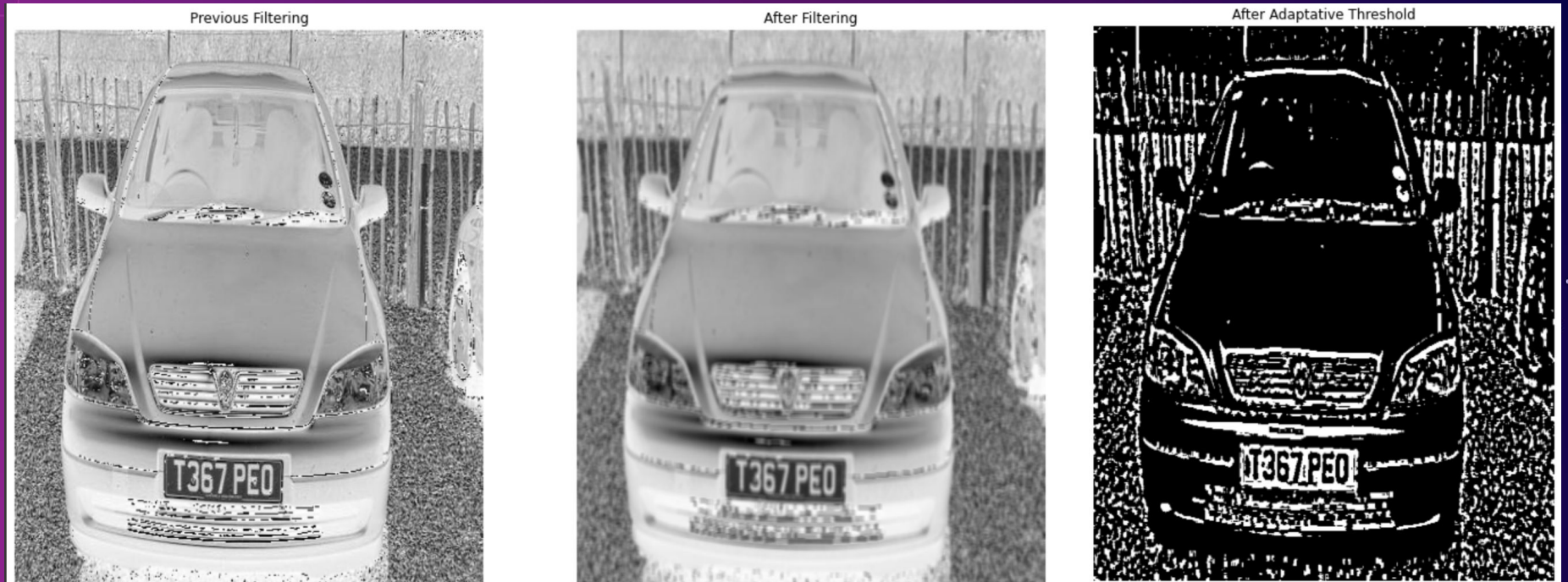
License Plate Detection

Gray + Tophat

Blackhat - (Gray + Tophat)

