

Up-to-date city maps for modeling, planning, and assistive technologies

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The Goal:
Map, assess, and monitor all the infrastructure



Distributed data collection

Imaging is done with a portable Android device mounted inside a vehicle.



Can be used in service vehicles - no special personnel required for data collection

Obtain time-stamped images, GPS, accelerometer, compass and gyroscope measurements city-wide, on a regular basis



Identify cracked regions



Road segmentation



Crack detection

Using computer vision and machine learning



Commercialization:



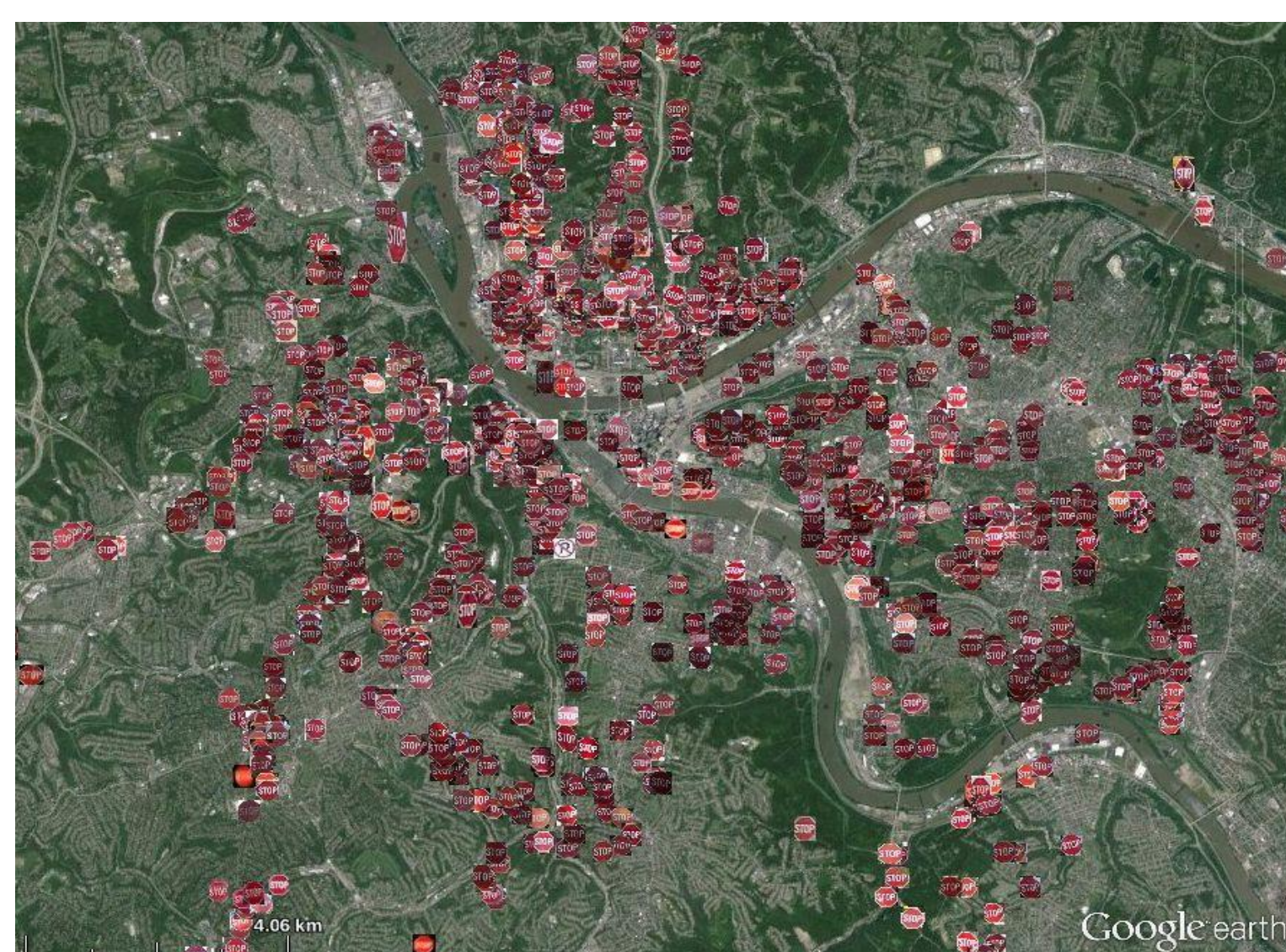
Automated road surveys using smartphones. Delivers road damage maps to customers

