AUTOMATIC VEHICLE LICENSE PLATE RECOGNITION SYSTEM

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JK Lakshmipat University

August 2020

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Practice School-I

Submitted in partial fulfilment of the requirements

for the degree of

Bachelor of Technology in Computer Science Engineering

by

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CERTIFICATE

This is to certify that the Practice School-I project work entitled "**Automatic Vehicle License Plate Recognition System**" submitted by **Samyak Bhagat (2018BtechCSE030) & Piyush Tolumbia (2018BtechCSE025)** towards the partial fulfilment of the requirements for the **Bachelor of Technology in Computer Science Engineering** of JK Lakshmipat University Jaipur is the record of work carried out by them under my supervision and guidance. In my opinion, the submitted work has reached a level required for being accepted for Practice School-I examination.

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Date of Submission _____

ACKNOWLEDGEMENTS

We want to communicate our most profound gratefulness to each one of the individuals who gave us the likelihood to finish this task. An exceptional appreciation to our project supervisor, Mr. Krishan Mittal, for allowing us the chance to seek internship in the organization and giving us consolation, priceless direction, and backing all through our undertaking. Without his help and commitments, this venture could never have been finished. Albeit very short, for us this was an incredible opportunity to gain the hands-on learning on real industry problems. It helped us to investigate our abilities and expanded our enthusiasm for different advancements.

Besides, we want to offer our genuine thanks to Prof. Sanjay Goel, Director, Institute of Engineering and Technology, JK Lakshmipat University Jaipur for giving us this chance. We likewise want to express gratitude towards Mr. Gaurav Raj, Supervisor and Assistant Professor, Department of Computer Science and Engineering for his valuable mentorship at every step of the journey. We are also thankful to our JK Lakshmipat University, Jaipur for the significant time, backing and consistent inspiration in making our PS-1 effective.

Sincerely yours,

Samyak Bhagat

Piyush Tolumbia

ABSTRACT

Automatic Vehicle License Plate Recognition System (AVLPR) has a wide range of applications since the license number is the primary, most widely accepted, human readable, mandatory identifier of motor vehicles. It plays a vital role in numerous real-life applications, and numbers of technique have been proposed. Different recognition strategies have been produced and number plate recognition systems are today used in different movement and security applications, for example, parking, access and border control, or tracking of stolen autos. The project aims at identification of the license plate of the vehicles. It is done through Image processing and Optical Character Recognition

AVLPR has 5 major stages, i.e., Image Acquisition, License Plate Detection, Character Segmentation, Character Recognition & Accuracy Optimization. The accuracy of the model depends on training set so developed during the process.

LIST OF FIGURES

LIST OF ACRONYMS

- AVLPRS: Automatic vehicle license plate recognition system
- UCWL: Udaipur Cement Works Limited
- JKO: JK Organisation.
- MTPA: Million tonnes per annum
- OLBC**:** Over Land Belt Conveyor
- BSE: Bombay Stock Exchange
- MW: Mega-watts
- CLPD: Car-License Detection
- OCR: optical character recognition

CONTENTS

CHAPTER 1: ABOUT THE ORGANIZATION

Udaipur Cement Works Limited (UCWL), is one of the leading cement manufacturing Company that has its roots originated in city of lakes, state of Rajasthan, in western India. Our philosophy is based on sustainable growth and developmental framework that works for a better and happier tomorrow/future.

Udaipur Cement Works Limited, (formerly known as JK Udaipur Udyog Ltd) was incorporated as a Public Limited Company on 15th March 1993 having registered office at Jaipur, Rajasthan. The name of the Company was subsequently changed to its present name Udaipur Cement Works Limited from 19th May 2006. The company presently is a subsidiary of renowned Indian Cement Manufacturing Company, JK Lakshmi Cement Limited, which is part of reputed business conglomerate JK Organisation (JKO) that has rich business legacy of more than 135 years. The company is listed on Bombay Stock Exchange (BSE).

