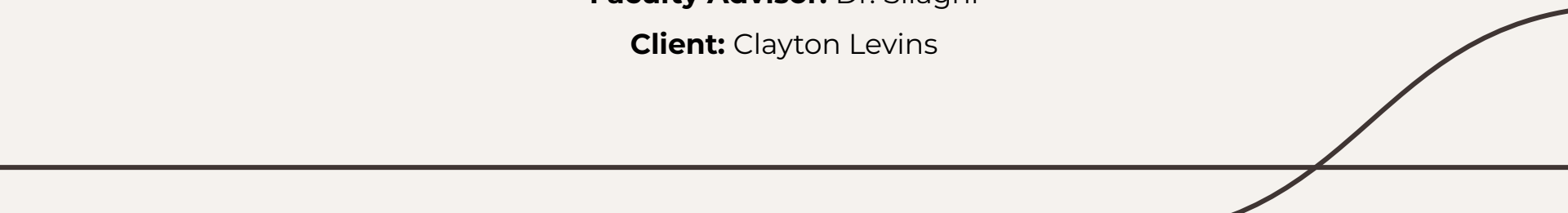# VehID – Milestone Evaluation

Members: Remington Greko, Spencer Hirsch, Thomas Johnson, and Alexis Nagle

Faculty Advisor: Dr. Silaghi

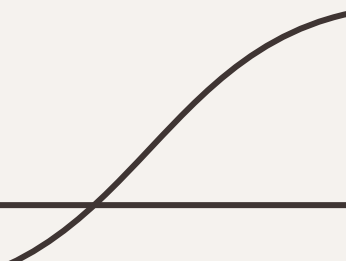**Client:** Clayton Levins

Milestone 4

Milestone 4 Progress Matrix

Task	Completion %	Remington	Spencer	Thomas	Alexis	To-do
Create Database	50%	50%	0%	50%	0%	NA
Create Web Application	50%	50%	0%	50%	0%	NA
Split Dataset	100%	0%	50%	0%	50%	NA
Create Vehicle Make Recognition Model	100%	0%	50%	0%	50%	NA
Hyper-parameter tuning	100%	0%	50%	0%	50%	NA
Data Preprocessing	100%	0%	50%	0%	50%	NA
Sprint Planning	100%	25%	25%	25%	25%	NA
Milestone Evaluation	100%	25%	25%	25%	25%	NA

Vehicle Detection Model

- Yolov8n model
  - 255 layers
    - Primarily convolutional layers
  - 11135687 parameters
  - 11135971 gradients
- Epochs = 30
- Patience = 7

