Big Data in Transportation at UMTRI

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Carol Flannagan, Ph.D.

Director, Center for the Management of Information for Safe and Sustainable Transportation (CMISST)

UNIVERSITY OF MICHIGAN
TRANSPORTATION RESEARCH INSTITUTE

University of Michigan Transportation Research Institute (UMTRI)

Primary "Big Data" Groups

- Engineering Systems (data acquisition design, data collection, database design, data analysis for vehicle system design and evaluation, traffic modeling)
- CMISST ("the data group"—data analysis, analytical methods development, open data)
- Biosciences (large-scale body-shape data collection, finite element modeling and other body-shape modeling)
- Human Factors (data collection, data analysis)

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Some "Big Data" Areas

- Human driving behavior
- Vehicle system evaluation
- Traffic modeling
- Travel patterns
- Bike share/car share/dynamic pricing
- Human body-shape and motion modeling
- …

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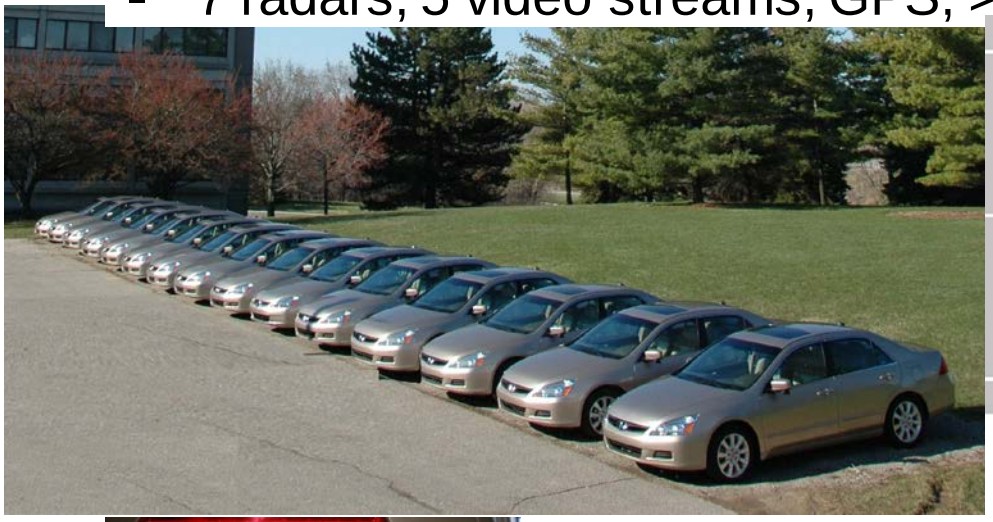
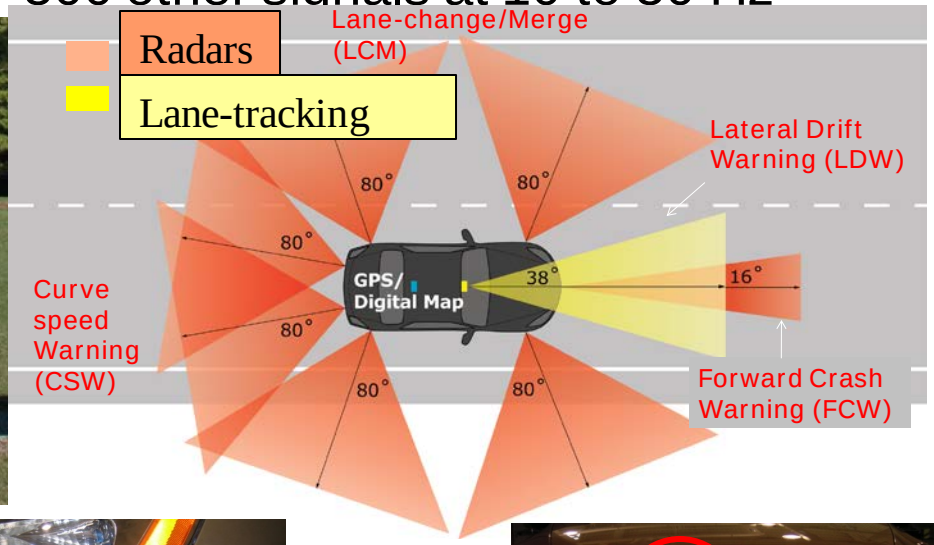
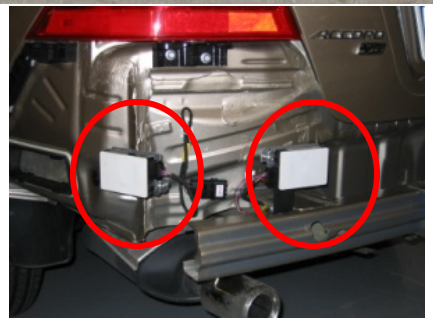
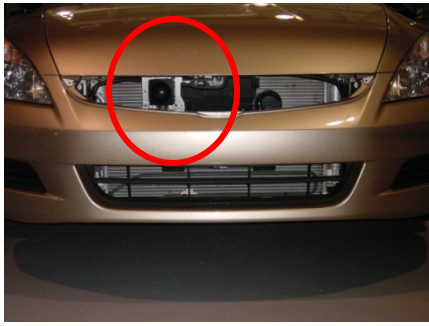
IVBSS Light Vehicles

