

research review

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Transportation Projects Receive Data-Science Funding

Several UMTRI researchers are involved in two transportation projects recently funded in the first round of the Michigan Institute for Data Science (MIDAS) Challenge Initiatives program.

Four research projects—two in transportation and two in learning analytics—will each receive \$1.25 million dollars from MIDAS as part of the Data Science Initiative announced in fall 2015. U-M Dearborn also will contribute \$120,000 to each of the two transportation-related projects.

The goal of the multiyear MIDAS Challenge Initiatives program is to foster data-science projects that have the potential to prompt new partnerships between U-M, federal research agencies, and industry.

The challenges are focused on four areas: transportation, learning analytics, social science, and health science.

“These interdisciplinary projects will push innovation in data science and transportation research in ways that will have long-term impact on the way people and goods will move for years to come,” said MIDAS codirector Brian Athey, professor and chair of computational medicine and bioinformatics. “This includes studying the social and behavioral side of the equation. For example, will drivers and riders accept automated and connected vehicles?”



Source: U.S.DOT

Illir Miteza, associate provost at U-M Dearborn, said the MIDAS Challenge Initiatives program provides a valuable opportunity for collaboration: “These projects show the combined strength of our campuses to use emerging data-science techniques to address society’s grand challenges.”

The transportation projects, summarized below, bring together interdisciplinary teams of researchers from both campuses to tackle the grand problems of the future of transportation using massive amounts of data being produced

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Transportation Projects Receive Data-Science Funding

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by automated- and connected-vehicle testing sites, as well as in conventional driver-directed settings, in Ann Arbor and around the country.

Reinventing Public Urban Transportation and Mobility

Led by Pascal Van Hentenryck of the College of Engineering, this project will help design and operate an on-demand, public transportation system for urban areas in which a fleet of connected and automated vehicles is synchronized with buses and light rail, using predictive models based on high volumes of diverse transportation data. The goal is to begin testing on the U-M campus within a year, and then expand the experiment to Ann Arbor and Detroit.

Van Hentenryck said one of the goals is to make public transportation a viable option for getting to and from work, health care, and other services for people who can't afford to own a car.

"We're trying to revolutionize mobility for entire population segments with poor access to transportation," he said. "On-call, affordable public transportation that can get you to and from work or the doctor's office efficiently would increase employment opportunities and result in better health care outcomes. The potential for improved quality of life is huge."

The project will use the University of Michigan, Ann Arbor, and Detroit as testing grounds for these innovative transportation models, and will include collaboration with the U-M Parking and Transportation Services Department involving real-time data collection on driver behavior. The project will leverage massive amounts of mobility data to design and operate an innovative, on-demand transportation system that will address the "first-mile/last-mile" problem—that is, the challenge of getting people

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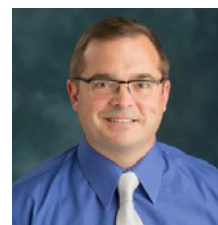
from their homes or final destinations into the transit system.

The system will be multimodal, using light-rail, shuttles, cars and bicycles, and will be well positioned to add connected and driverless vehicles when they become available. U-M will become the first testing location within a year, with planned expansion to the rest of the city of Ann Arbor, and then to Detroit.

Among the collaborators on the project are UMTRI assistant research professor Robert Hampshire and UMTRI director and research scientist Jim Sayer, as well as researchers from the School of Information, College of Engineering, Emergency Medicine, Architecture and Urban Planning, and Computer Science.



Robert Hampshire



Jim Sayer

Building a Transportation Data Ecosystem

This project, led by UMTRI associate research scientist Carol Flannagan, will create a system allowing researchers to access massive, integrated datasets on transportation in a high-performance computing environment. Research by Flannagan's team and others will support future transportation research and development.



Carol Flannagan

Flannagan said creating a common repository of transportation data—including data on driving, traffic, weather, accidents, vehicle messages, traffic signals and road characteristics—will inform the development of connected- and automated-vehicle systems of the future.

"For example, real-world and simulated data on vehicle accidents will be invaluable to federal regulators developing regulations and guidelines for crash avoidance technology in the new generation of automated and connected vehicles," she said.