- Training:
  - mAP50: 0.968
  - Precision: 0.914
  - Recall: 0.938
- Testing:
  - mAP50: 0.756
  - Precision: 0.75
  - Recall: 0.75
- In application, restrict to only bounding boxes with > 80% confidence levels
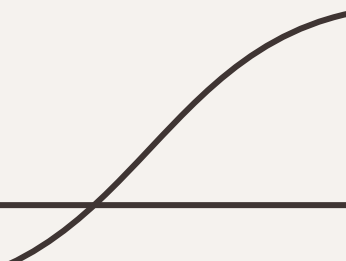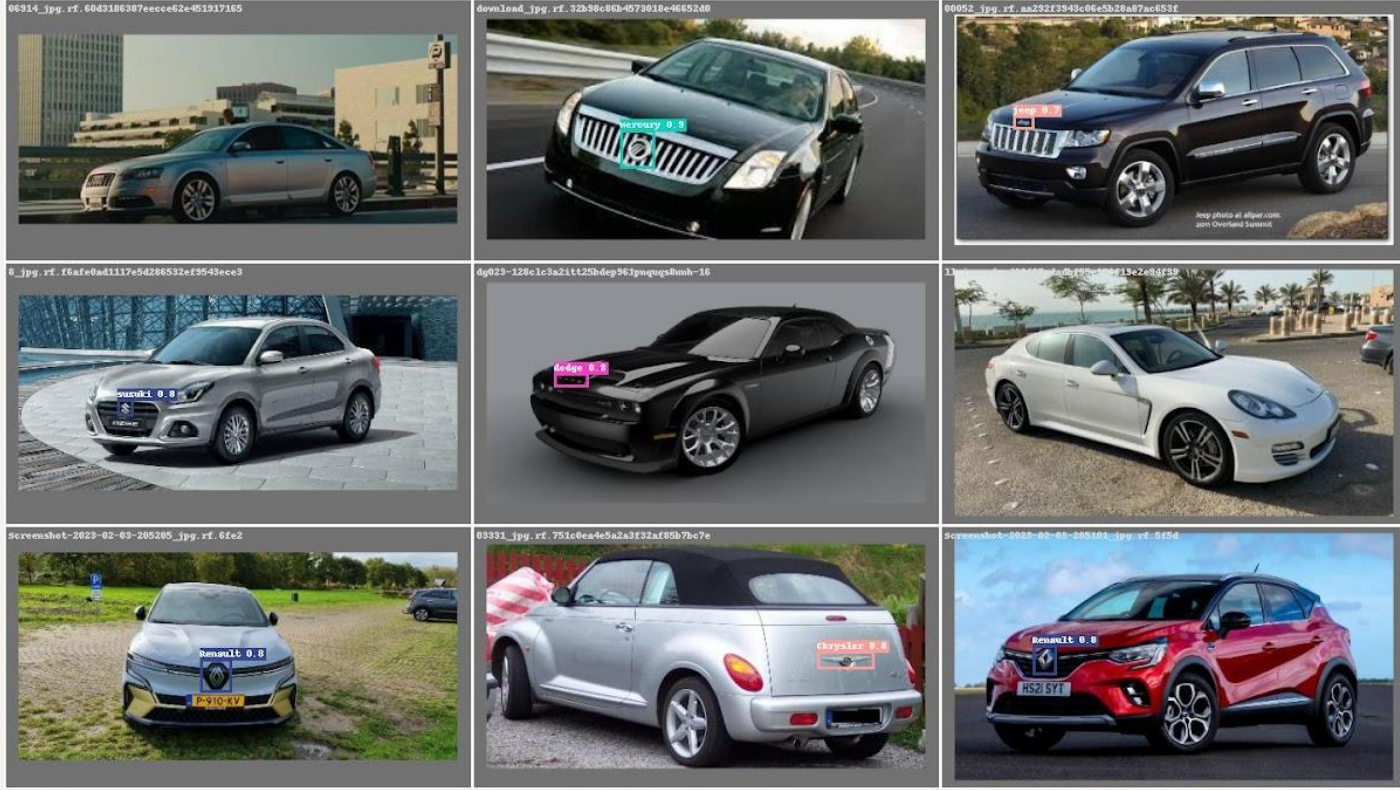
Vehicle Detection Example
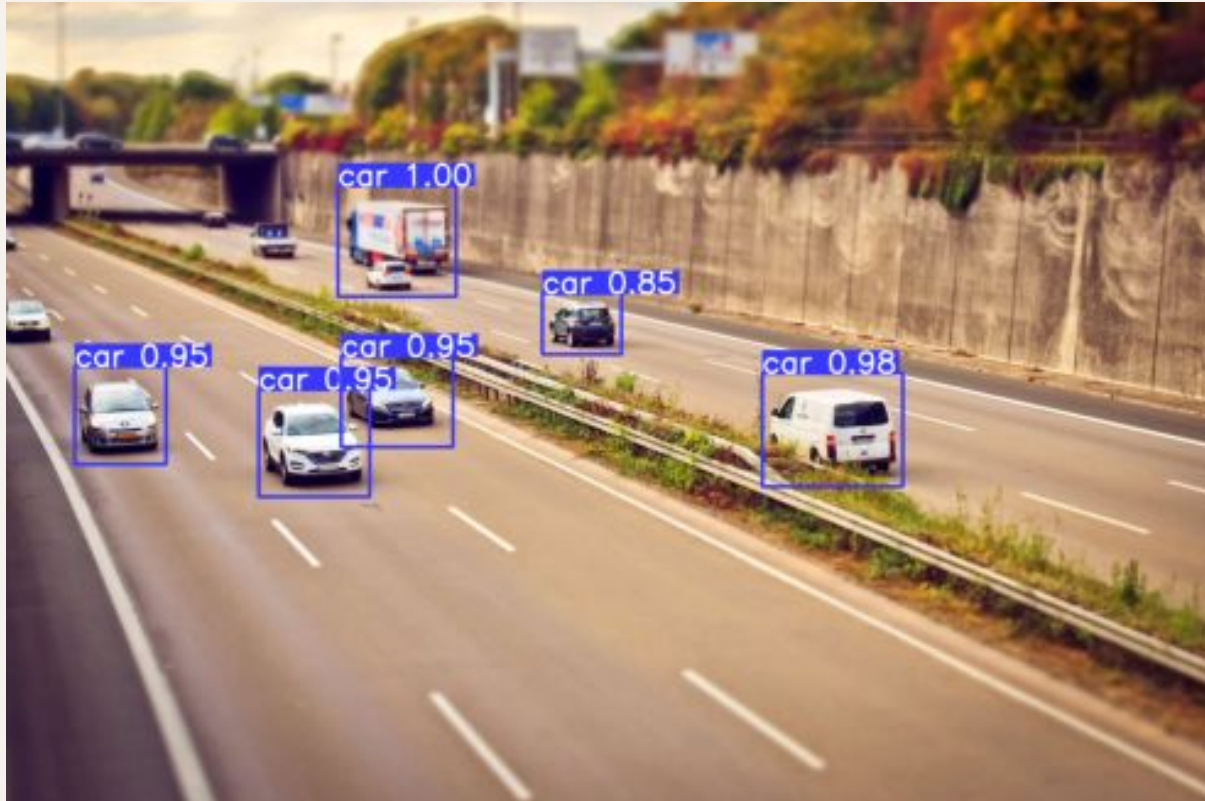
Vehicle Make Data Preparation

