

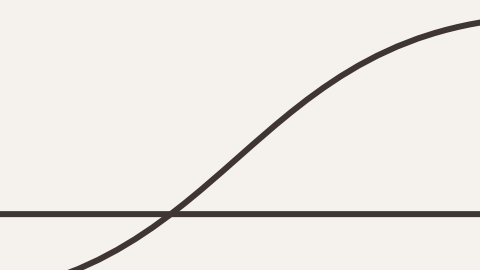


VehID – Milestone Evaluation

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

Faculty Advisor: Dr. Silaghi

Client: Clayton Levins



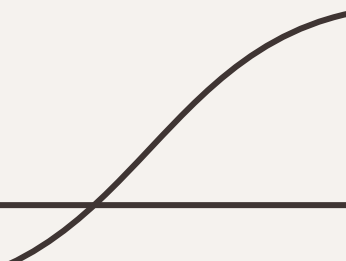
The image features two horizontal lines, one at the top and one at the bottom. Each line has a smooth, curved end on the left and right sides, creating a frame-like effect.

Milestone 4

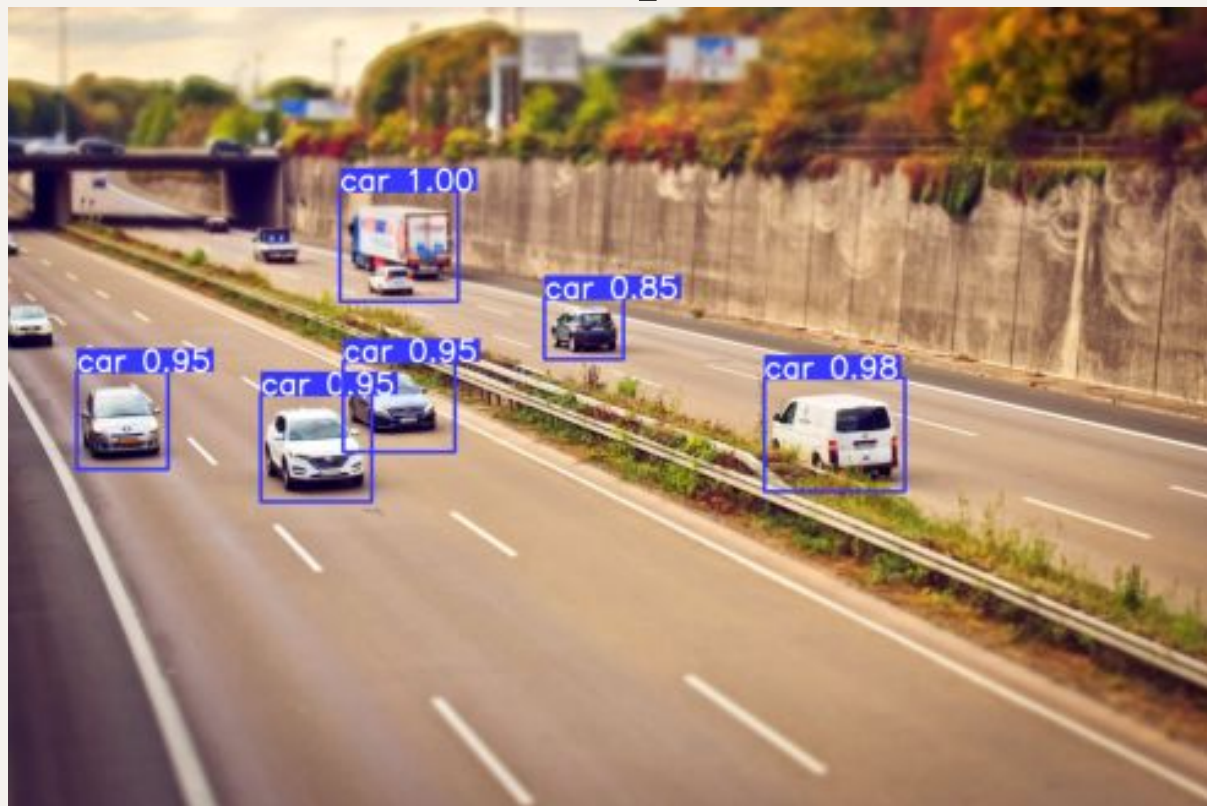
Milestone 4 Progress Matrix

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



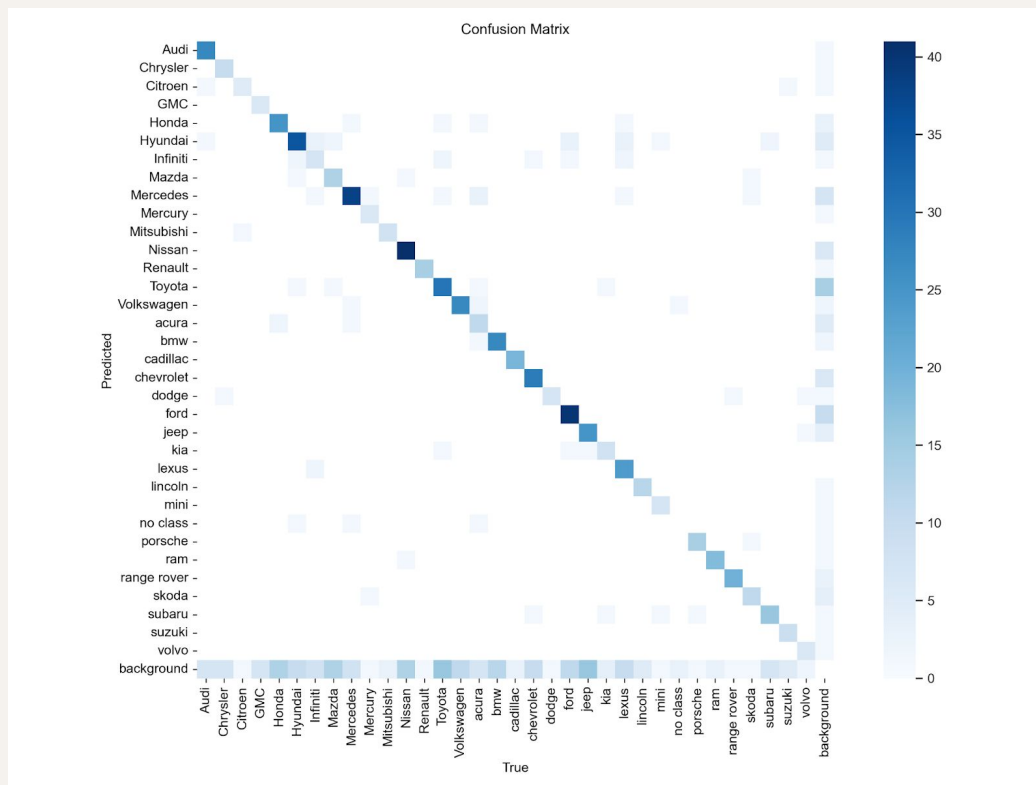
