

Enhanced Transportation Asset Data Collection Using Video Log Image Pattern Recognition

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**on-going research project of “Developing Image
Pattern Recognition Algorithms for Processing
Video Log Images to Enhance Roadway
Infrastructure Data Collection”**

Outline

- Problem Statement
- Research Objective
- Proposed Methodology/Algorithms
- Preliminary Tests
- Implementation Results
- Next Step

Problem Statement

Photo logging provides a safe and effective means to visualize roadway condition and retrieve roadway data (e.g. Signs). However, to collect roadway data by reviewing images one by one is:

- Very labor-intensive.
- time consuming (i.e. Year).
- Not getting up-to-date roadway data.
- Very costly (million of dollars).

(For example, there are more than 17.5-million images collected by LADOTD.)

Research Objective

Develop sign image recognition algorithms to streamline existing sign data collection. The objectives are to:

- Save time (i.e. month).
- Save cost (reduce at least 50%).
- Quickly get up-to-date roadway data.

Proposed Methodology

For 17.5-million images collected by LADOTD, there are less than 5% of images containing signs. The proposed methodology is to:

- Effectively eliminate images containing no signs with an acceptable false negative.
- Streamline sign data collection using sign type and legend recognition algorithms.

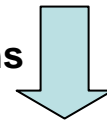
Sign Type and Legend Recognition



Image Processing



Character Recognitions



Result - **Speed Limit : 15 MPH**

Sign Location Calculation

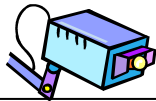
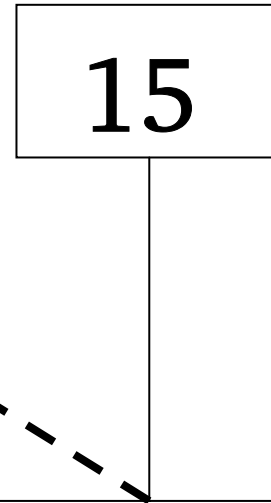


Image taken here



GPS Location:

LAT: 36.149039055

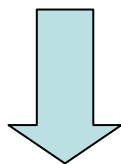
LON: -86.863680089

Sign Location Calculated:

