**Indian Vehicle Number Plate detection and Recognition**

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# Background

This project deals with identifying the license place in the image and do an OCR to extract the characters from the detected license plate. It requires use of advanced image processing technology like computer vision and Deep learning (DL). Automatic License Plate Recognition (ALPR) is a challenging task because of the diversity of plate formats, non-uniform outdoor illumination, fonts and the font’s size and other conditions during image acquisition. There are many existing solutions for License Plate Recognition but the efficiency with conventional solutions is poor especially for Indian License Plates which are more complex in terms of license plate size, position and fonts.

The major problem in Indian scenario is:

* Number plates do not adhere to the standards like different plate sizes.
* License plates have symbols or pictures.

The objective is to extract and recognize vehicle registration numbers from vehicle images without any human intervention. Deep learning AI methods will overcome the drawbacks of conventional systems.

# Your Understanding

The challenges posed to conventional image processing techniques for license plate detection can be overcome with the use of DL. Procedural techniques like Image processing might not adapt to all the variable situations like illumination, font sizes etc.

DL makes use of the training data to learn to recognise the objects. For training dataset with different illumination conditions, same image is pre-processed in different condition for feeding as training data.

# Scope

The scope of this work is to train a Deep Neural Network (DNN) for detecting the license plate and then using Optical Character recognition (OCR) on top of it to get the license plate text for Indian scenario.

# Out of Scope

The region of license plate detected by DNN is at last passed to OCR for Text recognition. This work makes use of open source available OCR directly as last part of computation after DNN detects the license plate region. Developing of OCR is out of scope of this work.

# Assumptions

It is assumed that the dataset contains all variety of images taken like different sizes, illumination etc.

Yolo model is assumed to be good model for object detection and classification which can be trained further to detect the license plates.

# Solution Approach

**Case 1. Single car in a image**

Transfer learning approach is used for model training where pre trained models like Yolo, Mobilenet can be trained to detect custom objects just by changing the last few layers of the model. A Framework like Darknet provides the underlying services of changing the last few layers of Yolo for training to detect custom objects.

The implementation is done by transfer learning model to detect Indian license plates on top of Yolo-tiny-v3. The dataset ( json file) is parsed to get the images and the corresponding annotations in text files.

During training, to avoid over fitting of the model, the weights are stored after each 1000 iterations and error corresponding to validation dataset is taken into consideration. When the error curve becomes convex, the weights from that number of iterations are taken.

**Case 2. Multiple cars in a image**

This training posed problems to images with multiple cars in same image as it is trained with single car images only.

It is done by detecting vehicles first and then the license plates:

*First,* the vehicles are detected using the Mobilenet pre trained model and *second, that* detected vehicle image is then passed to the trained model for license plate detection.

After extraction of license plate region, it is passed to OCR for license plate text recognition.

For the case with multiple vehicles in same image, Pre trained models like Mobilenet and be used to detect vehicles in image, crop them and then pass them individually to the trained DNN for license plate detection .

Once, license plate region is detected, it can be pre-processed and then passed to the OCR for text recognition of license plate. The OCR works independently of the license plate detection DNN. Open source OCR like python-Tesseract is used for this work.

Better results can be obtained by using better OCR and License plate recognition is independent of it. OCR efficiency is out of scope of the work.

Models/ Algorithms proposed

# Implementation Framework

Darknet provides the framework for training the model.

Tensorflow framework is used for inference once the model is trained.

The model is trained on a system with following configuration:

Intel i7 3.8 GHz, 4core, 8GB Ram, Nvidia 1050 GPU

1. Solution Submission

The code is available at [Github/Indian-Vehicle-License-Plate-Detection](https://github.com/ankitbarai507/Indian-Vehicle-License-Plate-Detection)

1. References

* Medium.com blogs.
* Yolo-tiny v3 documentation.
* Github/ how-to-train-tiny-yolo-to-detect-your-custom-objects