

MICHIGAN STATE

UNIVERSITY

Alpha Presentation

Learning New Train Routes

The Capstone Experience

Union Pacific

Kangjie Mi

Matthew Schleusener

Nick Summers

Jon Wild

Department of Computer Science and Engineering

Michigan State University

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*From Students...
...to Professionals*

Project Overview

- Problem
 - Training costs millions every year
- Solution
 - Create AR experience
 - Overlay track information
 - Recognize signals and switches
 - Put on web app



System Architecture

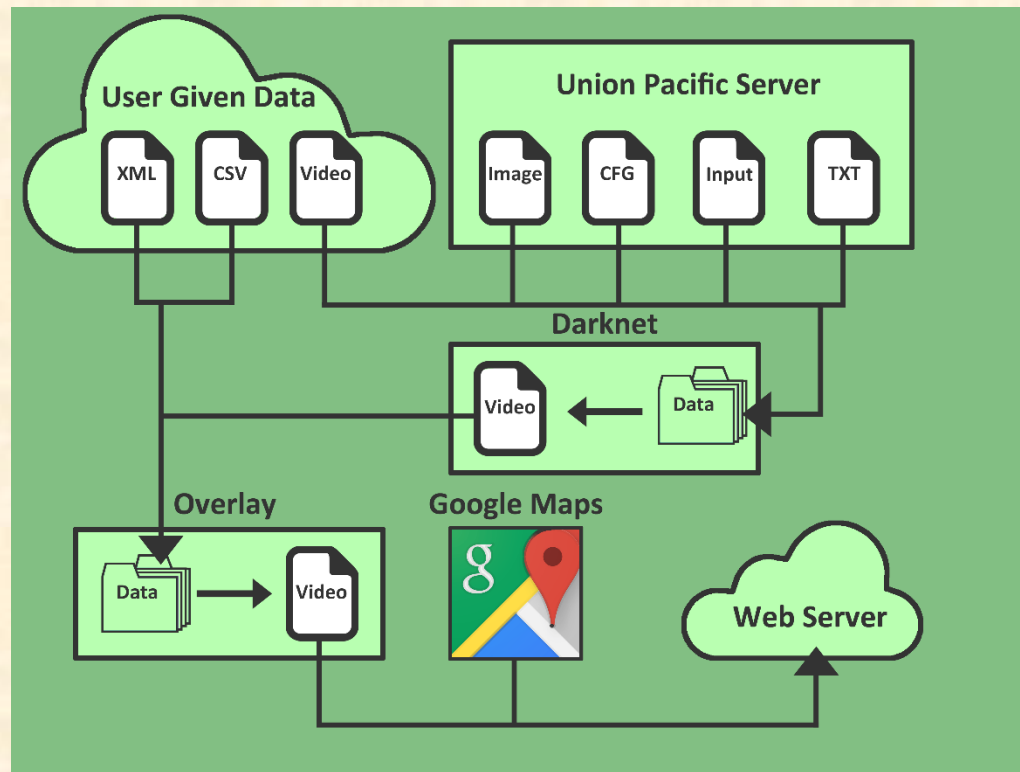


Image Recognition – Needed Files
























 Darknet1	2/13/2017 3:01 PM	JPG File	39 KB
 Darknet1	2/15/2017 2:24 PM	Text Document	1 KB
 Darknet2	2/13/2017 3:01 PM	JPG File	10 KB
 Darknet2	2/15/2017 2:31 PM	Text Document	1 KB
 Darknet3	2/13/2017 3:01 PM	JPG File	11 KB
 Darknet4	2/13/2017 3:01 PM	JPG File	52 KB
 Darknet4	2/15/2017 2:36 PM	Text Document	1 KB
 Darknet5	2/13/2017 3:01 PM	JPG File	41 KB
 Darknet5	2/15/2017 2:40 PM	Text Document	1 KB
 Darknet6	2/13/2017 3:01 PM	JPG File	27 KB
 Darknet6	2/15/2017 2:43 PM	Text Document	1 KB
 Darknet7	2/13/2017 3:01 PM	JPG File	18 KB
 Darknet7	2/15/2017 2:45 PM	Text Document	1 KB
 Darknet8	2/13/2017 3:01 PM	JPG File	29 KB
 Darknet8	2/15/2017 2:49 PM	Text Document	1 KB
 Darknet9	2/13/2017 3:01 PM	JPG File	22 KB
 Darknet9	2/15/2017 2:49 PM	Text Document	1 KB
 Darknet10	2/13/2017 3:02 PM	JPG File	41 KB
 Darknet10	2/15/2017 2:24 PM	Text Document	1 KB
 Darknet11	2/13/2017 3:02 PM	JPG File	34 KB
 Darknet11	2/15/2017 2:25 PM	Text Document	1 KB
 Darknet12	2/13/2017 3:02 PM	JPG File	20 KB
 Darknet12	2/15/2017 2:26 PM	Text Document	1 KB



