Weekly report

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September 9, 2019

Contents

DSN19'

Title: ML-based Fault Injection for Autonomous Vehicles

Organization: UIUC & NVIDIA

Motivation: safety and resilience of AVs are of significant concern (AV crash, report, road test) $\rightarrow$ compelling need for a comprehensive assessment

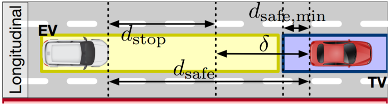
Method: Fault Injection + Bayesian

Environment: Apollo (Baidu) & NVIDIA

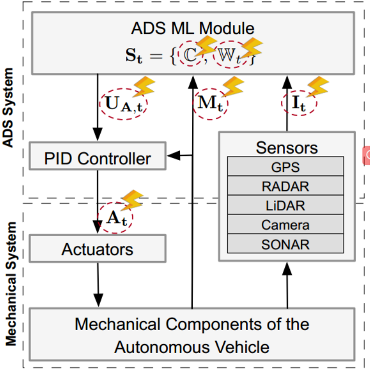
Result: 561 faults in 4 hours VS 0 fault over several weeks

DSN19'

safe: $\delta = d_{safe} - d_{stop} > 0$



FI: modify variables



DSN19'

Find a fault f, so that $\delta_{do(f)<=0}$

ML-based fault selection engine that can find the faults and scenes that are most likely to lead to violations of safety conditions and, hence, can be used to guide the fault injection.

Taken together, these components of DriveFI can identify hazardous situations that lead to accidents.

Architecture of AVS

Five layers:

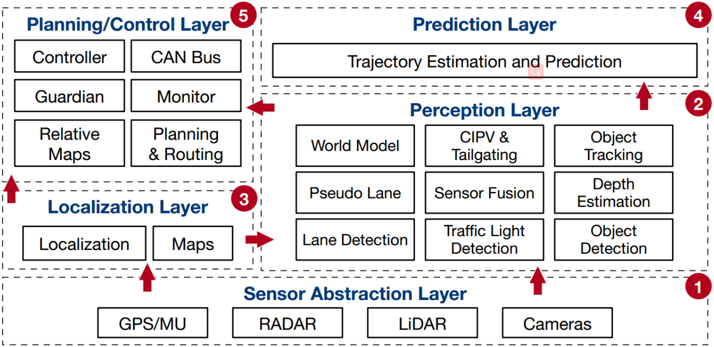


Figure 8: ADS architecture.

IEEE TRANSACTIONS ON INTELLIGENT VEHICLES

Title: Test Your Self-Driving Algorithm: An Overview of Publicly Available Driving Datasets and Virtual Testing Environments

Organization: Chalmers University of Technology, Gothenburg

Motivation: SAE Level 3-5; much more complex software; complex traffic situations; unpredictable traffic participant $\rightarrow$ thorough testing strategy, all scenarios.

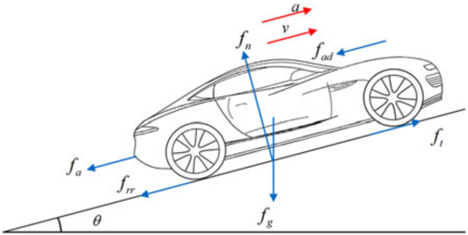
Method: Open-loop test (use data $\rightarrow$ ML) & Closed-loop test (simulator)

Result: Highlight of 37 datasets and 22 simulators;
Q: a standardized representation of different datasets?

Dataset	Time & Venue	Traffic condition	Sensors	Data format & size	What is provided	Typical usage scenarios
Oxford	from 2014-05-06 to 2015-12-13 Oxford (UK)	various light/ weather conditions	stereo vision, color; 3 monocular color cameras; 2 Sick 2D LiDARs; Sick 3D LiDAR; GPS/INS	133 sequences (23.15TB); png: image; bin: LiDAR data; csv: GPS/INS data	raw data; calibration; Matlab/Python tools	long-term localization and mapping
Stanford	2009-2010 San Francisco (US)	urban, campus, intersections	Velodyne 64 LiDAR; Applanix (GPS/IMU)	33 files (5.72GB); tm: Velodyne and Applanix data (own format)	raw data; background data without objects(training and testing sets); object labels; code in ROS package	3D object detection and classification
Stixel	2013	highway, good weather, heavy rain	stereo vision, grayscale	12 sequences (3.1GB); pgm: image; xml: ground truth stixel	videos; ground truth stixel (own novel concept); vehicle data including timestamps	stereo vision
TorontoCity	2009, 2011-2013 GTA (Canada)	densely populated area with many buildings	Vehicle: - PointGray Bumblebee3 stereo camera; - Velodyne HDL-64E LiDAR; - GoPro Hero 4 RGB camera; - Applanix POS LV; Airplane: airborne LiDAR; Drone: 3D camera	Size: unknown; image: format not mentioned	raw data; benchmark; annotated map	building height estimation, road extraction, building segmentation, building recognition, semantic labeling, scene type classification
TrafficNet	from 2012-10-01 to 2013-04-30 Ann Arbor, Michigan (US)	various road conditions	Mobileye's vision-based ADAS; Wireless Safety Unit (WSU); radar unit (part of the vehicle's integrated safety device unit)	10.3GB; csv for all data	raw data indexed by 8 scenarios; source code of scenario categorization methods	traffic scenario categorization
TRoM	from 2016-05-02 to 2016-06-03 Beijing (China)	different weather, time-of-the-day, illumination, traffic road conditions	PointGray color camera; GPS receiver	+700 scenes; jpg: image (RGB color)	raw data (training/validation/ test sets); pixel-level annotation of 19 road marking categories; annotation toolkit in Matlab; preliminary evaluation results	road marking detection and classification
Udacity	Sep-Oct, 2016 Mountain View (US)+around	sunny, overcast, daylight	monocular color camera; Velodyne 32 LiDAR; GPS+IMU	223GB (>10h); png or jpg: image; log: GPS and vehicle motion; csv: label; ROSBAG	videos; labels: vehicle, pedestrian, traffic lights; open source code; tools for ROSBAG files	vehicle/pedestrian/ traffic light detection, steering angle prediction

Other Work

- A Time and Energy Efficient Routing Algorithm for Electric Vehicles Based on Historical Driving Data
  - use historical driving data to train a new routing algorithm (battery longevity)
  - other drivers' history to estimate the goal driver (ML-based)
  - test it on a model of EV.

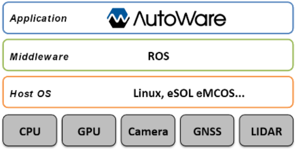


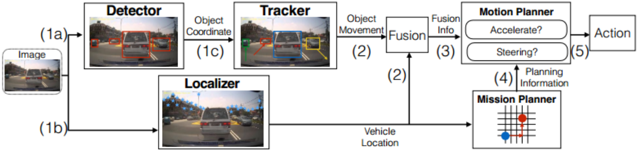
Autoware.AI

- Localization
- Object detection
- Driving control
- 3D map generation and sharing

Autoware & ROS

Autoware is an open source software based on ROS. It is developed by Nagoya University and is intended for autonomous driving research and development. It is open sourced on GitHub.





Plan

- Read papers
  - paving the roadway for safety of automated vehicles– An empirical study on testing challenges
  - scenario pattern matching in large sensor recordings with simulation models for cyber-physical systems
  - Intelligence Testing for Autonomous Vehicles: A New Approach
- Basic concept of ADS

Thanks!