The company has an integrated Cement Manufacturing unit with installed cement production capacity of 1.6 Million tonnes per annum (MTPA). Since its inception, the company is committed towards boosting sustainability through adopting latest art of technology designs, resource efficient equipment and various in-house innovations. The company has a 6 MW Waste Heat Recovery System that utilizes the waste heat of kiln and helps reducing the carbon footprint of the company by 34058 tCO2e per year and thereby saving 24724 tons of coal and 113529 KL of water compared to conventional thermal power plant . The company has also installed a 6 km long Over Land Belt Conveyor (OLBC) to source raw material from its captive mine to the manufacturing plant that further adds value in gaining cost and environmental efficiency.

With the blend of modern technology and rich legacy, UCWL manufactures world class cement under the brand name-Platinum Heavy Duty Cement. The cement is made using latest superior PSD Technology which provides a wide array of benefits to the consumers like 10% more volume, high initial strength, superior workability, and fast setting.

This incredible communion is the source of inspiration for JK Organisation, which also embodies a perfect blend of rich legacy of over 135 years and modern work culture. JK Organisation a very well-respected name in the Indian industry contributing in the various sectors important to the national growth. Its major interests are in the field of production of Tyres, Paper, Cement, Automotive transmission system, Agri-Genetics, Dairy Products, Education etc. The group has been committed to “Make in India’ even in the pre-independence era by manufacturing products of impeccable quality to substitute imported goods. It has been in cement business for over three decades and distinguishes itself based on its innovative practices and initiatives aimed at customer satisfaction.

All products of the JK Organisation have a strong brand recall and enjoy a significant market share in their respective segments. The strong brand equity of the JK Organisation has been built through use of latest technologies, continuous research & development, innovation and professional management. JK Organisation has set up highly reputed Research and Development Institutes in various fields.

1.1 VISION

To grow and foster into one of the leading customer centric cement companies and a promise to deliver products with latest technology.

1.2 MISSION

- Customer Gratification to be one of the predominant objectives
- Obtain to achieve operational excellence.
- Inclined towards a responsible corporate social attitude towards society.
- A talented pool of employees to achieve success in all domains!

1.3 LEGACY

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1.4 BOARD OF DIRECTORS

- Smt. Vinita Singhania, Chairperson
- Shri Onkar Nath Rai
- Shri Vinit Marwaha.
- Shri Surendra Malhotra
- Shri Shrivats Singhania
- Shri Naveen Kumar Sharma (Whole Time Director)

CHAPTER 2: INTRODUCTION

Automatic Number Plate Recognition (ANPR) is a system capable of reading vehicle number plates without human intervention through the use of high speed image capture with supporting illumination, detection of characters within the images provided, verification of the character sequences as being those from a vehicle license plate, character recognition to convert image to text. It takes the image of a vehicle as the input and outputs the characters written on its license plate.

2.1 OBJECTIVE

To develop an automatic system for recognising license plates of the vehicles using Image Processing.

2.2 SCOPE

The scope of the project lies amongst the urgent need of automating the entry record system in industries and factories.

This project can be used in all types and sectors of industries. Here manual labour is on work to have account of every vehicle entered in their premises. By our project, we can help them out. Also as it is automatic and from the perspective of least error, it will be quite beneficial.

2.3 LITERATURE REVIEW

Muhammad Tahir Qadri In this anticipate [2] for the recognition the OCR techniques is used which is susceptible to misalignment and to various sizes. The affine transformation can be used to advance the OCR recognition from various size and angles. The programmed vehicle identification system using vehicle license plate is exhibited. A series of image processing techniques of the system for identifying the vehicle from the database stored in the PC.

S.Kranthi, K.Pranathi In this paper they [3] proposed that Automatic Number Plate Recognition (ANPR) is a method that catches the vehicle image and confirmed their license number. ANPR can be used in the presentation of stolen vehicles. ANPR can be used in various manners by using to identify it stolen vehicle on the highway.

Abd KadirMahamad In this paper they explained [8] an automatic number plate inspection of letter sets of plate using image processing and optical character recognition. An imperative system has been created of training interface using LABVIEW software.