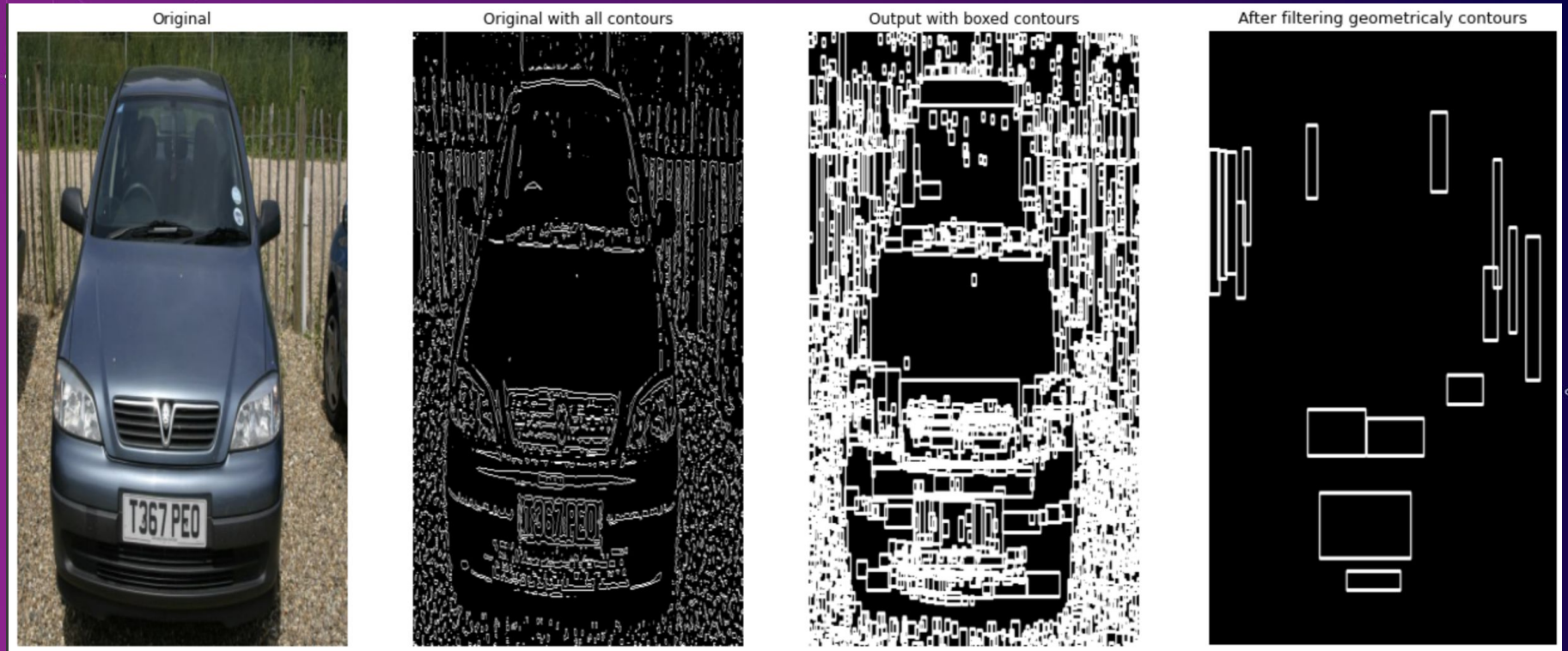
License Plate Detection

- Gaussian blur filter
- Adaptive threshold



License Plate Detection

- Finding all contours
- Geometric Filtering



License Plate Detection

- CNN model structure
- Classes are composed by License Plate and Non-License Plate

Layer Type	Parameters
Softmax	#2 classes
Fully connected	#2. neurons
Dropout	0.5
Fully connected	# 4224 neurons
Maxpooling	P :2 x 2, stride :2
ReLU	
Convolution	#filters : 32, kernel : 5x5, stride
Maxpooling	P :2 x 2, stride :2
ReLU	
Convolution	#filters : 16, kernel : 5x5, stride
Input	100 x 36 gray-scale image