- Dataset
  - Roboflow Dataset
  - Pre labeled bounding boxes
  - 33 Classes
    - Audi, Chrysler, Citroen, GMC, Honda, Hyundai, Infiniti, Mazda, Mercedes, Mercury, Mitsubishi, Nissan, Renault, Toyota, Volkswagen, acura, bmw, cadillac, chevrolet, dodge, ford, jeep, kia, lexus, lincoln, mini, porsche, ram, range rover, skoda, subaru, suzuki, volvo
- Split Dataset
  - The dataset was presplit into 16339 Training, 1146 Validation, 730 Testing
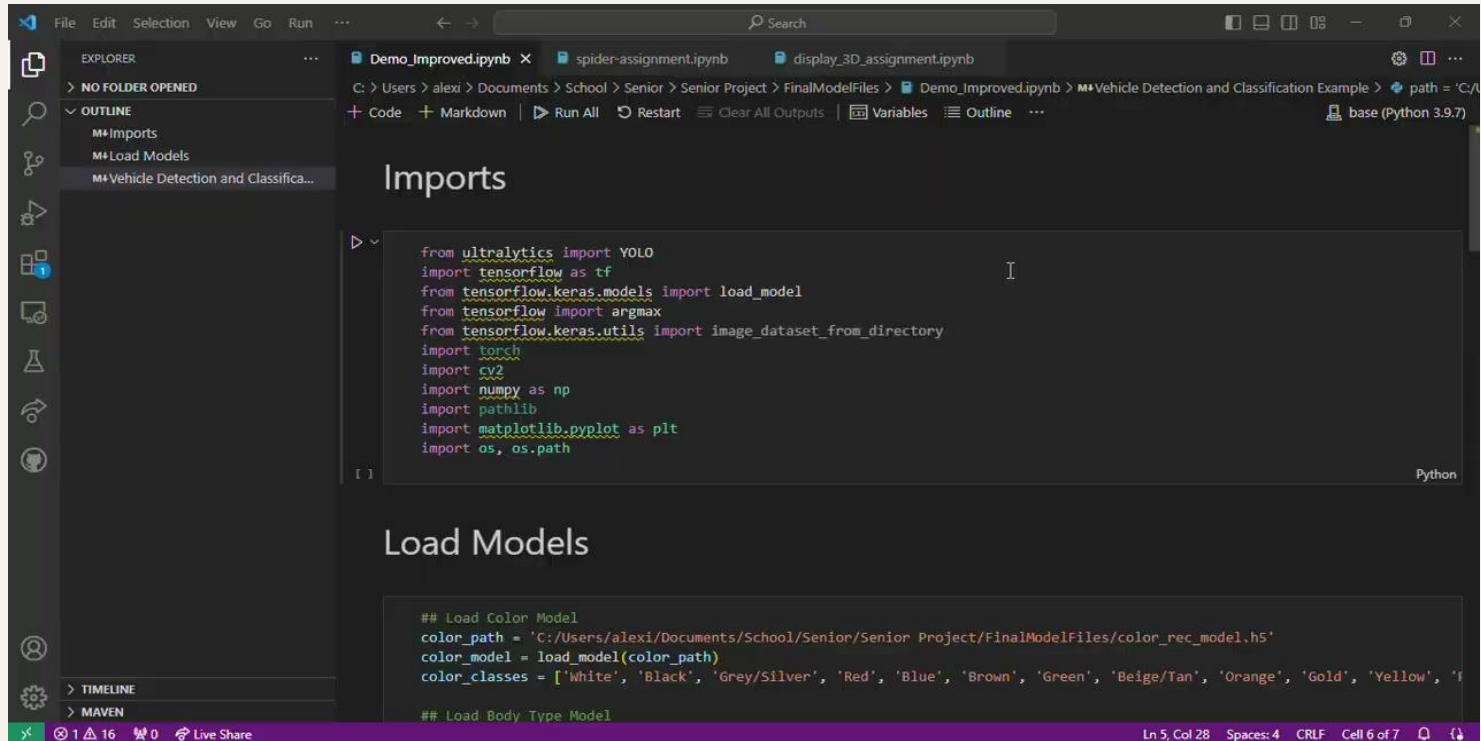
Vehicle Make Detection Model