Kuldeepak et al. In this paper [1] they introduced that high level of precision has been required by the number plate recognition when streets are occupied and number of vehicles are passing through. In this paper, by optimizing different parameters, they have accomplished an exactness of 98%. It is essential that for the tracking stolen vehicles and

monitoring of vehicles of an exactness of 100% can't be bargained with. Therefore to accomplish better precision streamlining is required. Additionally, the issues like stains, blurred regions, smudges with various text style and sizes ought to be remembered. This work can be further boundless to minimize the errors because of them.

AmrBadr et al. In this paper [8] Automatic recognition of car license plate number got to be indispensible part in our day by day life. This paper mainly explains an Automatic Number Plate Recognition System (ANPR) using Morphological operations, Histogram manipulation and Edge discovery Techniques for plate localization and characters segmentation. Artificial Neural Networks are used for Character classification and recognition.

2.3 TECHNOLOGY STACK

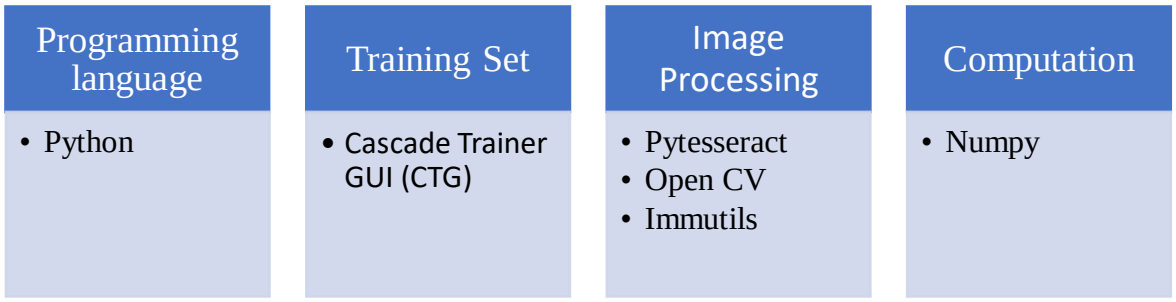

Fig 1: Technology stack

- Python is an excellent choice for image processing tasks due to its growing popularity as a scientific programming language and the free availability of many state-of-the-art image processing tools in its ecosystem.
- Image processing libraries like OpenCV and Immutils have enabled developers to make the task easy and robust as they provide different methods to work on images also PyTesseract OCR library is developed by google is one of the most popular choices among programmers for character recognition .

CHAPTER 3: DESCRIPTION OF PS-I WORK DONE

The project works with a model categorized in 5 major techniques

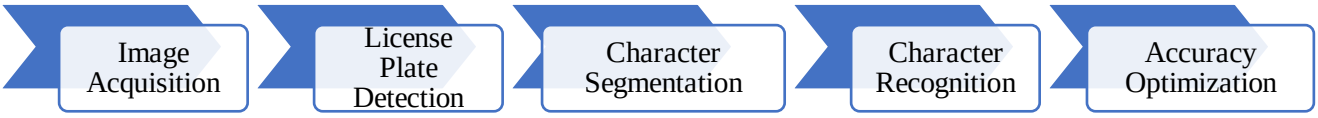

Fig 2: Block diagram of the model

3.1 TRANING DATA SET (XML File) USING CASCADE TRAINER GUI

Cascade Trainer GUI (CTG) is a program that can be used to train, test, and improve cascade classifier models. It uses a graphical interface to set the parameters and make it easy to use OpenCV tools for training and testing classifiers.

We created two sets of images and fetched them into CTG as an input.

- Set 1 containing license plate images, known as “p” - positive images.
- Set 2 containing all the photos (other than that of license plate), known as “n” - negative images

As, the output, the CTG returned a xml file made of the training data set.