Flannagan's project includes researchers from the School of Public Health, College of Engineering, U-M Dearborn, College of Literature, Science and the Arts, UMTRI, and the Institute for Social Research. 📱

Source: "Data Science Projects Promise to Transform Transportation," <http://ns.umich.edu/new/releases/23993-u-m-data-science-projects-promise-to-transform-transportation>.



UMTRI Research Excellence Award Winners

Five UMTRI research papers received awards for research excellence in 2016, bestowed by the UMTRI faculty-development committee. The committee established the inaugural research-excellence awards competition as a way to encourage and promote the success of UMTRI faculty in scholarship.

To be eligible for consideration, research papers had to be published in 2015 and were evaluated on originality, societal impact, scientific quality, and relevance to UMTRI's mission of advancing safe and sustainable transportation for a global society.

The five award-winning papers are summarized below. Authors will present the research at UMTRI's annual research symposium, scheduled for October 6 at the University of Michigan.

► **Integration of Active and Passive Safety Technologies—A Method to Study and Estimate Field Capability**

Jingwen Hu, Carol Flannagan, and Shan Bao

Stapp Car Crash Journal 59 (2015): 269-296.

This study demonstrates the potential for reducing vehicle-occupant injury risk in frontal crashes by integrating passive and active safety systems. A seatbelt restraint is considered a passive safety system, while a driver-assist feature, such as precrash braking, is considered an active safety system. Researchers developed a

methodology that uses a combination of field data analysis, naturalistic driving data analysis, and computational simulations to explore the potential injury-reduction capabilities of combining passive and active safety systems. Results demonstrate the potential for further reducing occupant injury risk in frontal crashes by the integration of a passive safety system with a driver-assist feature.

► **Evaluation of ISO CRS Envelopes Relative to U.S. Vehicles and Child Restraint Systems**

Jingwen Hu, Miriam Manary, Kathleen Klinich, and Matthew Reed

Report no. DOT HS 812 106 (Washington DC: National Highway Traffic Safety Administration, 2015).

While small cars have proliferated in recent years to meet demand for improved fuel economy, the size of some rear-facing child-restraint systems has increased, partly due to recommendations to keep children rear-facing longer. The result is that some child-restraint systems are too large to be installed properly in some vehicles. In this project, researchers used

a computer simulation to evaluate the international standard addressing the size of child-restraint systems relative to the size of rear-seat vehicle compartments as it applies to child-restraint systems and vehicles sold in the US market. Results will be used to help develop envelopes that can be used with US child restraints and vehicles.

► **Parametric Body Shape Model of Standing Children Aged 3-11 Years**

Daniel Park and Matthew Reed


Ergonomics 58, no. 10 (2015): 1714-1725.

Researchers developed a statistical body-shape model to be used for generating a child-size body shape with desired anthropometric parameters. A standardized template mesh was fit to whole-body laser-scan data from 137 children aged 3 to 11 years. The mesh coordinates along with a set of surface landmarks and 27 manually measured anthropometric variables were analyzed using principal-component analysis. This parametric-modeling approach is useful

(Continued on page 4)

UMTRI 2nd Annual Transportation Safety Research Symposium

UMTRI will host its second annual Transportation Safety Research Symposium on October 6, 2016, at the University of Michigan in the Michigan League ballroom from 8:00 a.m. to 4:00 p.m.

This one-day symposium will focus on UMTRI's interdisciplinary transportation safety research, with emphasis on energy, mobility, and safety. The symposium will also feature a keynote speaker, student poster competition, panel discussions with Q&A, presentations from UMTRI Research Excellence Award recipients, and networking opportunities. 

Details: <http://umtri.umich.edu/what-were-doing/events/umtri-2nd-annual-transportation-safety-research-symposium>.

UMTRI Research Excellence Award Winners (Continued from page 3)

for reliable prediction of the body shape of a specific child with a few given predictors such as stature, body mass index, and age. The model is publicly available online.

► **Statistical Models for Predicting Automobile Driving Postures for Men and Women Including Effects of Age**

Jangwoon Park, Sheila Ebert, and Matthew Reed

Human Factors 58, no. 2 (2016): 261-278.