Accomplishments:

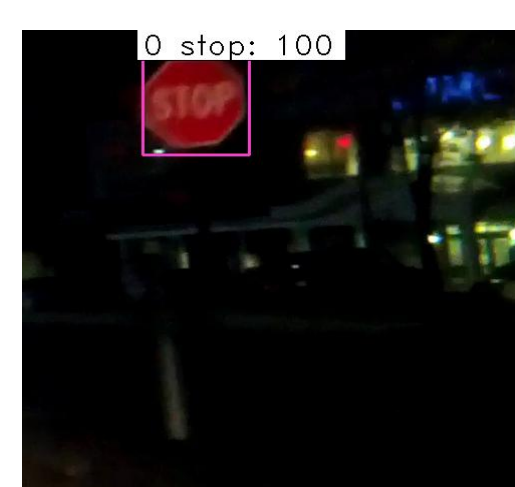
- Fall 2018: 75+ customers in 15 states and 2 countries
- American Society of Civil Engineers Innovation Contest Overall Winner, 2018
- First runner-up in the 2017 Le Monde International Smart Cities Competition



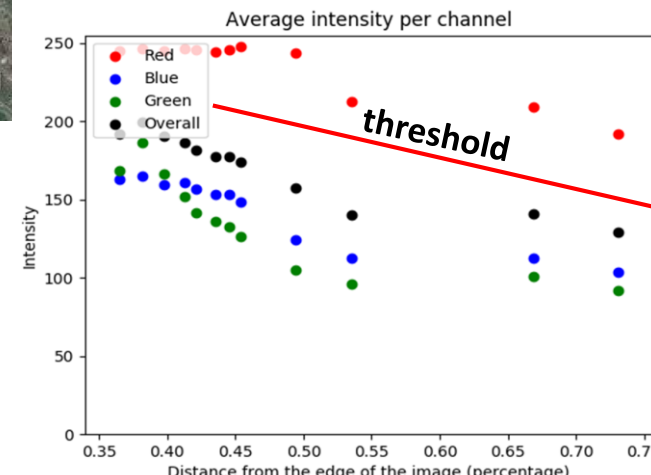
Stop sign inventory and assessment



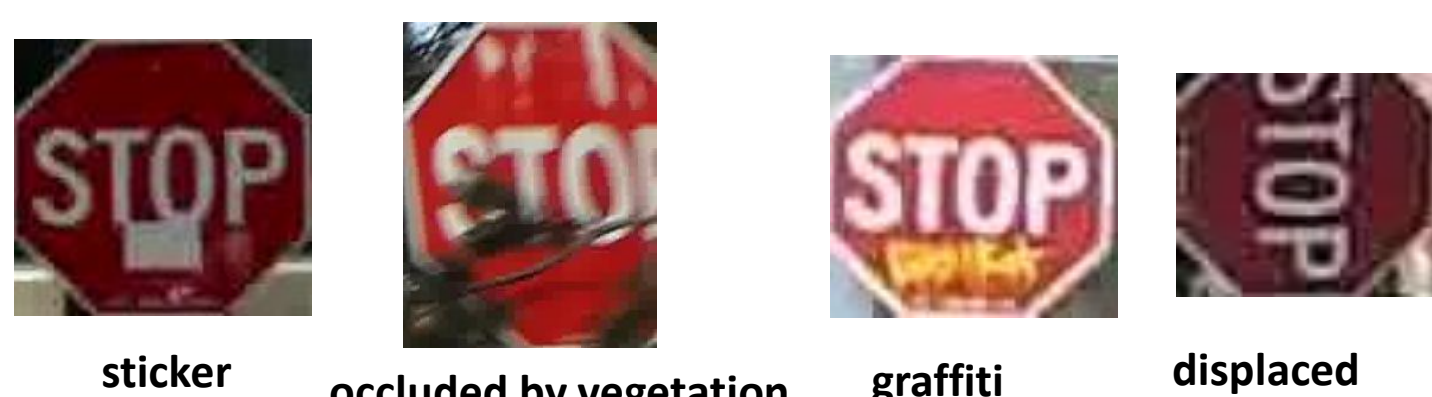
Detection at night time



Intensity above threshold => acceptable retroreflectivity



Stop signs with problems:

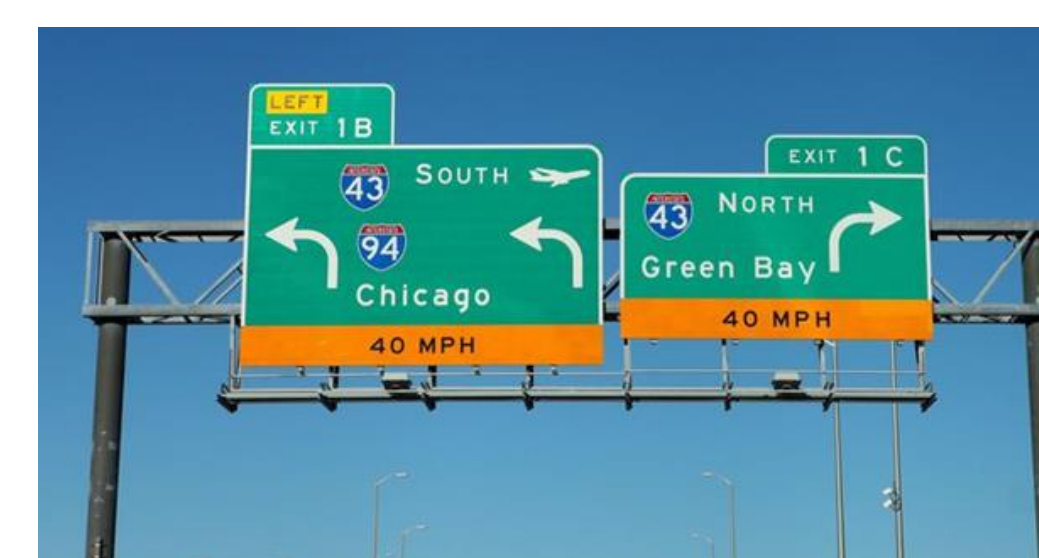


2017-2018 work

Semantic segmentation:
middle: line markings
bottom: 66 classes
(trained with Mapillary data)



Reading signs:



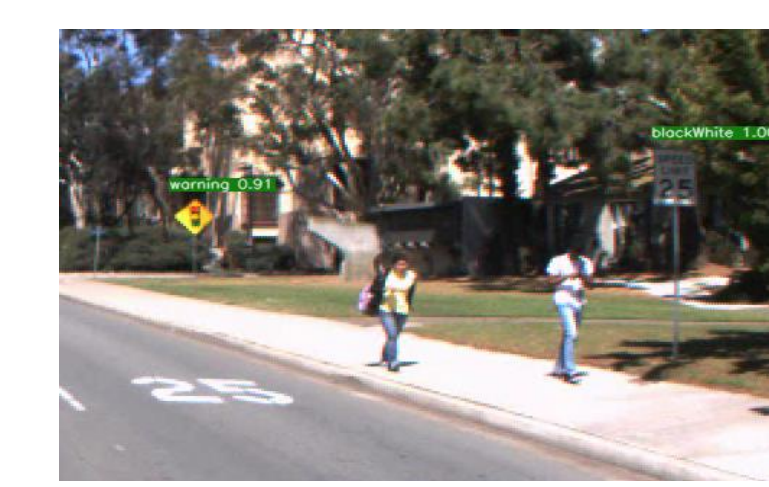
text detection



word recognition

e---XX---l---m---i---b--- => exitmb
g---r---e---n---b---a---y--- => greenbay
s---n---o---r---t---h--- => snorth
e---XX---t--- => exit
s---o---u---t---h--- => south
c---h---i---c---a---g---o--- => chicago
44---o---m---p---h--- => 40mph
1---o---m---p---e--- => 10mpe

General sign detection:

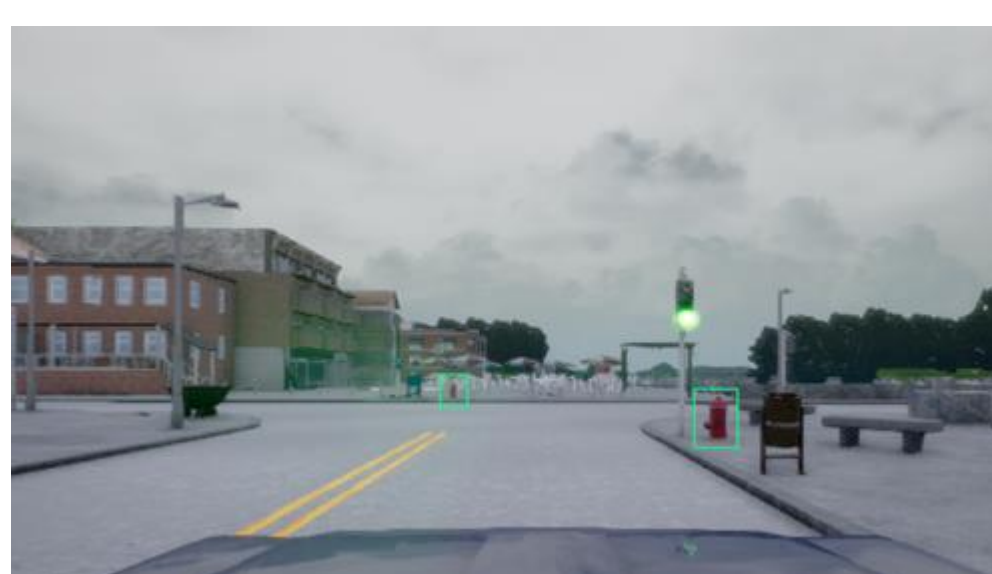


Tactile patch detection:



Follow-on Research

Training with simulation



Training of fire hydrant detection on synthetic images from CARLA



Testing on real road images from Pittsburgh

Preliminary results: 0.42 (average precision), 0.5 IOU)

Parking detection



Detect parked cars. This will be used as input to optimize parking regulations and fees.

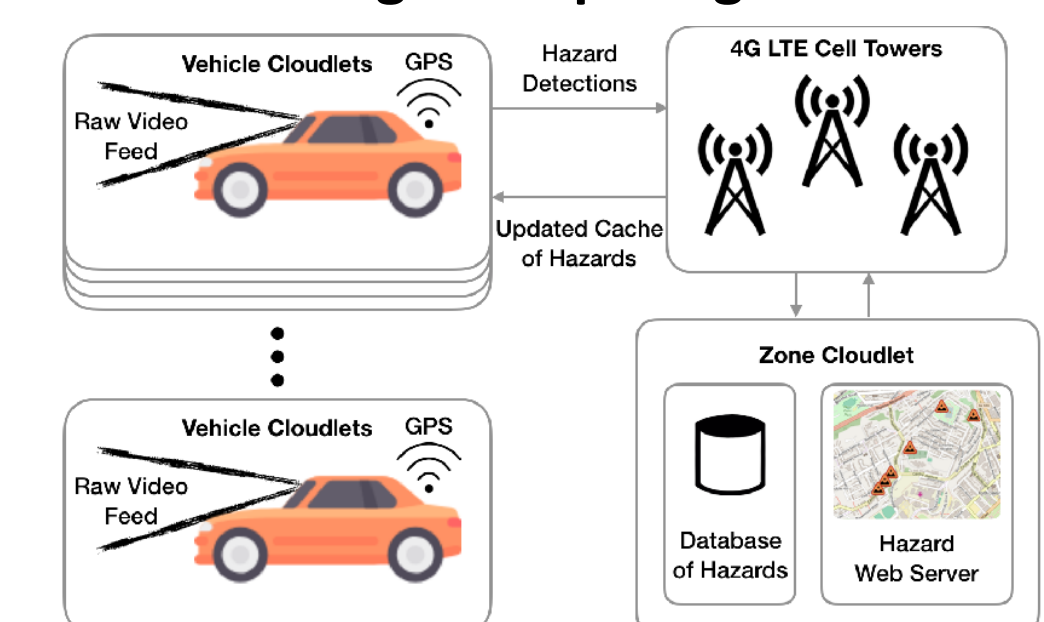
Related Research

Landslide prediction and analysis



Use deep learning and 3D reconstruction to predict, detect, and analyze landslides.

Edge Computing



Do the detection on the vehicle itself and only send pertinent information over the band-width limited network

Acknowledgements

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