Fig 3: “P” - Set of license plate images

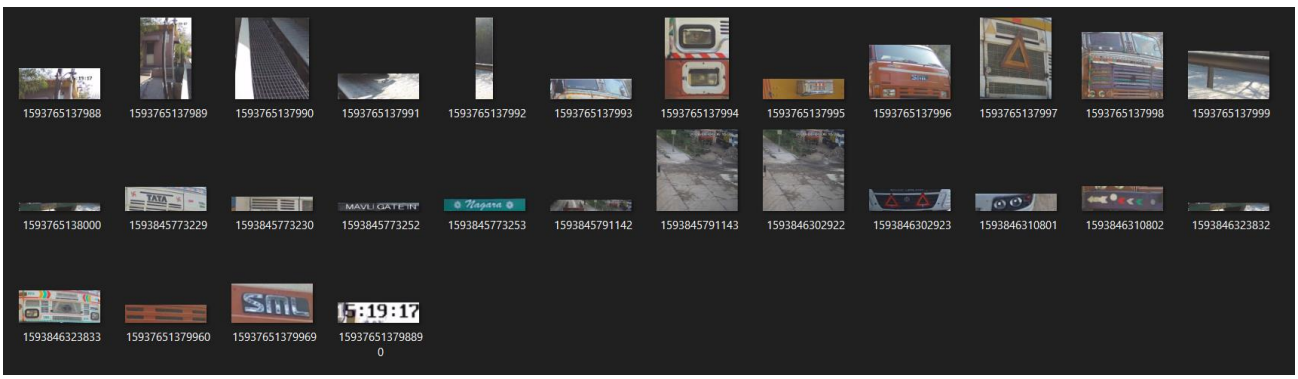

Fig 4: “N” – Set of all other images

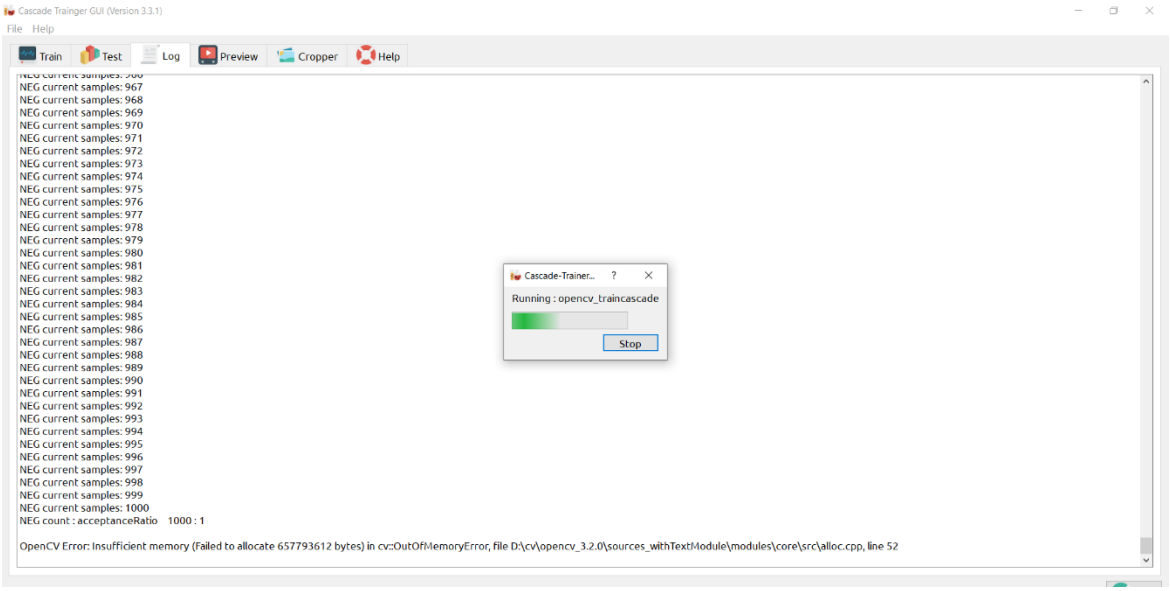

Fig 5: CTG deploying xml file

3.2 RECOGNISING LICENSE PLATE

Step 1: Loading the video and reading each frame

The method of OpenCV – VideoCapture() is used to load the video and read each frame of it.