- 108 drivers each use an instrumented vehicle for six weeks
- 16 vehicles each with four prototype crash warning systems
- 7 radars, 5 video streams, GPS, >500 other signals at 10 to 50 Hz







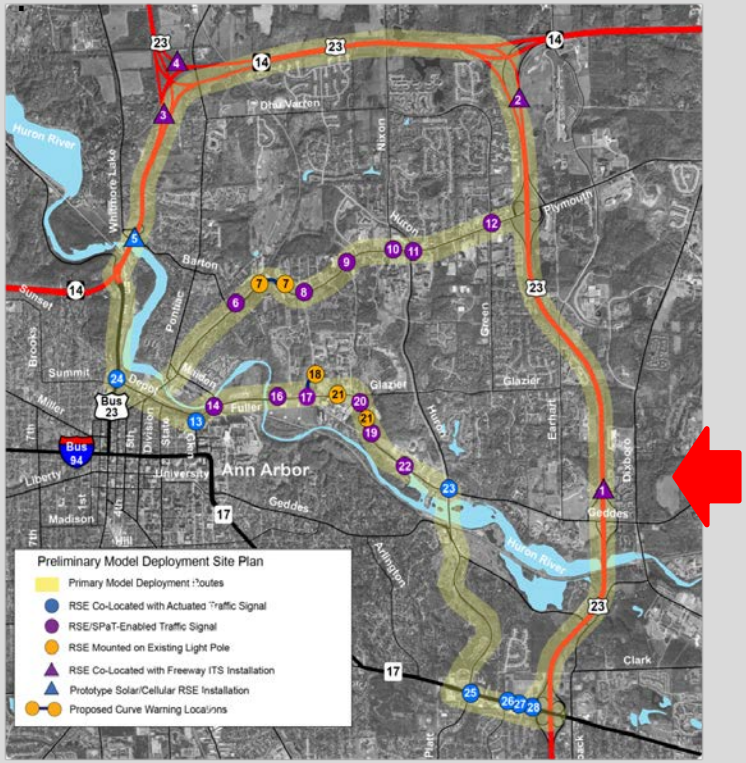


Radars behind fascias

LV system: Visteon Corporation & Takata Corp. Thanks to Honda R&D.

V2V/V2I: Safety Pilot Model Deployment

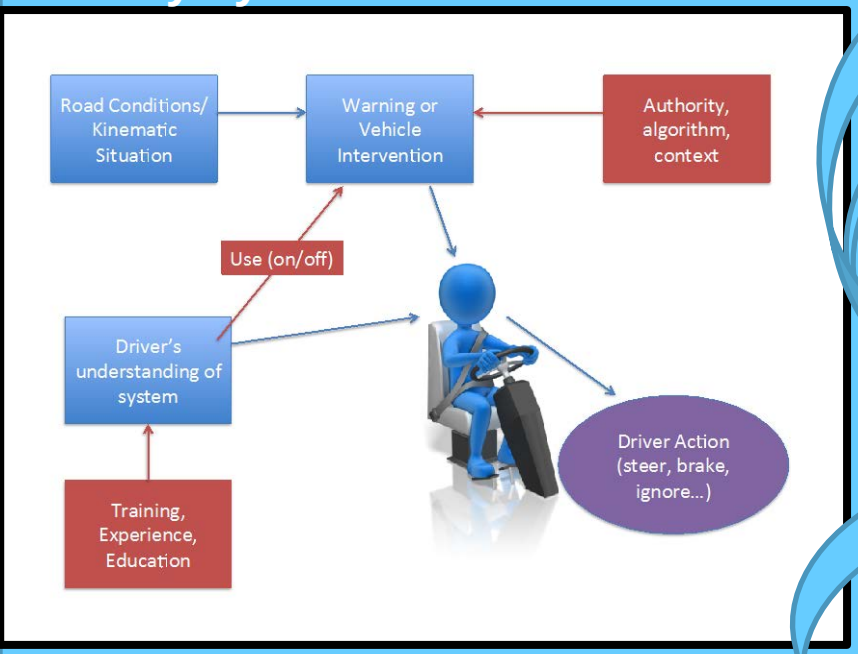
- 2836 vehicles equipped with DSRC wireless communication dev
  concentrated geographic area (Ann Arbor)
- Variety of vehicles, devices, functions, data collection
- Launched 2012-2014, deployment is ongoing

