PROBLEM STATEMENT

Object Detection by Image processing and Machine learning

OBJECT DETECTION

Object detection is a computer technology related to computer vision and image processing that deals with detecting instances of semantic objects of a certain class. It refers to the capability of computer and software systems to locate objects in an image/scene and identify each object. Object detection has been widely used for face detection, vehicle detection, pedestrian counting, web images, security systems and driverless cars.

OPTICAL CHARACTER RECOGNITION

Optical character recognition is the mechanical or electronic conversion of images of typed, handwritten or printed text into machine-encoded text, whether from a scanned document, a photo of a document, a scene-photo (for example the text on signs and billboards in a landscape photo). It is a common method of digitizing printed texts so that they can be electronically edited, searched, stored more compactly, displayed on-line, and used in machine processes such as cognitive computing, machine translation and text mining.

USE CASES

- Digitization of data from standardized documents such as Aadhar cards and PAN Cards
- Automation of image to text conversion of application forms and agreements
- Banking sector to process cheques
- Healthcare to process large amount of forms
- Digitize paper work in government offices

CASE STUDY

To develop a license plate detection model using image processing and machine learning

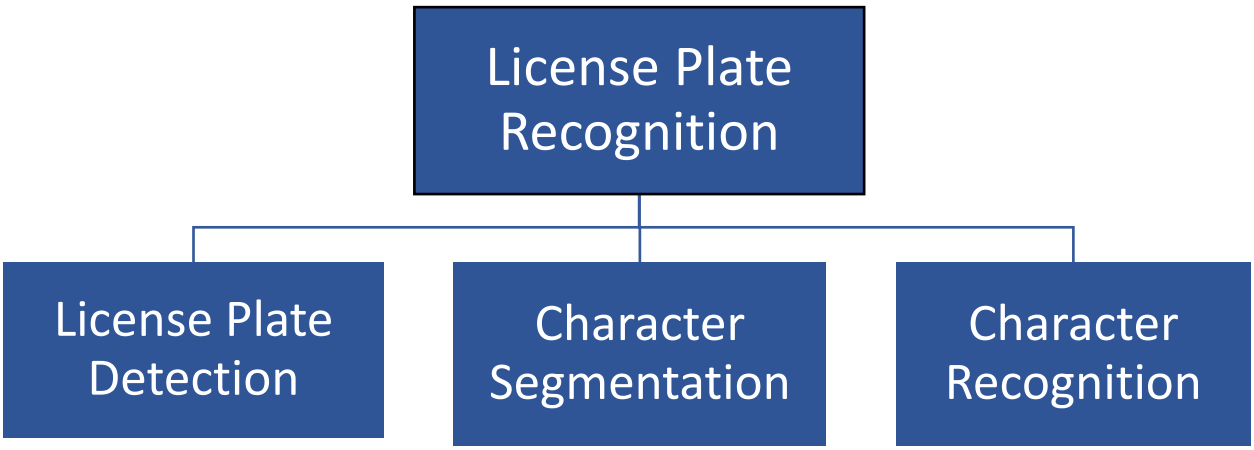
USE CASE

- Car arrives at the gate.
- Camera clicks the picture of the car.
- Detects the license plate.
- Obtains the license number.
- If authorized, the gate is opened.

