

AUTOMATIC NUMBER PLATE RECOGNITION

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Purpose of the project is to **identify and recognise characters in cars' license plates** in video recordings.

Number plate detection and recognition is an essential component of today's security surveillance cameras. Automation of this process can be extremely helpful for managing vehicle security through CCTV cameras.

1. Pre-processing
2. License Plate Localization
3. Character Segmentation
4. Character Recognition

Sample Car



IMAGE PRE-PROCESSING

The following operations are performed on the frames extracted from the video

1. Grey scale conversion
2. Gaussian blurring to remove noise
3. Sobel edge detection
4. Thresholding
5. Morphological Closing

PRE-PROCESSING

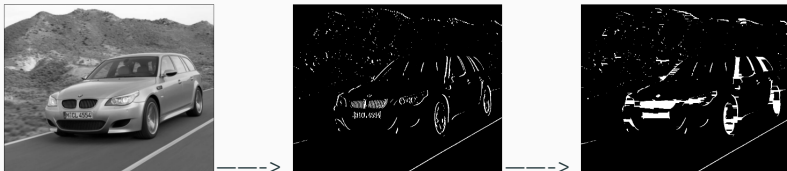


PLATE LOCALIZATION

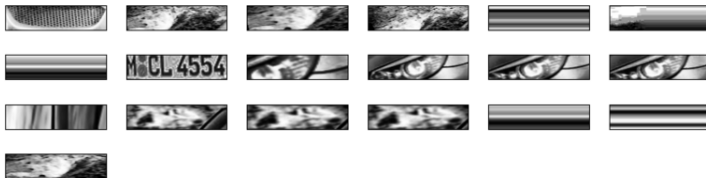
Contour construction and analysis

- Contours are drawn on the images obtained above. From these, we obtain the minimum bounding rectangular regions to represent the contours.
- Geometrical Refinements -
 - Aspect Ratio must be > 2
 - Area constrained within 400 to 30000 square pixels
- Colour Analysis - Since most number plates have a white background by Government's rules, we use Floodfill and reconstruct masks



RE-ORIENTING THE RECTANGULAR REGIONS

The above rectangles are are rotated, cropped and re-sized to give proper orientations to candidate plate regions.



CANDIDATE REGION SELECTION

For considering the selected rectangle as a number plate or not, several classification algorithms are implemented.

Dataset - Self generated

Comparison of different Classifiers with 5-fold cross validation

Classifier	Accuracy
SVM	95.7
Random Forests (400 estimators)	97.9
Extra Trees (300 estimators)	97.5

POSITIVES PASSED BY THE CLASSIFIER

MCL 4554

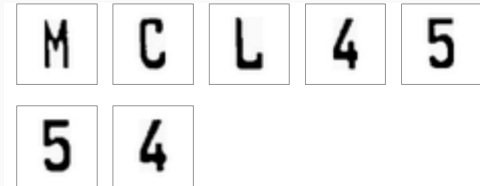


CHARACTER SEGMENTATION

CHARACTER SEGMENTATION

Again, image processing is employed to find the contours in the number plate after the relevant pre-processing, contour drawing and minimum bounding rectangle construction.

The contours are validated using aspect ratio and area constraints.



CHARACTER RECOGNITION

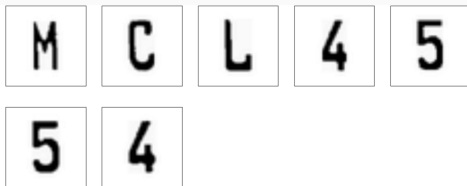
Training and Test Dataset : Char78K Dataset

Features Used : Hog Features

Method	Accuracy(in %)
Multilayer Perceptron(with grid search)	87.2
RBM feature extractor with Log Reg, L.R. = 0.06	93.5
Linear SVM	93.9
Random Forest Classifier	95.8
Extra Trees Classifier	98.6

MODEL FOR CHARACTER RECOGNITION

- Optimum Model : Extra Trees Classifier
- Dataset : Char78K Dataset
- No. of trees : 300
- Accuracy : 98.6



Output : 'M' 'C' 'L' '4' '8' '8' '4'

TESTING AND RESULTS

Dataset : Images with Croatia cars with license plates

Test data size = 382

Number of number plates correctly localized = 375

Accuracy = 98.17%

Characters recognized correctly = 1521 out of 2889

FUTURE WORK

- Number plate detection for motorcycles can be incorporated by allowing aspect ratio variations and some changes in localization techniques.
- In India, we have number plates in regional languages too. The dataset can be increased to include such variations.
- By enough experimentation for tuning parameters, Optical Character Recognition can be modelled using neural networks for state of the art accuracy.

Our algorithm implements a combination of some of the popular methodology for each stage of the pipeline. The dataset for Indian license plates is not readily available and hence makes training difficult for the Indian format license plates.

QUESTIONS?

THANK YOU !
