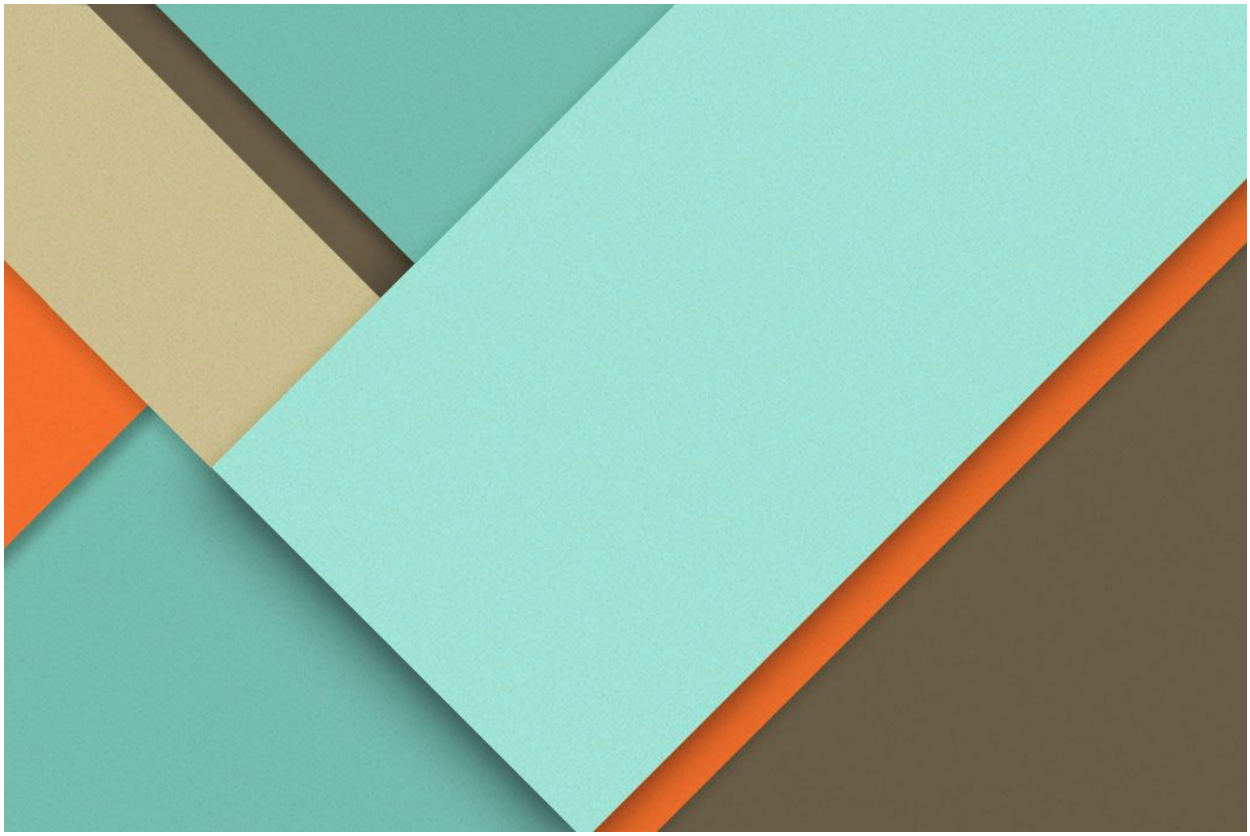

Parking Lot Construction using LPR and Linear SVM

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Introduction:

The project is based on a typical License Plate Recognition using linear SVM to train and recognize the characters present on the license plate from a picture of the vehicle.

Problem Formulation:

In our model the input will be an image of the front side of the vehicle containing the license plate(These images can easily be obtained when a car is entering a parking lot using specialized cameras).

Input Preprocessing:

The image is read as a grayscale image (intensity values from 0 to 255).

The grayscale image is converted to binary image using otsu threshold value. Otsu is an algorithm that performs clustering based image thresholding.

This binary image is the input for the next stages.

The process consists of broadly three major steps:

A. Plate Detection
B. Character Segmentation
C. Character Recognition

Plate Detection

From the binary image input we are using the concept of connected component analysis to find the bounding box containing the license plate.