DATASET

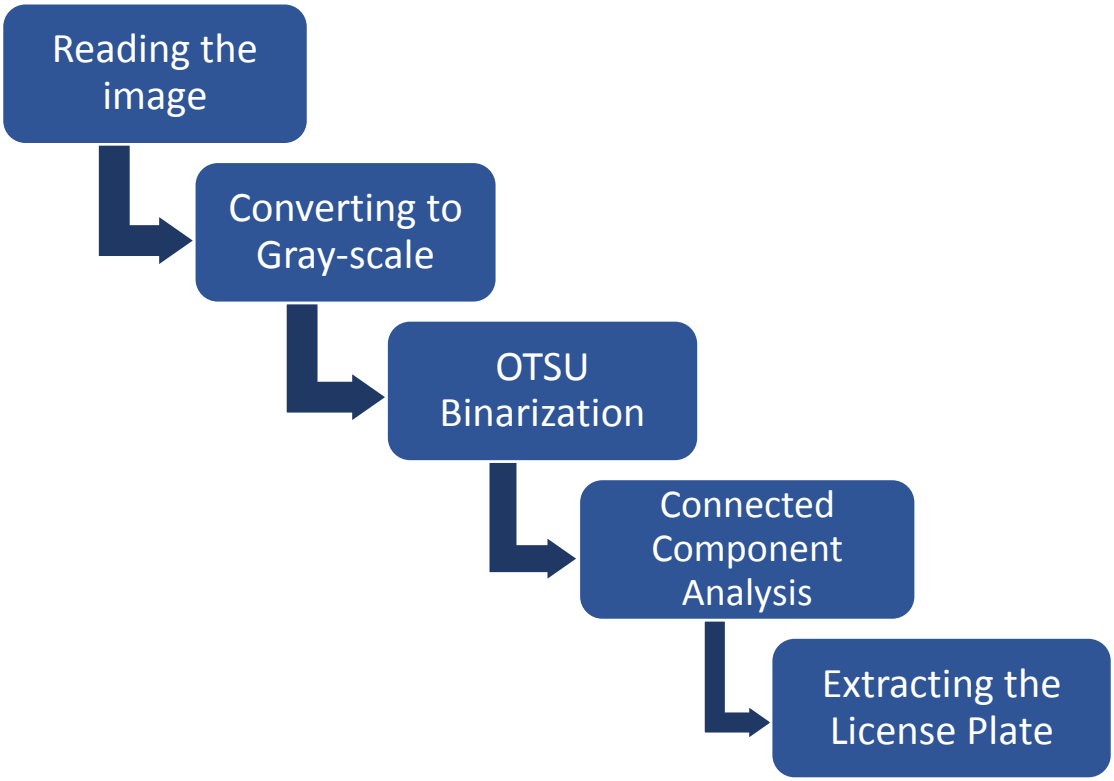
The character dataset comprises of 10 different images of each character from A-Z and 0-9. The car images dataset contains around 50 images clicked manually. Out of these images, 20 images were labeled to determine accuracy.

DESIGN



MODULES AND DESCRIPTION

1. **License Plate Detection:**



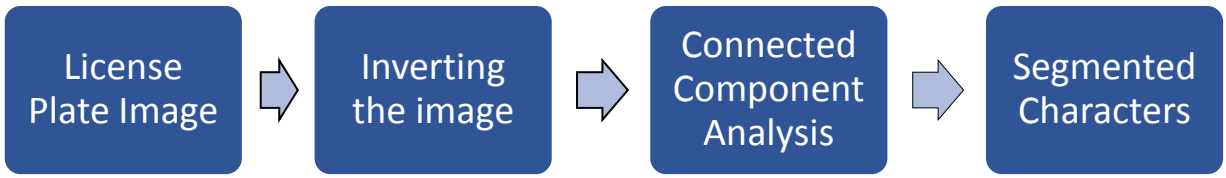
It is the first stage of the problem where the position of the license plate is detected. It involves a series of steps which includes different techniques of image processing.

- OTSU Binarization – It is threshold based image processing technique to reduce a gray scale image to binary image. It automatically calculates an optimum threshold value and convert the image into bimodal i.e. the pixels of the image will be either black or white.

- Connected Component Analysis – It is a region based image processing technique. It scans the image pixel-by-pixel and connects the clusters of pixels with the same intensity values together. It then labels the connected regions on the foreground. A rectangular patch is plotted around all the connected components.

