

Developing a Web-based License Plate Recognition System using Python

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January 4, 2022

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- What is License Plate Recognition?
- Project outcome

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- License plate detection
- Character segmentation
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What is License Plate Recognition?

- A program that can:
 - Detect license plate from a digital picture or video
 - Read characters from the recognized plate
- A solution for security and vehicle management operations



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Outcome

- A web-based License Plate Recognition system
- Input: JPEG / PNG image or MP4 video of cars/motorbikes
- Output: Raw text of plate number

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About

- Determine license plate from an image / video frame.
- Transform into a standardized form (colors, size, orientation, etc.) for further processing.

Methods

- Pre-trained model: Warped Planar Object Detection Network (WPOD-NET) [1]
- Detecting license plate and modifying it to a frontal view

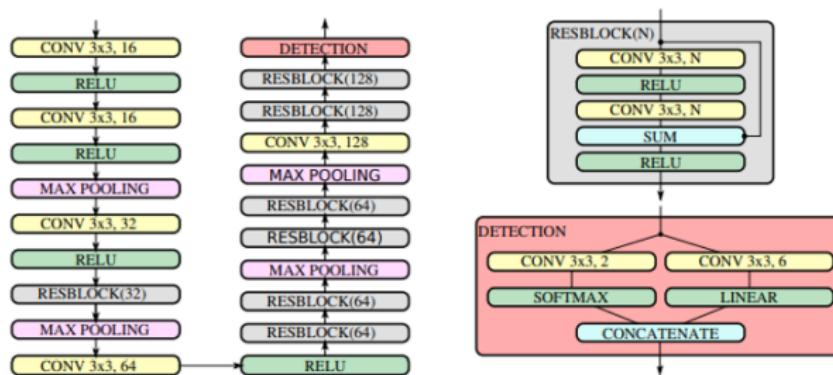


Figure: WPOD-NET architecture

Demo



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Overall

- Characters will be segmented from the license plate.
- Use connected component analysis algorithm to segment bounding boxes, then discard potential noise.



Figure: Binary image

Connected component analysis

- A concept from Graph theory
- Use for detect connected regions in a binary image
- Can be done using either OpenCV Library or manually coded using graph traversal algorithm.



Character segmentation

For a region to be considered as a valid character, its area S_r must satisfy:

$$\alpha \times S_{plate} \leq S_r \leq \beta \times S_{plate}$$

Where:

- S_{plate} is the plate's total area
- α and β are heuristic parameters.



Demo



Figure: Binary image



Figure: Segmented characters

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Concept

- Apply a multi-layer convolutional neural network.
- Output: raw text

Convolutional neural network with Pytorch [2]

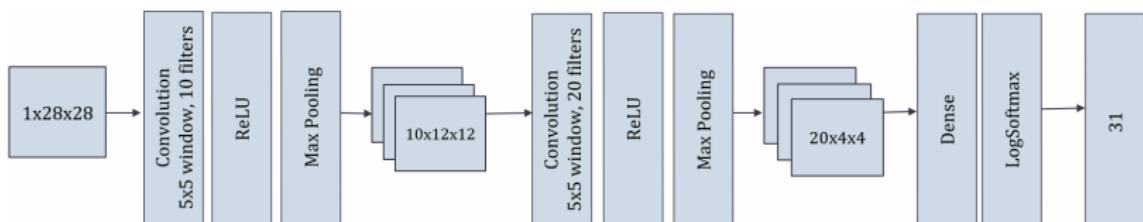


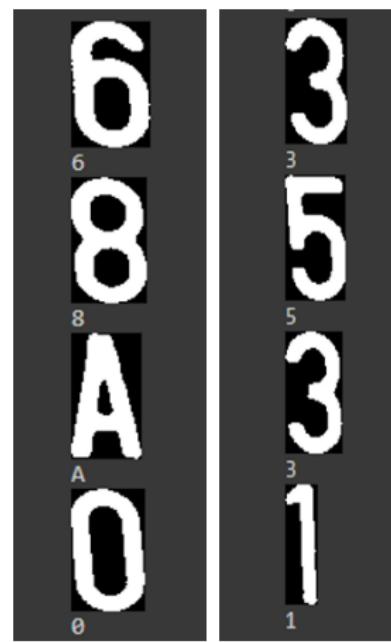
Figure: Multi-layer CNN architecture

Training Dataset



Figure: Training Dataset

Demo



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About

Framework used: Flask [3]