LAT: 36.149049212

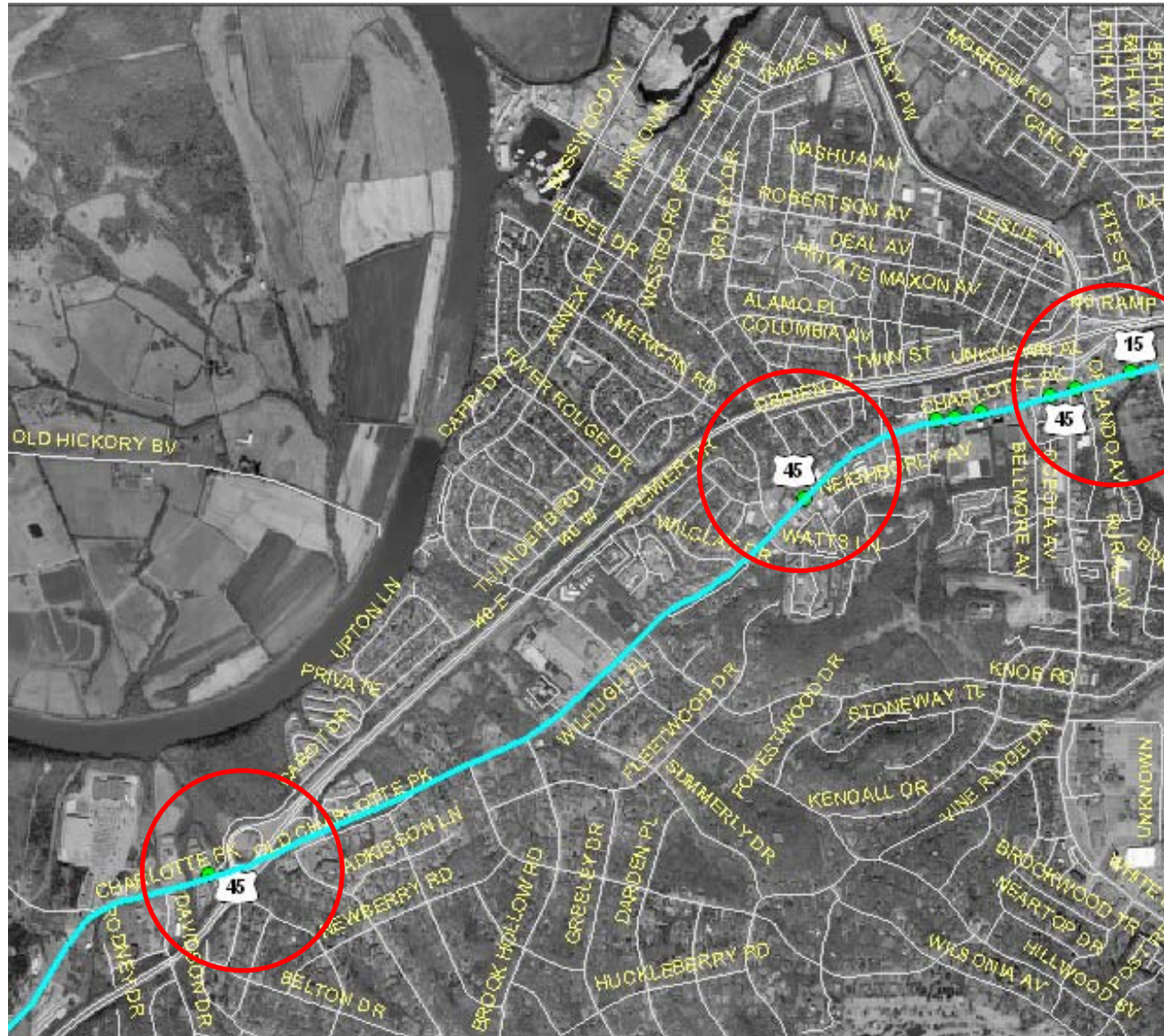
LON: -86.863794344

Automatic Database Recording and Data Management



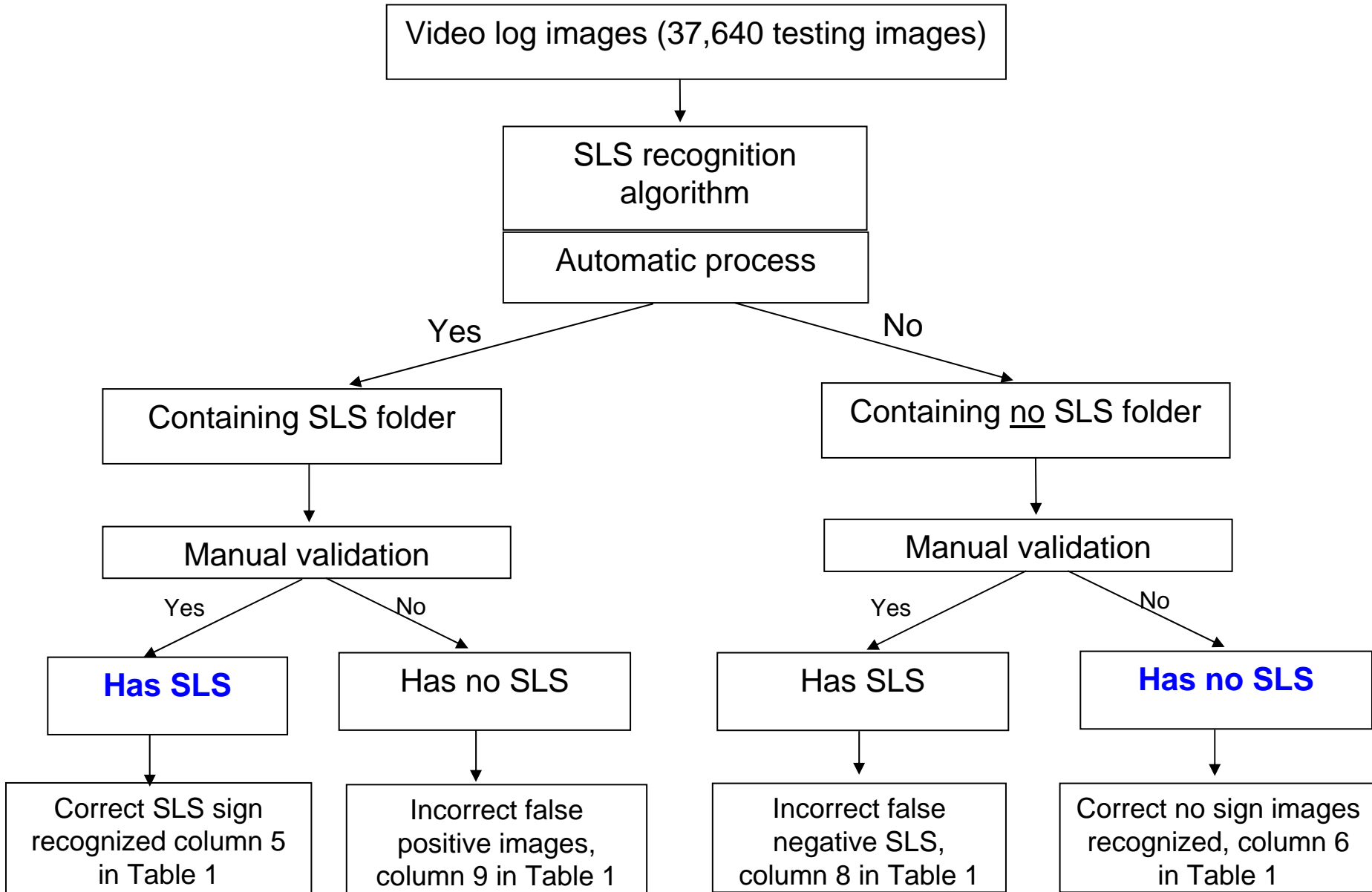
Processed Results										
	MP	Image	SignType	Legend	x1	y1	x2	y2	confidence	gpsx
	130	2F000130.JPG	speedlimit	45	1051	88	1116	123	100	-86.858961029
	184	2F000184.JPG	speedlimit	15	1073	236	1130	279	100	-86.862467148
	204	2F000204.JPG	speedlimit	15	1054	145	1102	182	100	-86.863794344
	214	2F000214.JPG	speedlimit	45	941	210	980	233	100	-86.864654566
	332	2F000332.JPG	speedlimit	45	1122	193	1169	218	100	-86.871287980
▶	766	2F000766.JPG	speedlimit	45	1207	253	1260	284	100	-86.901091216