- Yolov8m model
  - 295 layers
    - Primarily convolutional layers
  - 25876006 parameters
  - 25875990 gradients
- Epochs = 30
- Patience = 5

- Training:
  - mAP50: 0.767
  - Precision: 0.806
  - Recall: 0.706
- Testing:
  - mAP50: 0.704
  - Precision: 0.78
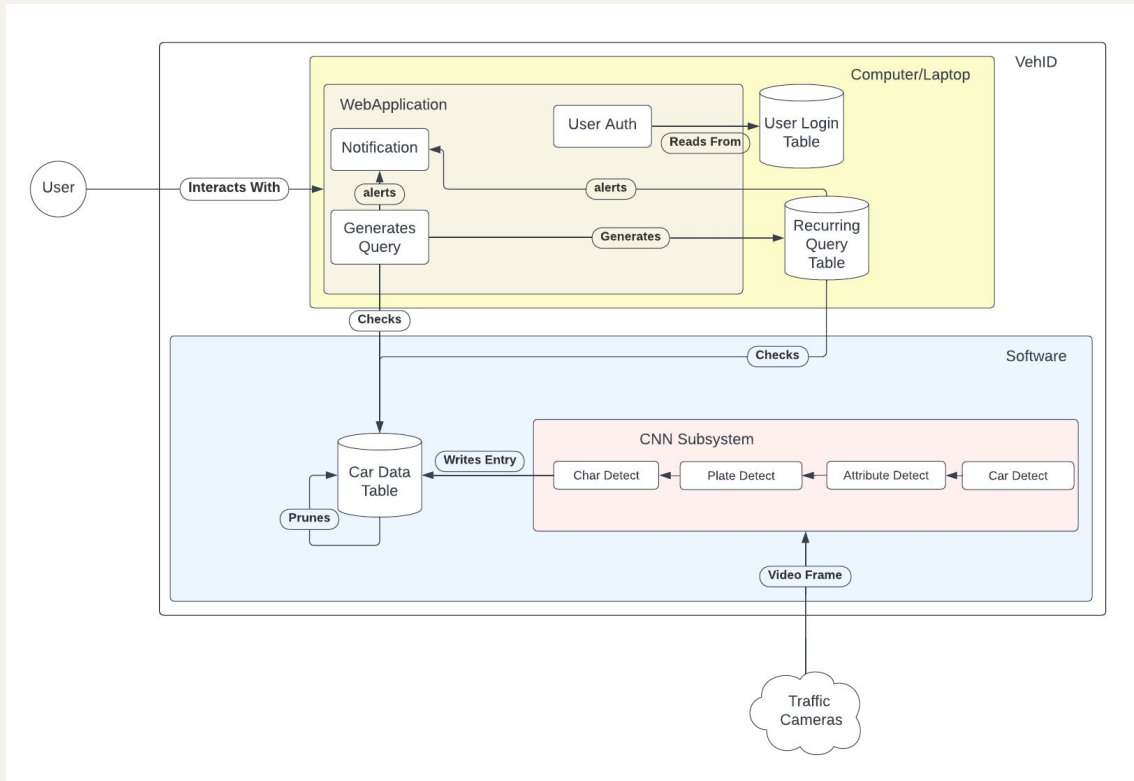 - Recall: 0.626