Image Recognition - Breakdown



```
Darknet1 - Notepad
File Edit Format View Help
0 0.355859 0.672222 0.063281 0.400000
1 0.664844 0.650694 0.065625 0.565278
|
```



Image Recognition - Train

```
cmd Command Prompt - darknet.exe detector train obj.data yolo-obj.cfg darknet19_448.conv.23

C:\Users\Nick\Desktop\Team-UP-Capstone-Project\Build-Darknet\darknet\build\darknet\x64>darknet.exe detector train
yolo-obj
layer   filters  size      input              output
0 conv   32        3 x 3 / 1  416 x 416 x 3    -> 416 x 416 x 32
1 max    2 x 2 / 2  416 x 416 x 32  -> 208 x 208 x 32
2 conv   64        3 x 3 / 1  208 x 208 x 32  -> 208 x 208 x 64
3 max    2 x 2 / 2  208 x 208 x 64  -> 104 x 104 x 64
4 conv   128       3 x 3 / 1  104 x 104 x 64   -> 104 x 104 x 128
5 conv   64        1 x 1 / 1  104 x 104 x 128 -> 104 x 104 x 64
6 conv   128       3 x 3 / 1  104 x 104 x 64   -> 104 x 104 x 128
7 max    2 x 2 / 2  104 x 104 x 128 -> 52 x 52 x 128
8 conv   256       3 x 3 / 1  52 x 52 x 128   -> 52 x 52 x 256
9 conv   128       1 x 1 / 1  52 x 52 x 256   -> 52 x 52 x 128
10 conv  256       3 x 3 / 1  52 x 52 x 128   -> 52 x 52 x 256
11 max   2 x 2 / 2  52 x 52 x 256   -> 26 x 26 x 256
12 conv  512       3 x 3 / 1  26 x 26 x 256   -> 26 x 26 x 512
13 conv  256       1 x 1 / 1  26 x 26 x 512   -> 26 x 26 x 256
14 conv  512       3 x 3 / 1  26 x 26 x 256   -> 26 x 26 x 512
15 conv  256       1 x 1 / 1  26 x 26 x 512   -> 26 x 26 x 256