Fig 6: Truck entering premises

Step 2: Frame processing

Step 2.1: Grayscale conversion of the frame using cvtColor() method of OpenCV

Step 2.2: Smoothening the frame for better results using bilateralFilter() method of OpenCV.

Fig 7: Grayscale frame of the truck

Step 3: Spotting the license plate in the frame using XML file.

The coordinates of the license plate are found with the help of Cascade Classifier. Cascading classifiers are trained with several hundred "positive" sample views of an object and arbitrary "negative" images of the same size. After the classifier is trained it can be applied to a region of an image and detect the object in question.

Step 4: Extraction & Processing of the cropped image of license plate

Step 4.1: Making a rectangular boundary using the coordinates

Step 4.2: Cropping the detected licence plate from the frame

Step 4.3: Resizing the number plate using resize() method of imutils package.

Fig 8: License plate detection by numerous frames

3.3 OPTICAL CHARACTER RECOGNITION

By running the pytesseract library for OCR on the image, we determined/read the characters of the license plate from the cropped image.

3.4 ACCURACY OPTIMISATION

Eliminated the number plates which do not have state code as their first two elements. Also based on whose middle elements are not alphabets and last 4 characters are not numbers.

An algorithm that will make the result accurate by selecting each character from the array element and taking the maximum frequent value and displaying the same.

CHAPTER 4: LIMITATIONS & FUTURE SCOPE

The project aiming at license plate recognition uses specific constraint for better functioning of the model. But these constraints are not always fulfilled. So we came across a limitation of our project:

Due to numerous bifurcations of video in frames, the size of the memory increases. Unlike the filtered original value all elements are merely waste. This can lead to memory issue on real time.

Solution: Optical sensors should be placed on the entry point. It will detect the vehicle from a distance and then start recording.

FUTURE SCOPE

Following are the observations that can be the future scope of the project:

1. Optical Sensors for efficient video recording
2. Cloud storage for all the data and complete model attributes

CHAPTER 5: CONCLUSION

The automatic vehicle license plate recognition system utilizes image processing techniques for recognizing the license plate with video of its entry captured. The optical character recognition model is designed purely in python. Its performance is tried and tested on real time videos of vehicle. As the results expected, it could produce the license number.

In the study going through each step individually we could see results which help us in creating insights for better results. Also, if the limitation mentioned is overcome, this model could be used in real time live projects.

In today's life, where maintaining all records have become essential, our project provides the solution in ease and finesse.

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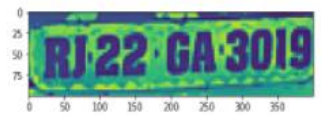
ANNEXURE I

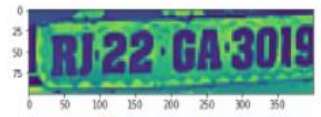
In [38]:
```
import pytesseract
import cv2
import matplotlib.pyplot as plt
import numpy as np
import matplotlib.image as mpimg
import imutils
from PIL import *
import urllib
pytesseract.pytesseract.tesseract_cmd = 'E:\\Tesseract-OCR\\tesseract.exe'
import numpy as np
```

In [39]:
```
#loading trained dataset file
num_cascade = cv2.CascadeClassifier("indian_license_plate.xml")
#loading the video
cap = cv2.VideoCapture("10.15.8.72_31_20200618093853482.mp4")
```

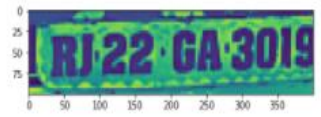
In [30]:
```
letters = [
            '0', '1', '2', '3', '4', '5', '6', '7', '8', '9', 'A', 'B', 'C', 'D',
            'E', 'F', 'G', 'H', 'J', 'K', 'L', 'M', 'N', 'P', 'Q', 'R', 'S', 'T',
            'U', 'V', 'W', 'X', 'Y', 'Z'
]
#this array will contain the lisence plate numbers from each frame
npr=[]
while(True):
    #reading each frame
    ret, frame = cap.read()
    frame = imutils.resize(frame,width=1400)
    #grayscale conversion of the frame
    gray=cv2.cvtColor(frame,cv2.COLOR_BGR2GRAY)
    #smooting the image for better results
    gray = cv2.bilateralFilter(gray,11,17,17)

    #taking the coordinates of the number plate in the frame using XML file
    num=num_cascade.detectMultiScale(gray, 1.1, 4)

    for (x, y, w, h) in num:
        if y>1:
            #making the rectangle using the coordinates
            cv2.rectangle(frame, (x,y), (x+w,y+h), (255,0,0), 2)
            #cropping the the detected lisence plate from the frame
            cropped_img = gray[y:y+h,x:x+w]
            #resizing the number plate
            cropped_img = imutils.resize(cropped_img, width=400)
```