The interior design of vehicles relies on accurate prediction of a driver's posture and position, which may change throughout a person's lifetime. This study developed new statistical models for predicting driving postures of men and women, including the effects of age. Researchers measured driving postures of 90 US drivers representing a wide range of ages and body sizes. Results show that driving posture was significantly associated with age. This is the first study of driver posture to include a large cohort of older drivers and the first to report a significant effect of age.

The posture-prediction models can be used to position computational human models or crash-test dummies for vehicle design and assessment.

► **Characteristics of Turn Signal Use at Intersections in Baseline Naturalistic Driving**

John Sullivan and Shan Bao

Accident Analysis & Prevention 74 (January 2015): 1-7.

The purpose of this study was to determine whether a driver's use of turn signals is sufficiently reliable to forecast a vehicle's path through an intersection. This information could potentially inform the development of a connected-vehicle-based intersection collision-avoidance application. Using the baseline portion of a previously conducted field operational test of a safety system, researchers extracted naturalistic observations of turn-signal use among 108 drivers on surface streets. They found that overall 25 percent of left turns and 29 percent of right turns were not signaled. Road type, turn direction, and presence of a forward vehicle were found to influence the odds that a turn is signaled, while gender and age of the driver did not. Results indicate that turn-signal activation alone may be insufficiently reliable to forecast a driver's path. 

Automotive Research Conference Series Begins Eighth Year

The UMTRI Automotive Futures group will host the eighth annual Focus on the Future Automotive Research Conference Series, which runs from September 2016 through July 2017.

The first event in the series, The Future of Automotive IT: Driving Organizations, Vehicle Development, and Autonomous Vehicles, took place September 14 at the University of Michigan (Michigan Union, Kuenzel Room). The conference focused on the role that information technology (IT) plays in the vehicle, in the corporation, and in the structure of the automotive industry.

IT continues to be the key enabling technology for company strategy, R&D, product development, manufacturing, sales and marketing, and even the aftermarket. When it comes to the future of the industry, vehicle IT is the backbone of all advanced powertrain, safety, and connected- and autonomous-vehicle technologies, as well as nearly all the new mobility platforms.

The conference touched on many of these issues, as presenters discussed current and future trends in automotive IT, but dialogue also covered some of the limits of IT in the Internet of Things, Big Data, and the more complex vehicle IT systems, such as safety, autonomy, and new mobility.


Focus on the Future Automotive Research Conference Series

► **September 14, 2016: The Future of Automotive IT: Driving Organizations, Vehicle Development and Autonomous Vehicles.** The conference focuses on the role that information technology (IT) plays in the vehicle, in the corporation, and in the structure of the automotive industry.

► **November 9, 2016: Inside China: Understanding China's Current and Future Automotive Industry.** The annual Inside China conference has traced the rapid rise of the Chinese auto industry. The largest automotive market in the world is such a unique market that it demands continued examination of both its current and future trends from a variety of perspectives, including consumer choice, marketing, product development, government support and regulations, alternative energy, automotive research and development, industry structure, labor, economic impact, and manufacturing.

► **February 15, 2017: New Mobility Conference.** The annual New Mobility conference, hosted in collaboration with UM-SMART, will investigate mobility as a service, or transportation business models that support sustainability as well as transport.

► **April 12, 2017: The University of Michigan and the Japanese Automotive Industry: A 35 Year Partnership.** In celebration of U-M's 200th anniversary, UMTRI Automotive Futures and the U-M Japan Center will host this conference, which examines the past, present, and future relationship of the Japanese auto industry to the United States and the University of Michigan.

► **July 19, 2017: Powertrain Strategies for the 21st Century.** This annual conference focuses on major issues related to future powertrains. Results of the annual Powertrain Strategies for the 21st Century expert survey, which estimates powertrain-technology penetration for 2020 and 2025, will also be presented. 



Reed named Don B. Chaffin Collegiate Research Professor

Matthew Reed, head of UMTRI's Biosciences Group has been named Don B. Chaffin Collegiate Research Professor.

Established in June 2016, the Don B. Chaffin Collegiate Research Professorship is awarded in recognition of exceptional scholarly achievement and impact on advancing knowledge in science, engineering, health, education, the arts, humanities, or other academic fields of study. This renewable position is effective September 1, 2016, through August 31, 2021.