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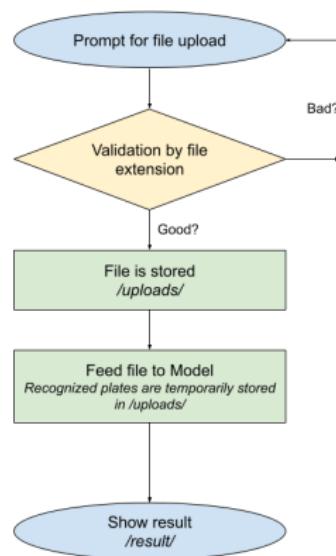


Figure: Web application workflow

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Uploader

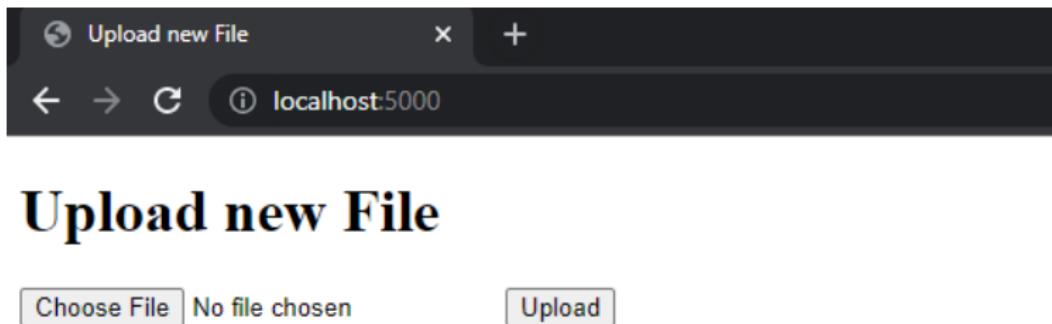


Figure: Minimalist upload interface

Image input

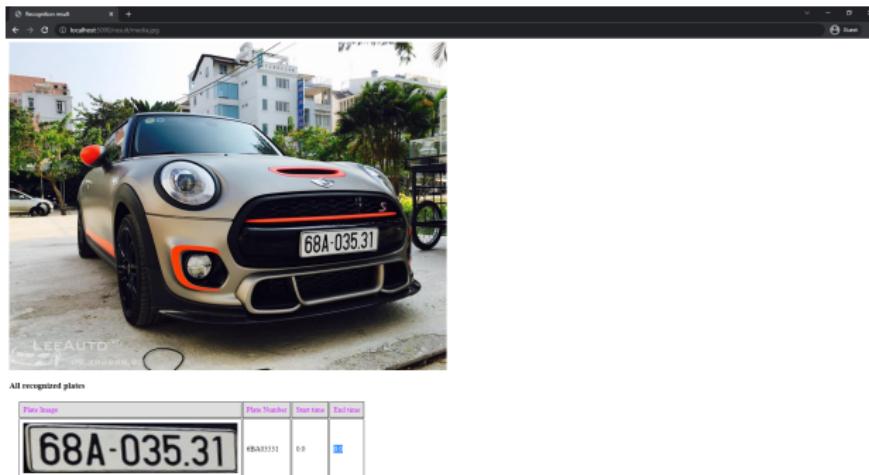


Figure: Result for a test image

Video input



Video input

The screenshot shows a web browser window titled "Recognition result" with the URL "localhost:5000/result/media.mp4". The main content displays a video frame of a license plate mounted on a vehicle. Below the video, the text "Plate with highest certainty" is followed by the recognized plate number "29-A1 208.82". The text "Plate number: 29A120882" and "Certainty = 0.5" is also present. A table titled "All recognized plates" lists two entries, both corresponding to the same plate number and timestamp.

Plate Image	Plate Number	Start time	End time
	41NBR8L	1.1333333333333333	1.1333333333333333
	41V10R82	1.2	1.2

Figure: Result for a test video

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Discussion

- Automate the recognition of license plates with a decent accuracy



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- Rooms for improvement:
 - Lighting conditions heavily affect recognition quality



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Discussion

- Automate the recognition of license plates with a decent accuracy
- Rooms for improvement:
 - Lighting conditions heavily affect recognition quality
 - Many confusion pairs of characters: B-8, Z-2, D-0
 - Recognition speed is slow for video input (about 15 seconds of processing for each second of video)



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- [2] PYTORCH documentation. URL:
<https://pytorch.org/docs/stable/index.html>.
- [3] Welcome to flask. URL:
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