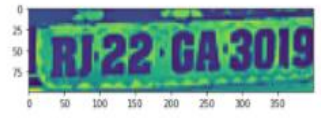
R22GA3019G



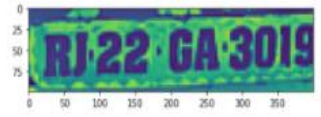
RJ22GA3018



RJ22GA3018



RJ22GA3019



```
            #running the OCR on the image to read the characters
            text = pytesseract.image_to_string(cropped_img, lang='eng')
            #only select the plate which have characters more than 10
            if len(text)>=10:
                t=''
                #it will only select if the characters are in the letters array
                for i in text:
                    if i in letters:
                        t=t+i
                #if the length of the caracters detected is equal to 10 it will append in the npr array
                if len(t)==10:
                    plt.imshow(cropped_img)
                    plt.show()
                    print(t)
                    npr.append(t)
            break
    cv2.imshow('frame',frame)
    #we can quit the video by pressing 'q'
    if cv2.waitKey(1) & 0xFF == ord('q'):
        break
print(npr)
cap.release()
cv2.destroyAllWindows()
```

```
RJ22GA3019
['EEA22GA309', 'RE22GA3019', 'R22GA3019G', 'RJ22GA3018', 'RJ22GA3018', 'RJ22GA3019', 'RJ22GA3019']
```

In [34]:
```
## Accuracy optimization
state=['RJ','AP','AR','AS','BR','CG','GA','GJ','HR','HP','JH','KA','KL','MP','MH','MN','ML','MZ','NL','OD','PB','SK','TN','TS','TR
      'UP','UK','WB','AN','CH','DD','DL','JK','LA','LD','PY']
alphabets=['A','B','C','D','E','F','G','H','I','J','K','L','M','N','O','P','Q','R','S','T','U','V','W','X','Y','Z']
numbers=['0','1','2','3','4','5','6','7','8','9']

temp=[]
#it will eleiminate the number plates which do not have state code as thir first two elements
for i in npr:
    x=i[:2]
    if x in state:
        temp.append(i)
print(temp)
pemp=[]
#it will eleiminate the number plates whose middle elements are not aplhabets and last 4 characters are not numbers
for l in temp:
    x=l[4:5]
    y=l[5:6]
    z1=l[6:7]
    z2=l[7:8]
    z3=l[8:9]
    z4=l[9:10]

    if x in alphabets and y in alphabets and z1 in numbers and z2 in numbers and z3 in numbers and z4 in numbers:
        pemp.append(l)
print(pemp)
del temp
```

```
['RJ22GA3018', 'RJ22GA3018', 'RJ22GA3019', 'RJ22GA3019']
['RJ22GA3018', 'RJ22GA3018', 'RJ22GA3019', 'RJ22GA3019']
```

In [35]:
```
npr=pemp
del pemp
npr
```

Out[35]:
```
['RJ22GA3018', 'RJ22GA3018', 'RJ22GA3019', 'RJ22GA3019']
```

In [36]:
```
'''
this algoritm will make the result accuate by selecting the each caracter from  the array elemnt and taking the maximum
frequent value and displaying it
'''
final=''
for i in range(0,10):
    temp=[]
    for j in range(0,len(npr)):
        temp.append(npr[j][i])
    x=max(set(temp), key = temp.count)
    final=final+x
print(final)
```

```
RJ22GA3019
```