Vehicle Make Data Preparation

- 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

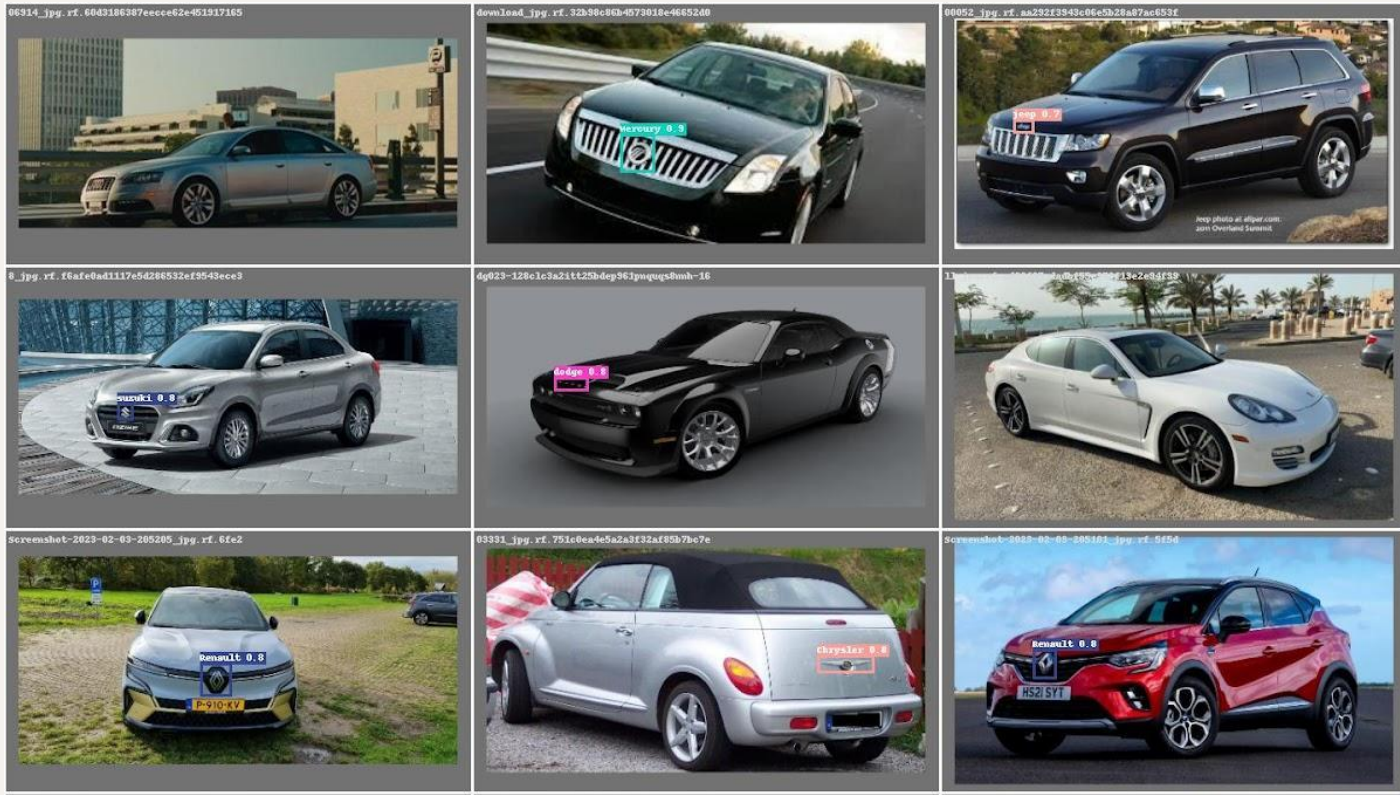
Vehicle Make Detection Model

- 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

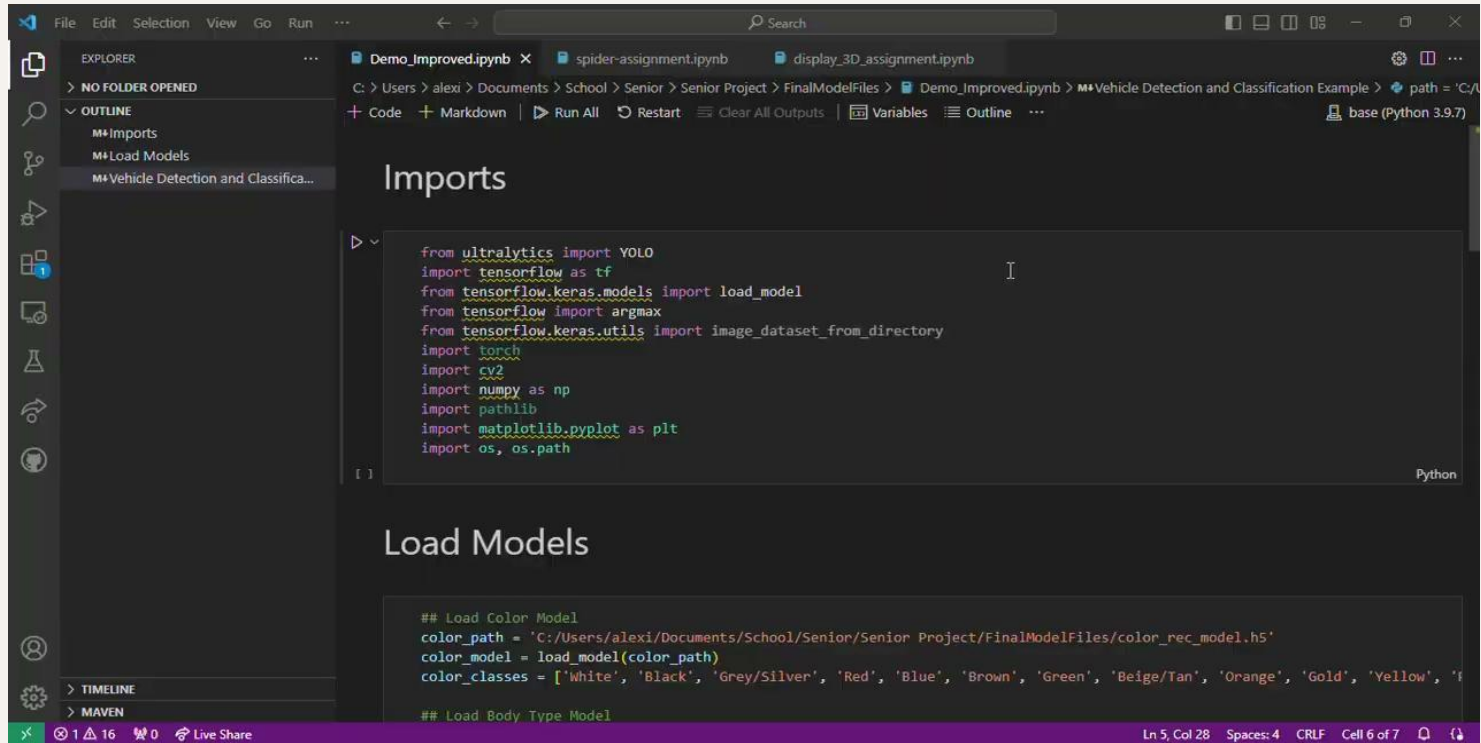
Vehicle Make Detection Model Confusion Matrix