Vehicle Make Detection Model Confusion Matrix

Vehicle Make Detection Model Example

Live Demo

Updated System Architecture

Web Application UI Mockup

Vehicle Identification

Input a Query | Check Timed Queries | Table View

Submitting a Query

Select Vehicle Color:

[Select a color]

Select Vehicle Body:

[Select a body type]

Select a body type
Convertible
Coupe
Hatchback
Pick-Up
Sedan
SUV
VAN

Query Time:

[Select Time To Recheck]

Submit Query

```javascript
document.addEventListener('DOMContentLoaded', function() {
    const colorSelect = document.getElementById('color');
    colorSelect.innerHTML += generateColorOptions();

    const bodySelect = document.getElementById('body-style');
    bodySelect.innerHTML += generateBodyOptions();

    const makeSelect = document.getElementById('make');
    makeSelect.innerHTML += generateMakeOptions();

    const querySelect = document.getElementById('query');
    querySelect.innerHTML += generateQueryTimes();
});
```

Web Application UI Mockup

```
fetch(filePath)
    .then (response => response.json())
    .then (data => {
        data.forEach(item => {
            const entry = {
                id: item.id,
                color: item.Color,
                body: item.Body,
                make: item.Make,
                license: item.License,
                timer: item.QueryTime
            };
            queryList.push(entry)
        });
        generateEntries(queryList);
    });
```

```
[
    {
        "Body": "SUV",
        "Color": "orange",
        "License": "DTL W74",
        "Make": "GMC",
        "QueryTime": 30,
        "id": 1
    },
    {
        "Body": "Pick-Up",
        "Color": "black",
        "License": "P62-11T",
        "Make": "lincoln",
        "QueryTime": 60,
        "id": 2
    },
    {
        "Body": "SUV",
        "Color": "red",
        "License": "KZN-6575",
        "Make": "bmw",
        "QueryTime": 60,
    }
```

Web Application UI Mockup

Vehicle Identification

Input a Query | Check Timed Queries | Car Table

Viewing Queries

ID: 1
Color: orange Body: SUV Make: GMC
License: DTL W74
Time to recheck query: 30

ID: 2
Color: black Body: Pick-Up Make: lincoln
License: P62-11T
Time to recheck query: 60

ID: 3
Color: red Body: SUV Make: bmw
License: KZN-6575
Time to recheck query: 60

ID: 5
Color: gold Body: SUV Make: Mitsubishi
License: 670 PQL
Time to recheck query: 15

ID: 6
Color: orange Body: Coupe Make: volvo
License: 8EP N30
Time to recheck query: 45

ID: 7
Color: white Body: Sedan Make: Audi
License: XMH W12
Time to recheck query: 60

ID: 9
Color: red Body: Sedan Make: volvo
License: SQC 489
Time to recheck query: 45

ID: 10
Color: gold Body: Convertible Make: range rover
License: 58A•507
Time to recheck query: 30

ID: 11
Color: white Body: Convertible Make: lexus
License: SBM 920
Time to recheck query: 60

ID: 13
Color: red Body: SUV Make: kia
License: PAB 2008
Time to recheck query: 60

ID: 14
Color: purple Body: Convertible Make: Nissan
License: 838 SVB
Time to recheck query: 15

ID: 15
Color: blue Body: Pick-Up Make: Mazda
License: YYC-620
Time to recheck query: 15

Database

id		Color		Body		Make		License		Image	
	Search column...		Search column...		Search column...		Search column...		Search column...		Search column...
1	1	green		VAN		lexus		61H K07		NA	
2	2	red		Convertible		Mercedes		418-KKC		NA	
3	3	white		Sedan		Hyundai		ZKD 491		NA	
4	4	purple		Pick-Up		dodge		167 1SE		NA	
5	5	green		Pick-Up		chevrolet		WP 3039		NA	
6	6	beige-tan		Coupe		jeep		33IQ845		NA	
7	7	grey-silver		Coupe		jeep		URX-828		NA	
8	8	red		Sedan		kia		50W A56		NA	
9	9	green		SUV		volvo		ZIR-758		NA	
10	10	yellow		VAN		lincoln		0994 ZF		NA	
11	11	blue		SUV		Mazda		FUV 056		NA	
12	12	pink		SUV		cadillac		LLU8053		NA	
13	13	white		Sedan		Citroen		1YQ0557		NA	
14	14	purple		SUV		cadillac		K67 7HI		NA	
15	15	grey-silver		Hatchback		range rover		5HTV020		NA	
16	16	red		Coupe		mini		LNJ4034		NA	
17	17	orange		VAN		subaru		702-IZH		NA	
18	18	yellow		Convertible		ram		1IO 256		NA	
19	19	beige-tan		Convertible		Renault		5OY O08		NA	