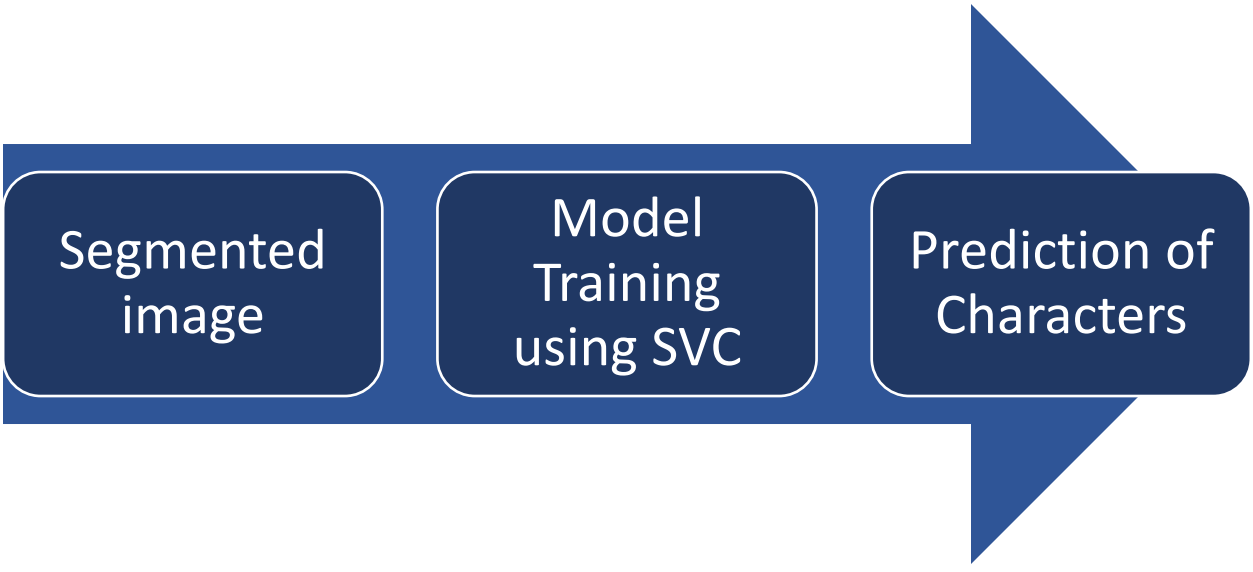
From the connected components, the extraction of license plate region is done by ratio proportion. The proportion of the width of the license plate region to the full image ranges between 20% and 70%. The proportion of the height of the license plate region to the full image is between 5% and 10%.

2. **Character Segmentation –**



The characters on the license plate are mapped out and segmented into individual images. The connected component analysis is performed to form connected regions and detect the characters on the number plate. The detected characters are resized to 20px by 20px. The extraction of characters is done by ratio proportion. The proportion of the width of the license plate region to the full image ranges between 2% and 45%. The proportion of the height of the license plate region to the full image is between 35% and 80%.

3. **Character Recognition –**



Machine learning is defined as the branch of AI that deals with data and processes it to discover pattern that can be used for future predictions. The major categories of machine learning are supervised learning, unsupervised learning and reinforcement learning. Supervised learning makes use of a known dataset (called the training dataset) to make predictions. Supervised

learning can be divided into two categories: classification and regression. Character recognition belongs to the classification category.

The accuracy scores for different algorithms are as follows:

Algorithm / Accuracy	Fold 1	Fold 2	Fold 3	Fold 4	Average	Execution Time
Decision Tree	83.17	85.51	86.96	90.09	86.43	0.218
Gaussian Naïve Bayes	83.17	88.41	93.07	97.11	90.44	0.301
K-nearest Neighbor	88.12	89.85	94.06	94.21	91.56	0.296
Multinomial Naïve Bayes	93.07	94.06	95.65	97.11	94.97	0.203
Logistic Regression	94.21	96.04	99.01	100	97.32	0.938
SVM-SVC	99.01	99.01	95.65	100	98.42	1.425

SVM classifier was chosen as it gave the best performance. A 4-cross validation is done to determine the accuracy. The training model is persisted to a pickle file so that the predictions can be done without training a model anymore.

APPLICATIONS OF LICENSE PLATE RECOGNITION –

- To ensure authenticity at parking zones in organizations
- To ensure Security in high restricted areas such as military zones and government offices
- Reduce Speed enforcement on roads
- Journey time measurement
- Red light enforcement

CONCLUSION

The project is successfully completed by implementing various image processing techniques to detect the number plate and the characters are predicted using a machine learning algorithm Support Vector Machine. There is a lot of scope for future enhancement to use it more efficiently for other purposes.

TEST CASES -

S.NO	IMAGE	EXPECTED OUTPUT	ACTUAL OUTPUT	RESULT
1.		KL 01 AY 4174	KL 01 AY 4174	SUCCESS
2.		KL 16 F 299	KL 16 F 299	SUCCESS
3.		KL 57 G 7015	KL 57 0 7015	FAIL
4.		KL 30 F 967	KL 30 F 967	SUCCESS