Professor Reed received his BSE in mechanical engineering in 1989, his MSE in industrial and operations engineering in 1993, and his PhD in industrial and operations engineering in 1998 from the University of Michigan. During his long career at the University of Michigan, he has established himself as a world leader in the study of vehicle occupant body shape

and posture and is responsible for major innovations in his field that have improved the safety and comfort of millions of people. Early on, he established the statistical and biomechanical models that are the basis of all software packages used for vehicle occupant-compartment design and have become the global standard for occupant-compartment layout.

More recently, he has led cutting-edge work on the effective and efficient statistical modeling of a wide variety of body shapes and characteristics. In the course of his research, he has published more than 130 articles in top journals with collaborators from around the world, and he has received multiple prestigious awards in recognition of his contributions to his field.



Don Chaffin, who retired from U-M in 2007, is the R.G. Snyder Distinguished University Professor (Emeritus) in Industrial and Operations Engineering, Biomedical Engineering, and Environmental Health Sciences. He served as chair of the Department of Industrial and Operations Engineering from 1977 to 1981, and director of the Center for Ergonomics from 1981 to 1998. In 1998 he founded the Human Motion Simulation Laboratory in the Center for Ergonomics and directed it until his retirement in 2007. [M](#)

UMTRI Speaker Series to Present Judy Jin

Judy Jin, professor in the U-M Department of Industrial and Operations Engineering, will speak at UMTRI on November 2 as part of the UMTRI Speaker Series, cosponsored by the ATLAS Center. The event will take place from 11:30 a.m. to 1 p.m. in the UMTRI Library.

Jin's research focuses on data fusion and system informatics for better comprehension and operation of engineering systems and decision making for quality and reliability assurance. Her research innovation and broad industrial impacts have been recognized by numerous awards, including nine best-paper awards.

She is currently serving as a departmental editor for *IIE Transactions* and an editorial advisory board member for the *Journal of Industrial and Production Engineering*. [M](#)





UMTRI In The News

Industry emissions down, transportation up

<http://ns.umich.edu/new/releases/24033-industry-emissions-down-transportation-up>

Licenses needed for self-driving cars?

<http://www.nytimes.com/2016/07/07/opinion/a-16-year-old-needs-a-license-shouldnt-a-self-driving-car.html? r=1>

Reed quoted in New York Times

<http://www.nytimes.com/2016/06/22/business/anton-yelchins-death-highlights-a-known-issue-with-jeeps.html? r=2>

Self-driving vehicles will have limited impact on productivity

<http://www.ns.umich.edu/new/releases/24189-self-driving-vehicles-will-have-limited-impact-on-productivity>



Upcoming Events

UMTRI Transportation Safety Research Symposium

October 6; University of Michigan
www.umtri.umich.edu

European Transport Conference

October 5-7; Barcelona, Spain
<http://etcproceedings.org/>

ITS World Congress

October 10-14; Melbourne, Australia
www.itsworldcongress2016.com

National Shared Mobility Summit

October 17-19; Chicago, Illinois
<http://sharedusemobilitycenter.org/2016-summit/>

TRB Webinar: Improving Rear Seat Passenger Safety: Challenges and Strategies

October 27; Online
www.trb.org/calendar

TRB Partners in Research Symposium: Transformational Technologies

October 31-November 1; Detroit, Michigan
<http://www.trb.org/Calendar/Blurbs/174253.aspx>

Stapp Car Crash Conference

November 7-9; Washington, D.C.
www.stapp.org

Inside China Automotive Research Conference

November 9, Ann Arbor, Michigan
<http://umtri.umich.edu/who-we-are/research-groups/automotive-futures>

University Transportation Center (UTC) Spotlight Conference: Pedestrian and Bicycle Safety

December 1-2; Washington, D.C.
<http://www.trb.org/Calendar/Blurbs/174017.aspx>

2017 TRB Annual Meeting

January 8-12; Washington, D.C.
www.trb.org



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UMTRI's Strategic Intent

To be the leader in transportation systems research integrating vehicles, people, and infrastructure to achieve a highway transportation system where:

- ▶ Fatalities and injuries are eliminated
- ▶ People and goods flow efficiently
- ▶ Reliance on nonrenewable energy is reduced

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