Reset Filters   Records: 500

id		Color		Body		Make		License		QueryTime	
	Search column...		Search column...		Search column...		Search column...		Search column...		Search column...
1	1	orange		SUV		GMC		DTL W74		30	
2	2	black		Pick-Up		lincoln		P62-11T		60	
3	3	red		SUV		bmw		KZN-6575		60	
4	4	red		Convertible		GMC		108R6		30	
5	5	gold		SUV		Mitsubishi		670 PQL		15	
6	6	orange		Coupe		volvo		8EP N30		45	
7	7	white		Sedan		Audi		XMH W12		60	
8	8	red		Pick-Up		suzuki		860572		15	
9	9	red		Sedan		volvo		SQC 489		45	
10	10	gold		Convertible		range rover		58A•507		30	
11	11	white		Convertible		lexus		SBM 920		60	
12	12	orange		Coupe		ram		JKC6052		60	
13	13	red		SUV		kia		PAB 2008		60	
14	14	purple		Convertible		Nissan		838 SVB		15	
15	15	blue		Pick-Up		Mazda		YYC-620		15	
16	16	yellow		Convertible		suzuki		40J 469		30	
17	17	purple		Convertible		GMC		719 8QR		60	
18	18	red		Sedan		lexus		QEX 4338		15	
19	19	purple		VAN		Audi		C36-RLT		5	

Web Application Hosting

Free Hosting – Researched multiple options for free server hosting as well as hosting images on a separate server application

Andrew.fit.edu – Dr. Silaghi suggested using the FIT servers to host our web
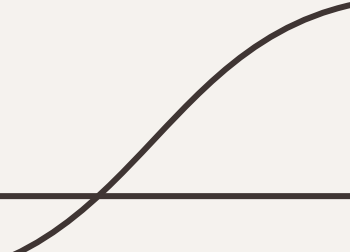
Client Feedback - Clayton Levins

- Very pleased with the progress we are making
  - Showed a small demonstration of make recognition
  - Showed a small demonstration of vehicles in frame recognition
- Looking forward to seeing our front end and database integration
- Continues to be pleased with the way that we handle our work load

Advisor Feedback – Dr. Silaghi

Create Database – Received feedback on ER Diagram, some adjustments need to be made.

Create Web Application – Did not have a demonstration prepared, no comments were made regarding design.

Split Dataset – Didn't express any concern

Create Recognition Model – Expressed concern with the size of our model with it having 295 layers.

Advisor Feedback Continued

Hyper-parameter Tuning – No comments were made regarding tuning of model.

Data Preprocessing – Had no concerns with data preprocessing.

Spring Planning – Previously gave advice with workload division.

Milestone Evaluation – Suggested some additions to Milestone Evaluation Documentation.

Milestone 5

Milestone 5 Tasks

Construct Web Application – Continue working on Web Application.

Implement License Plate Recognition – Construct two CNNs for the purpose of license plate recognition.

Hyper-parameter Tuning – Improve performance of CNNs.

Data Preprocessing – Ensure data fits requirements for models.

Implement Video Processing – Implement vehicle recognition in frames.

Milestone 5 Tasks Continued

Split Dataset – Split data into train, test, and validation samples.

Create Poster and Ebook – Create both required pieces for Milestone 5.

Sprint Planning – Discuss work necessary in effectively completing the tasks laid out for this milestone.

Milestone Evaluation – Document our progress for this Milestone.

Task Matrix - Milestone 5

Task	Remington	Spencer	Thomas	Alexis
Construct Web Application	50%	0%	50%	0%
Implement License Plate Recognition Model	0%	50%	0%	50%
Hyper-parameter tuning	0%	50%	0%	50%
Data preprocessing	0%	50%	0%	50%
Implement Video Processing	0%	50%	0%	50%
Split Dataset	0%	50%	0%	50%
Create Poster and Ebook for Senior Design Showcase	25%	25%	25%	25%
Sprint Planning	25%	25%	25%	25%
Milestone Evaluation	25%	25%	25%	25%

Questions?