16 conv  512       3 x 3 / 1  26 x 26 x 256   -> 26 x 26 x 512
17 max   2 x 2 / 2  26 x 26 x 512   -> 13 x 13 x 512
18 conv  1024      3 x 3 / 1  13 x 13 x 512   -> 13 x 13 x1024
19 conv  512       1 x 1 / 1  13 x 13 x1024   -> 13 x 13 x 512
20 conv  1024      3 x 3 / 1  13 x 13 x 512   -> 13 x 13 x1024
21 conv  512       1 x 1 / 1  13 x 13 x1024   -> 13 x 13 x 512
22 conv  1024      3 x 3 / 1  13 x 13 x 512   -> 13 x 13 x1024
23 conv  1024      3 x 3 / 1  13 x 13 x1024   -> 13 x 13 x1024
24 conv  1024      3 x 3 / 1  13 x 13 x1024   -> 13 x 13 x1024
25 route 16
26 reorg 26 24      / 2        26 x 26 x 512   -> 13 x 13 x2048
27 route 26 24
28 conv  1024      3 x 3 / 1  13 x 13 x3072   -> 13 x 13 x1024
29 conv  40        1 x 1 / 1  13 x 13 x1024   -> 13 x 13 x 40
30 detection

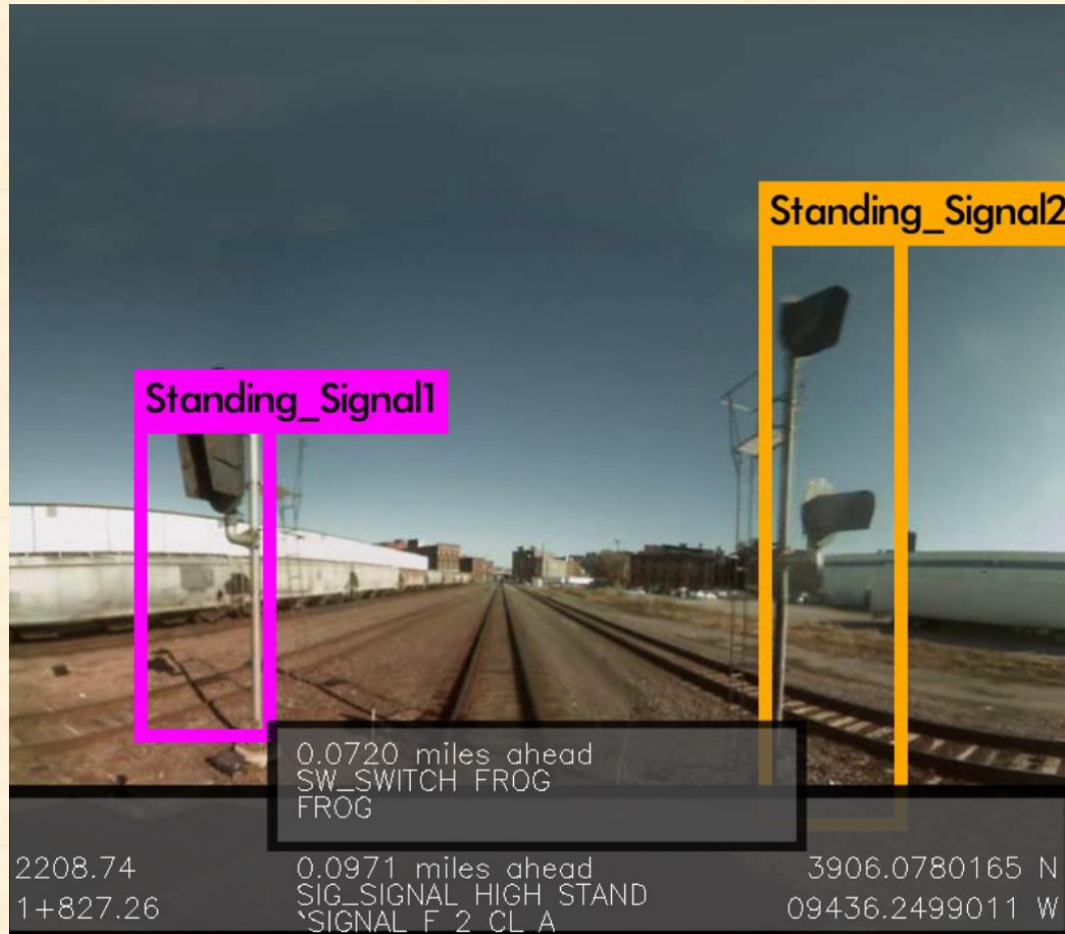
Loading weights from darknet19_448.conv.23...Done!
Learning Rate: 0.0001, Momentum: 0.9, Decay: 0.0005
Loaded: 4.795000 seconds
Region Avg IOU: 0.189858, Class: 0.298231, Obj: 0.442942, No Obj: 0.510077, Avg Recall: 0.000000, count: 10
Region Avg IOU: 0.189474, Class: 0.298963, Obj: 0.439253, No Obj: 0.510115, Avg Recall: 0.000000, count: 10
Region Avg IOU: 0.189912, Class: 0.296682, Obj: 0.441914, No Obj: 0.510088, Avg Recall: 0.000000, count: 10
Region Avg IOU: 0.188126, Class: 0.297333, Obj: 0.440256, No Obj: 0.510109, Avg Recall: 0.000000, count: 10
```