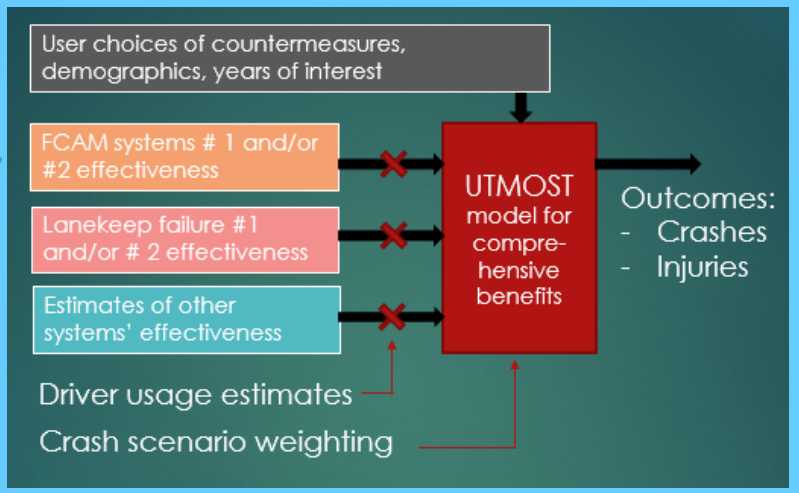


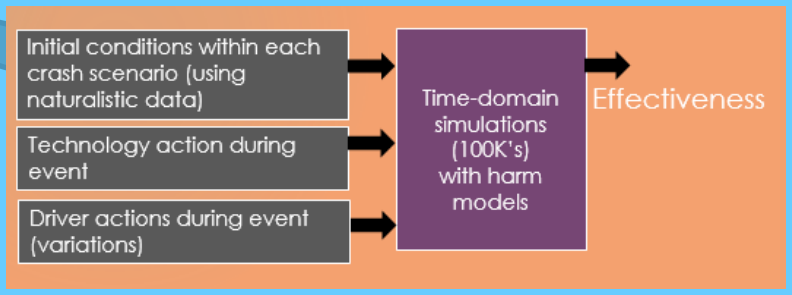
- 19 Intersections
- 3 Curve-related sites
- 3 Freeway sites
- Over-the-air security
- All DSRC communications logged
- Backhaul comm network
- Back-end data storage
- 180 Billion messages , 40M miles
- >3 million miles detailed data

Comprehensive Evaluation of Multiple Active Safety Systems*

Nine faculty, $3M/3 years: Research safety benefits of multiple active safety systems







New models for driver response (naturalistic/sim)

New experimental findings on driver mental models using on-road testing

*Toyota Settlement Safety Research & Education Program

Analysis of Telematic Data Collection

U.S. Department of Transportation
National Highway Traffic Safety Administration

Large-Scale Field Test of Forward Collision Alert And Lane Departure Warning Systems

NHTSA
www.nhtsa.gov

DOT HS 812 247

C. Flannagan, D.LeBlanc, et al (UMTRI), R. Kiefer et. al. (GM)

February 2016

Total Vehicles	1,958
Total Trips	2,463,142
Total Miles of Driving	18,815,458
Total Hours of Driving	615,054
Total LDW Alerts	10,058,567
Total FCA Tailgating Alerts	1,830,501
Total FCA Imminent Alerts	260,756

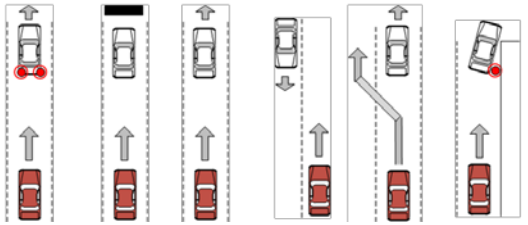
Leveraging detailed driving data for analysis of large-scale, simpler data

Categorizing 1.8M events into scenarios using 3 data snapshots per event from 2000 vehicles X 1 year testing

