Applied Machine Learning Intensive (AMLI), Summer 2022

Capstone Report

# License Plate Detection and Recognition

July 29, 2022

## 1 Abstract

Our license plate recognition model detects and returns the license plate number of a car entering a garage. We utilized a COCO dataset and SSD mobile net to detect cars that are driving into the garage. Our input data consisted of demo videos of cars entering parking garages here at the University of Arkansas. Our Recognition model utilizes an SVM from common characteristics of license plates such as their contours, edges, and size in order to find the license plate on the car. To prevent missing the license plate, we cycle through each frame of our demo video and check for the license plate in every frame. If a license plate is found, we then utilize MMOCR to put boxes around the text and to return the text found in the frame. Our model is meant to simulate the actions of camera’s used in parking Garages that record videos entering in order to determine how long they have been there. In order to complete the license plate detection, we utilized a GitHub repo to model our license plate detection system.

## 2 Introduction

The most important applications of our Stock Market Predictor are the following:

1. Detect the License plate of car entering a garage
2. Print the text of the license plate number

The extraction of license plate data from cars is very common today. This can include anything from Parking enforcement at our school to law enforcement that use it track suspects. It is very useful because all license plate numbers are unique, so it can easily be used in a parking garage to determine when someone enters, leaves, and to determine whether they paid for parking. This could allow our university to do the following:

1. Display the number of parking spaces available based on the number of unique license plates seen entering the parking garage.
2. Bill anyone that parks without paying by sending the ticket to the address that matches the license plate number
3. Track the flow of traffic through the parking garages on campus

*The contributions and role of each member:*

* Team Manager: Jordy Morquecho
* Program Manager: Perry Williams
* Resource Manager: Eugene Boykins

1. **Phase 1:**

Timeline: June 25, 2022 - July 2, 2022

Goals: Our team is composed of Perry Williams, Jordy Morquecho, and Eugene Boykins. We will build a License plate recognition model.

1. **Phase 2:** Timeline: July 1, 2022- July 09, 2022, Goals:
   * Reviewed GitHub Repository for understanding
     + **Date: July 6-9, 2022**
     + Entire Team
2. **Phase 3:** Timeline: From July 9, 2022, to July 19, 2022

Goals:

* + Reproduced code
    - **Date: July 10, 2022**
    - Jordy
  + Begin modifying source code in order to solve our problem
    - **Date: July 15, 2022**
    - Jordy
  + Begin running code with example videos
    - **Date: July 18, 2022**
    - Jordy

• Begin working on Presentation slides

* + - * **Date: July 18, 2022**
      * Eugene

1. **Phase 4:**

Timeline: July 19, 2022 - July 28, 2022

• Took our own demo video

* + - * **Date: July 20, 2022**
      * Jordy & Perry

• Edited model based on demo video

* + - * **Date: July 21, 2022**
      * Jordy & Perry

• Edit and review Capstone Presentation slides

* + - * **Date: July 23, 2022**
      * Eugene

• Added MMOCR to our model in order to read the information from the license plate.

* + - * **Date: July 25, 2022**
      * Perry

• Made final corrections to model and Presentation slides

* + - * **Date: July 27, 2022**
      * Entire team

## 3 Data Analysis

Our license plate Recognition will take in a demo video of a car driving in a video and return the license plate number. To accomplish this our model loops through every frame of the demo video and utilizes COCO and SSD MobileNet to detect a car in a frame. Then the license plate is detected utilizing characteristics such as contours, edges, and width to length ratio.

## 4 Project Implementation

Our project implementation includes 3 steps. First, we detect whether there is a car in the frame of the video by utilizing the COCO dataset and SSD MobileNet. Second, we process the frame to determine whether a license plate can be found using the methods mentioned above. Lastly, if a license plate is found, we then utilize MMOCR to print the text found on the license plate.

## 5 Experimental Results

5.1 Testing

To test our model performance, we utilized videos we found online to see if our model could accurately identify the license plate number from a video. After finding success with this method, we recorded our own demo video of a car entering a garage.

5.2 Evaluation

For the most part our model performed extremely well on the videos found online and was returning results that matched the license plate number on the car. However, our model did have some trouble with our own demo video in the garage. We believe this is because of the angles and distance at which we had to record the video.

5.3 Results

The primary outputs we received from our model were either no text at all or the correct license plate number. This is exactly what we wanted since returning the wrong license plate could lead to someone receiving a ticket or other disciplinary action when they did not deserve it.

## 6 Conclusion

We created license plate recognition model utilizing an SVM model. This model utilizes characteristics of typical license plates such as their size and contours to detect a license plate on the car. The model then returns the license plate number found in the video. Overall, we great success with our model in terms of printing out the license plate number of the car. The model does however have some downsides such as having to loop through every frame of our demo video which causes it to have long run times. In order to further improve our model, we could have found a dataset of cars and manually annotated them using an annotation and then fed this data to a Convolutional Neural Network. This would allow our model to skip the step of utilizing COCO and SSD MobileNet to detect the cars and could have decrease the use of frames that did not have a clear license plate within them.

## 7 Acknowledgment

We would like to thank our advisors for their guidance, the financial support from our families and sponsors: NACME and GOOGLE, as well as the TA’s and our colleagues.

## References

1. GitHub repo that we used to determine how to proceed in our project, <https://github.com/wzh191920/License-Plate-Recognition>
2. <https://colab.research.google.com/github/open-mmlab/mmocr/blob/main/demo/MMOCR_Tutorial.ipynb#scrollTo=2AZqwCt09XqR>