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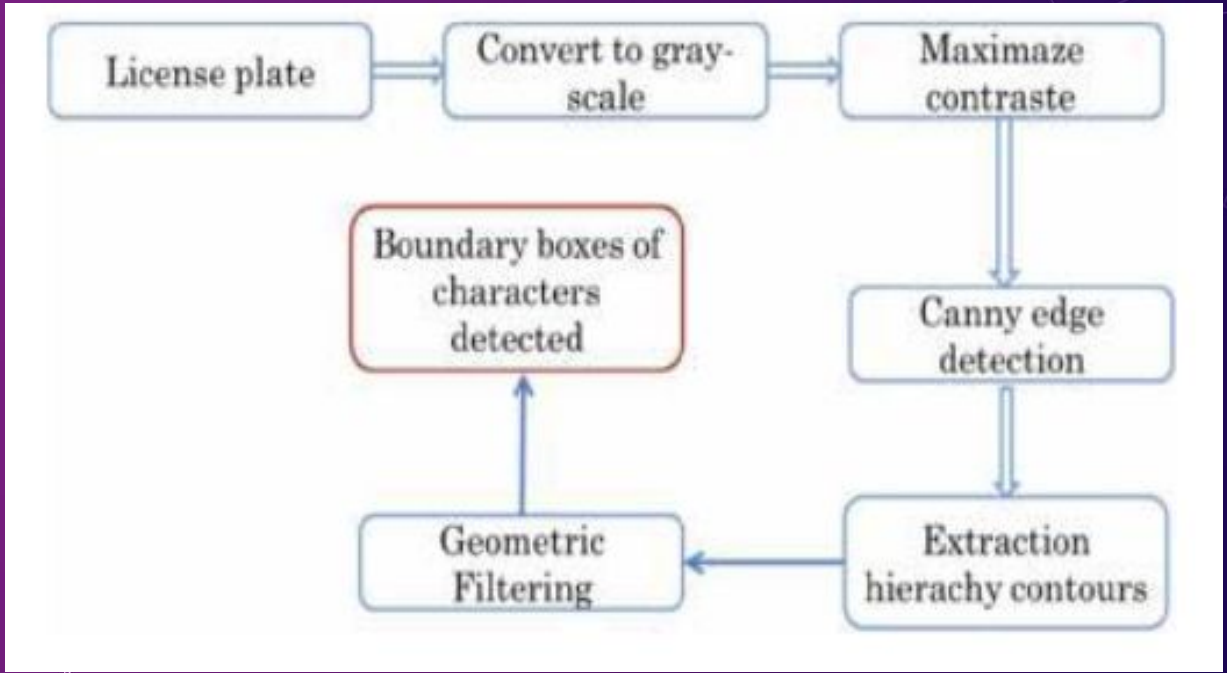
Character Segmentation