Vehicle Make Detection Model Example



Live Demo



The screenshot shows a Jupyter Notebook titled "Demo_Improved.ipynb" open in VS Code. The interface includes a sidebar with an Explorer and Outline view, a main editor area with a code cell, and a status bar at the bottom.

Imports

```
from ultralytics import YOLO
import tensorflow as tf
from tensorflow.keras.models import load_model
from tensorflow import argmax
from tensorflow.keras.utils import image_dataset_from_directory
import torch
import cv2
import numpy as np
import pathlib
import matplotlib.pyplot as plt
import os, os.path
```

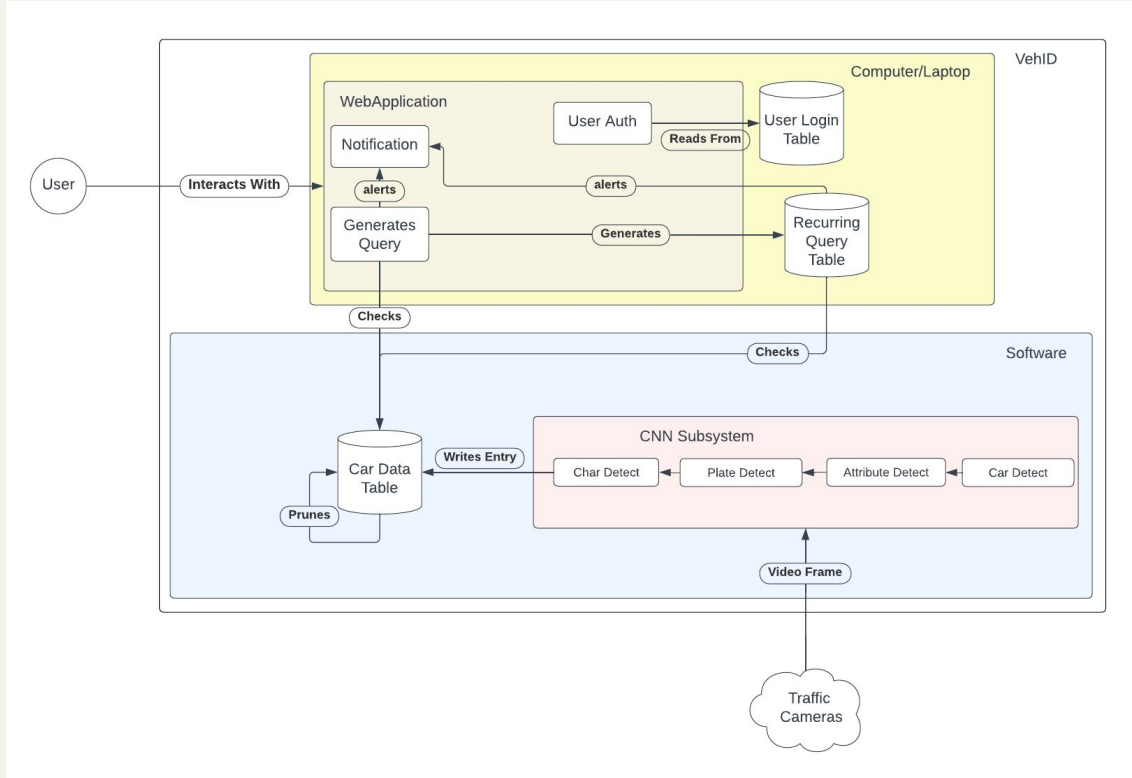
Load Models

```
## Load Color Model
color_path = 'C:/Users/alexi/Documents/School/Senior Project/FinalModelFiles/color_rec_model.h5'
color_model = load_model(color_path)
color_classes = ['White', 'Black', 'Grey/Silver', 'Red', 'Blue', 'Brown', 'Green', 'Beige/Tan', 'Orange', 'Gold', 'Yellow', 'f
```