GIS Presentation of Roadway Signs



Signs

Validation Design



Preliminary Result – Speed Limit

Table 1: Results of automatic speed limit sign recognition for LaDOTD

1	2	3	4	5	6	7	8	9
Functional Class	Total Image	Total Miles	No. of SLS	Correct SLS Recognized	Correct no Sign Images recognized	Total Images Need to be Reviewed Manually	Incorrect False Negative SLS	Incorrect False Positive images
Interstate highways	4760	9.52	13	13 (100%)	4651 (97.7)	109 (2.3%)	0 (0%)	96 (2%)
Non-interstate urban roads	20645	41.19	76	73 (96.1%)	20041 (97.1%)	601 (2.9%)	3 (3.9%)	528 (2.5%)
Non-interstate urban roads	12235	24.46	29	28 (96.6%)	11888 (97.2%)	346 (2.8%)	1 (3.4%)	318 (2.6%)
Total	37,640	75.17	118	114 (96.6%)	36580 (97.2%)	1056 (2.8%)	4 (3.4%)	942 (2.5%)

Preliminary Result – Stop Sign

Results of automatic stop sign (SS) recognition for ConnDOT and Nashville

Transportation Agency	Functional Class	Total Image	Total Miles	No. of SS	Correct SS recognized	Incorrect False Negative SS	Incorrect False Positive SS
Connecticut DOT	State Highway and Local Roads	10,731	107.3	29 (0.27%)	26 (89.7%)	3 (10.3%)	115 (1.07%)
City of Nashville	Urban and Rural Local Roads	14,312	143.1	160 (1.12%)	151 (94.4%)	9 (5.6%)	196 (1.37%)

Signs Correctly Recognized



Factors Causing False Recognition

- Small sign due to large video log spacing
- Poor lighting condition
- High compression ratio
- Tilted signs
- Blocked and scratched signs

Signs Not Correctly Recognized



Small signs



Blocked signs



Titled signs



Poor lighting condition

Optimal Video Log Spacing for Sign Recognition



Four consecutive images

Implementation

- Successful sign inventory on processing 600,000 images (half of Nashville City/Davidson County). Ready for processing the remaining 750,000 images.
- Pilot study and full-scale implementation using more data provided by state DOTs.

Next Step

- Refine the algorithms to improve false recognition and to have full-scale implementation.
- Test algorithms of recognizing other roadway assets such as roadway geometry, curvature computation, guardrails, sight distance, etc.

Thanks !

Contact Info

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