Character Segmentation

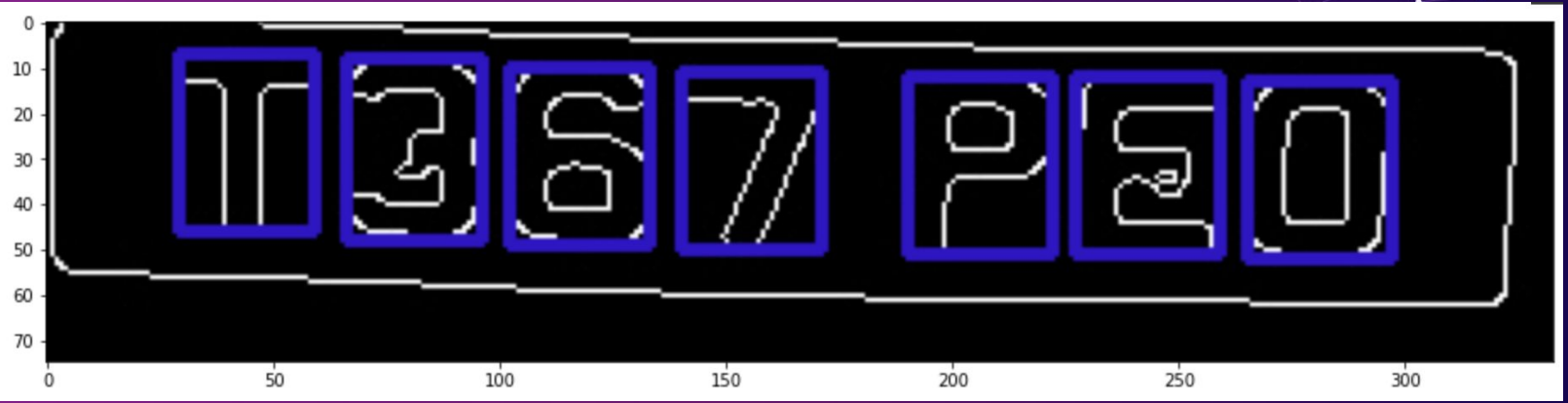


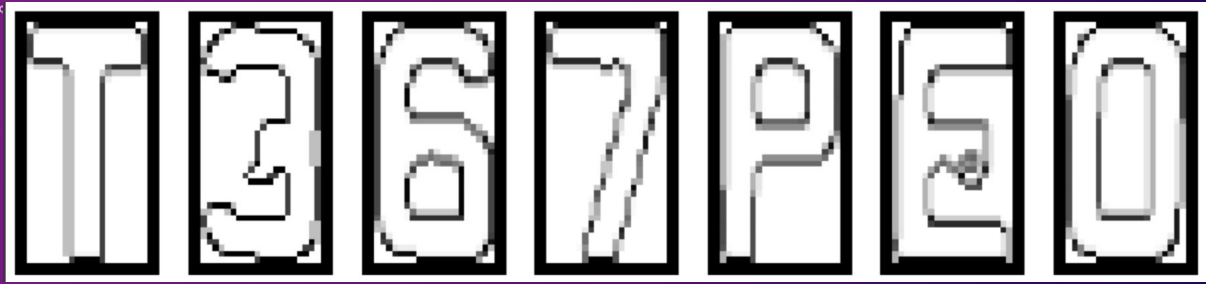
Character Segmentation

- RGB to Gray Scale
- Maximize contrast
- Canny edge detection
  - Implemented an Auto Canny function
  - The Auto-canny function that requires two arguments:
    - A single-channel image
    - A sigma value

Character Segmentation

- Extraction of hierarchy contours
- Geometric filtering





Character Segmentation

05

Character Recognition

Character Recognition

- Classes are A-Z, 0-9,and error class

Layer Type	Parameters
Sofmax	#37 classes
Fully connected	#37. neurons
Dropout	0.5
Relu	
Fully connected	#1024 neurons
Maxpooling	P :2 x 2 , stride :2
ReLU	
Convolution	#filtres 256 kernel :3 x3 , stride :1
ReLU	
Convolution	#filtres 128 kernel :3 x3 , stride :1
Maxpooling	P :2 x 2 , stride :2
ReLU	
Convolution	#filtres : 64 kernel :3 x3 , stride :1
Maxpooling	P :2 x 2 , stride :2
ReLU	
Convolution	#filtres : 32, kernel :5x5, stride :1, p :0
Input	32 x 32 gray-scale image

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Results and Discussion

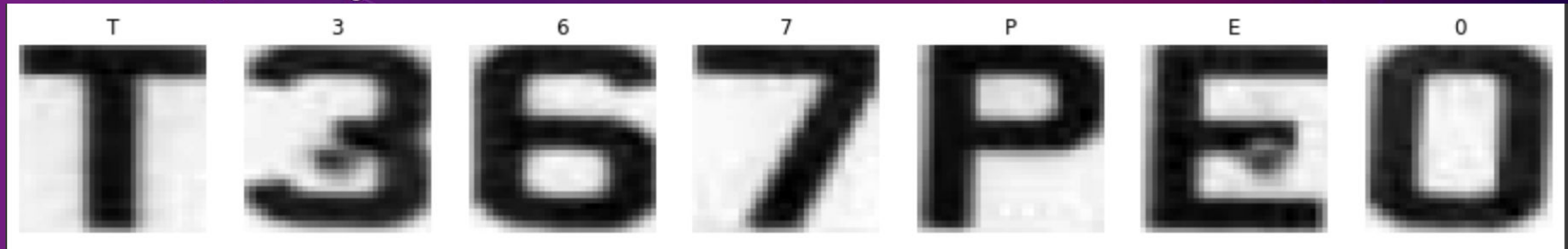
Results and discussion

Overall System Results Summarize

Compared with the results from the paper our results differ a lot for plenty of reasons, such as not working with the same datasets, different criteria for the geometric filtering and other parameters that were set by our own because they were not completely detailed in the paper.

ORIGINAL IMAGE

PLATE IMAGE



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