We are using some heuristics in deciding the correct bounding box for the plate. The exact heuristics used in code are :

```
# height of plate is within [5-20]% of image height and width within 15-60% of image_width

# region area >50

# plate height more than 20% plate_width

# sum of pixels in plate greater than 60 % of total pixels

# only 10 characters in actual plate
```

Character Segmentation:

Once the bounding box for the license plate is obtained we have used sweep line method to segment the characters from the recognized license plate. These segmented characters' binary image will be the input to our SVM model which was pre-trained on letters and numbers dataset.

Character Recognition:

For correctly recognizing the characters obtained from previous step we have trained a Support Vector Machine having Linear Kernel which learns a separating hyperplane for the inputs.

SVM were preferred over conventional CNN used in NLP as they are computationally cheaper and gave good results as can be seen later.

Training Set:

The training set consists of 20pX20p images of all letters and characters.

It can be found here.

We are using scikit learn package for implementing our model and cross validation with four folds.(That is 3/4th of the dataset is used for training and 1/4th is used for testing).

The average training error obtained was 97.38%

Now we will use this pre-trained model to recognize the characters obtained after segmentation of our license plate.

Additional Work For the Sake of Completion

Till now we have obtained the license plate number now we will use this in our task for automating the operations of the parking lot.

We have also implemented a prototype database which has the details of the vehicles (viz. The license plate number, type of vehicle(car,bike), owner,etc).

So when a vehicle enters the parking lot our LPR system will recognize the license plate number and this number will be used for querying the database to obtain the details of the vehicle and assigning the correct parking slot to it.

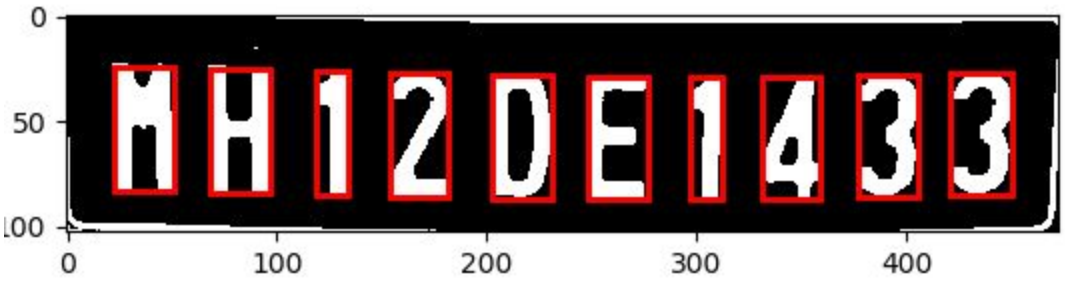
The complete working project can be found on this link.

Experiments and Results

Test image 1

License Plate Detection Step.

Character Segmentation:

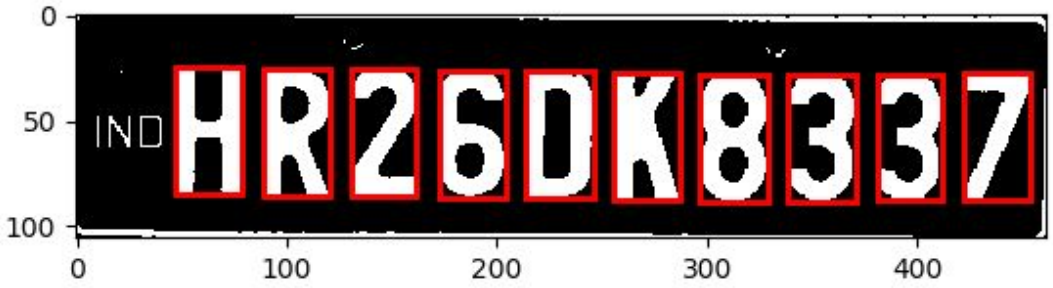


Code Output:

```
Recognized License Plate is:
MH12DE1433
Parking lot:
5
Type of vehicle:
Car
Price for vehicle:
100
```

Test Image 2

Detection and segmentation result:



Final Code Output:

```
Recognized License Plate is:
HR26DK8337
Parking lot:
4
Type of vehicle:
Car
Price for vehicle:
50
```

Conclusion

The model seems to work expectedly good on test images and gives reasonable results.

One big problem our system might possibly face is differentiating between similar characters like <I and 1> ,< O and 0> and <Z and 2>.

For this one strategy used was hard coding this information based on whether letter or number was expected at a particular position.

References

https://www.researchgate.net/publication/260720555_License_Plate_Recognition_A_Brief_Tutorial