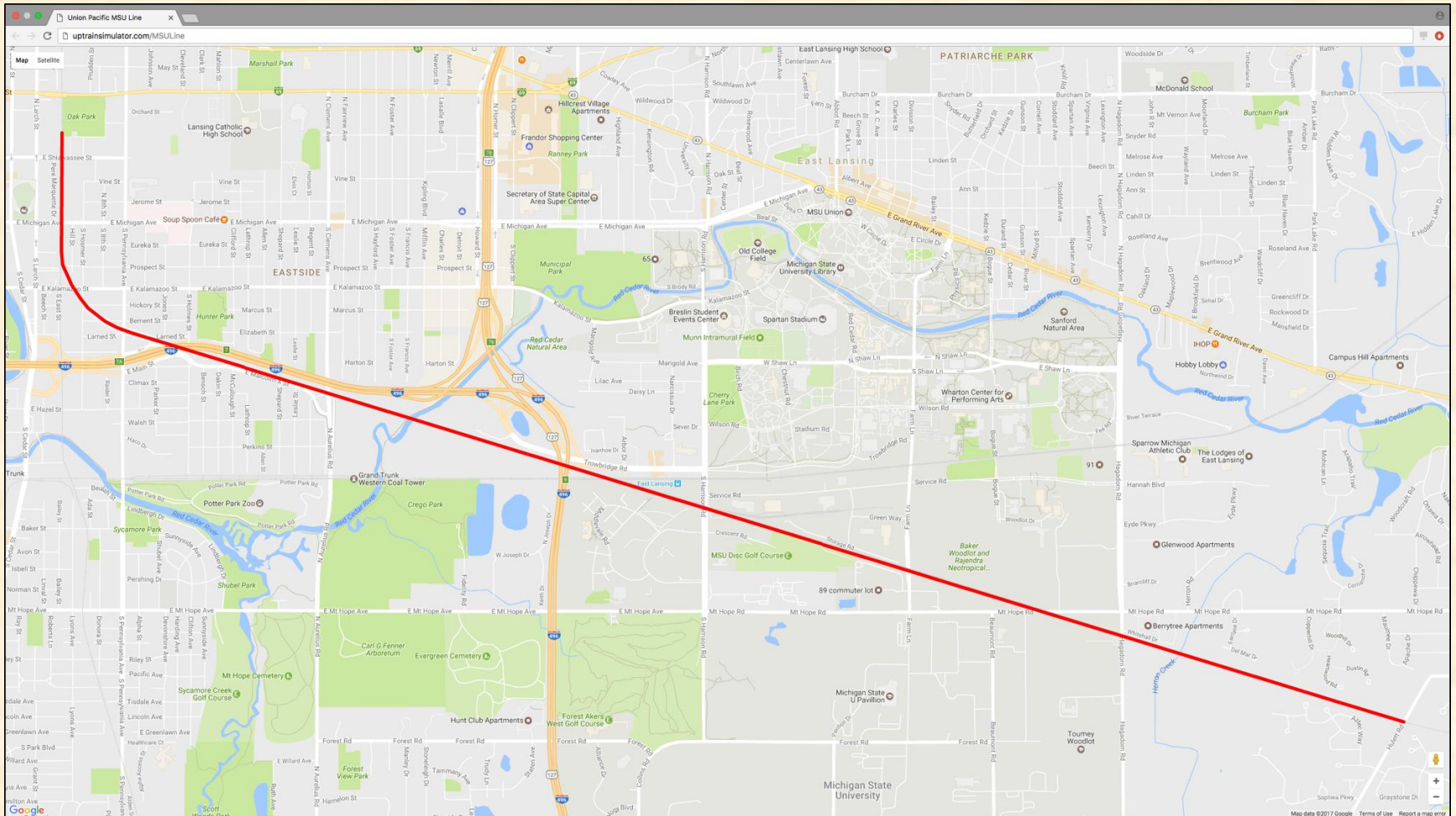
Image Recognition - Test



Overlay Module



Google Maps



What's left to do?

- Recognize switches
- Design website artwork
- Clean up video output
 - CSV Data
 - AVI to MP4 conversion
- Use Google Maps to skip video on polyline click



Questions?

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