Python

Ln 5, Col 28 Spaces: 4 CRLF Cell 6 of 7

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

Convertible

Coupe

Hatchback

Pick-Up

Sedan

SUV

VAN

Query Time:

Select Time To Rereck

Submit Query

Web Application UI Mockup

Vehicle Identification

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

Web Application UI Mockup

Vehicle Identification

Check Timed Queries

Car Table

Queries

ID	Color	Body	Make	License	Image Link
1	green	VAN	lexus	61H K07	NA
2	red	Convertible	Mercedes	418-KKC	NA
3	white	Sedan	Hyundai	ZKD 491	NA
4	purple	Pick-Up	dodge	167 1SE	NA
5	green	Pick-Up	chevrolet	WP 3039	NA
6	beige-tan	Coupe	jeep	33IQ845	NA
7	grey-silver	Coupe	jeep	URX-828	NA
8	red	Sedan	kia	50W A56	NA
9	green	SUV	volvo	ZIR-758	NA
10	yellow	VAN	lincoln	0994 ZF	NA
11	blue	SUV	Mazda	FUV 056	NA
12	pink	SUV	cadillac	LLU8053	NA
13	white	Sedan	Citroen	1YQ0557	NA
14	purple	SUV	cadillac	K67 7HI	NA
15	grey-silver	Hatchback	range rover	5HTV020	NA
16	red	Coupe	mini	LNJ4034	NA
17	orange	VAN	subaru	702-IZH	NA
18	yellow	Convertible	ram	1IO 256	NA
19	beige-tan	Convertible	Renault	5OY O08	NA
20	red	SUV	volvo	149 2661	NA
21	blue	Convertible	volvo	QUM 363	NA
22	green	VAN	GMC	7I 7Z5NWZ	NA

Database

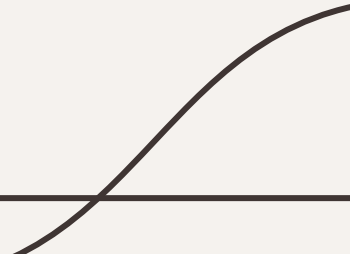
	id	Color	Body	Make	License	Image
	<input data-bbox="117 314 241 330" type="text" value="Search column..."/>	<input data-bbox="272 314 396 330" type="text" value="Search column..."/>	<input data-bbox="426 314 550 330" type="text" value="Search column..."/>	<input data-bbox="581 314 705 330" type="text" value="Search column..."/>	<input data-bbox="736 314 859 330" type="text" value="Search column..."/>	<input data-bbox="890 314 1014 330" type="text" value="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 15E	NA
5	5	green	Pick-Up	chevrolet	WP 3039	NA
6	6	beige-tan	Coupe	jeep	331Q845	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	11O 256	NA
19	19	beige-tan	Convertible	Renault	5OY O08	NA

Set Filters		Records: 500				
	id	Color	Body	Make	License	QueryTime
	<input data-bbox="1047 314 1170 330" type="text" value="Search column..."/>	<input data-bbox="1201 314 1325 330" type="text" value="Search column..."/>	<input data-bbox="1356 314 1479 330" type="text" value="Search column..."/>	<input data-bbox="1510 314 1634 330" type="text" value="Search column..."/>	<input data-bbox="1665 314 1789 330" type="text" value="Search column..."/>	<input data-bbox="1819 314 1932 330" type="text" value="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	XXH W12	60
8	8	red	Pick-Up	suzuki	860572	15
9	9	red	Sedan	volvo	5QC 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	C3G-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.

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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%

The image features two horizontal lines, one at the top and one at the bottom. Each line has a smooth, curved segment at its left and right ends, creating a frame-like effect. The word "Questions?" is centered between these lines.

Questions?