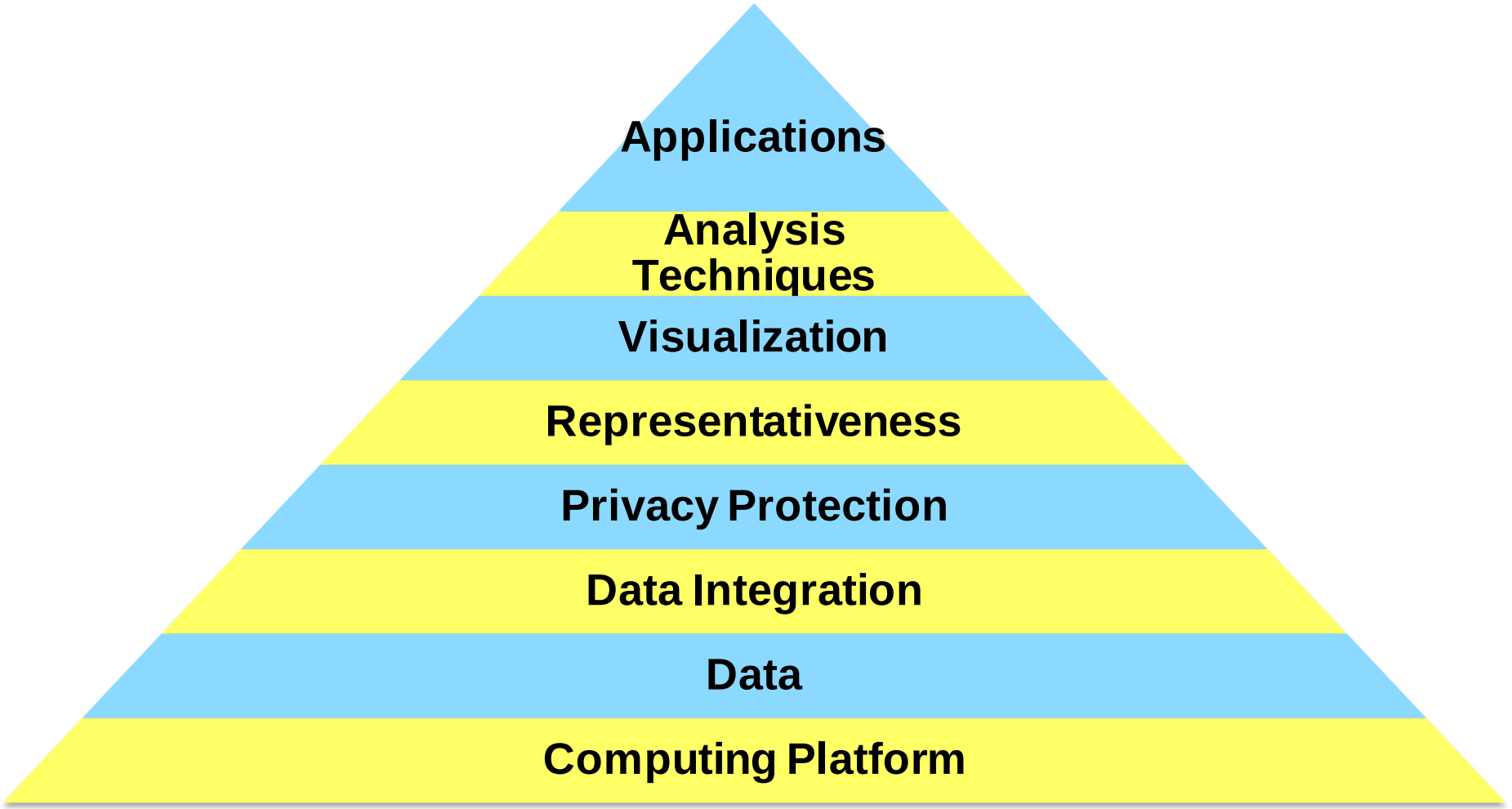
	Vehicles always share lane			False	Lateral motion of a vehicle		
Measure	Slowing	Stopped	Other	Not in path	Lane change	Target changes	Unknown
Percent of alerts:	19%	0.40%	31%	2%	11%	16%	20%
How often drivers don't respond:	19%	24%	54%	66%	81%	16%	20%
Does experience reduce the rate?	Yes	Yes	No	No	No	No	No

Analysis using prior data from UMTRI studies using vehicles equipped with cameras and radars allows us to identify these scenarios from the very sparse OnStar data.

"From empirical data to models"



Building a Transportation Data Ecosystem



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For additional information please contact
Carol Flannagan cacf@umich.edu

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