TransInfo
Tier I University Transportation Center

University at Buffalo
School of Engineering and Applied Sciences

FIFTH ANNUAL

Symposium on Transportation Informatics

Research at the Intersection of Big Data and Connected & Automated Vehicles

August 8, 2019

University at Buffalo

SPONSORED BY

University at Buffalo
Stephen Still Institute for Sustainable Transportation and Logistics

DEPARTMENT OF TRANSPORTATION
UNITED STATES OF AMERICA

CAVAS
UB'S CONNECTED AND AUTONOMOUS VEHICLE APPLICATIONS AND SYSTEMS

www.buffalo.edu/transinfo/symposium

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ACKNOWLEDGEMENTS

We would like to thank everyone who helped with the Fifth Annual Transportation Informatics Symposium.

Organizing Committee: **Adel W. Sadek,** Director, Transportation Informatics Tier I University Transportation Center (UTC); Professor, Department of Civil, Structural and Environmental Engineering, University at Buffalo; **Chunming Qiao,** SUNY Distinguished Professor and Chair, Department of Computer Science and Engineering, University at Buffalo; **Jennifer Giegel**, Director of Strategic Initiatives, School of Engineering and Applied Sciences, University at Buffalo; **Joah Sapphire,** Founder and President of GDG IoT, and Research Support Specialist, University at Buffalo.

School of Engineering and Applied Sciences Staff: Michelle Bowen, Dayeabasi Martin Akpan

Special thanks to **Stephen E. Still**, Professor of Practice, Institute for Sustainable Transportation and Logistics, University at Buffalo

WIFI

- To log in, make sure all your browsers are closed
- Connect to **UB_Connect** through WI-FI
- Open your browser (preferably chrome), it will direct you to a splash screen to then enter an e-mail to gain access to the internet
- If it doesn't automatically direct you, try typing in a web address (google, cnn, etc) and it should then direct you

WELCOME FROM THE DIRECTOR

Welcome to the Transportation Informatics (TransInfo) Tier I University Transportation Center's Fifth Annual Symposium on Transportation Informatics. The focus of this year's Symposium is on "Research at the Intersection of Big Data and Connected & Automated Vehicles", a topic which is currently attracting unprecedented attention, both nationally and internationally.

Since its establishment in 2013, TransInfo's researchers have been engaged in cutting edge research utilizing Big Data Analytics to improve all aspects of transportation. This research has covered a wide spectrum of topics including predicting border crossing delay, investigating factors affecting aggressive driving, using predictive analytics to analyze paratransit operations, mining social media data, and developing a crowd-sourced roadway sensing system. In the last couple of years, several TransInfo researchers have been engaged in cutting-edge research related to Big Data and Connected & Automated Vehicles (CAV). This research has attracted the attention of New York State Governor, and gained the University at Buffalo a mention in Governor's Cuomo last year's state of the State address, as a pioneer in CAV research.

This year's symposium builds on the success of last year's symposium and sheds additional light on CAVs, which promise to transform transportation as we know it. As we have done in previous year, the symposium strives to discuss the topic from the perspectives of government, industry and academia. The symposium is a joint effort of the University at Buffalo and the TransInfo University Transportation Center. The Interim Dean of UB's School of Engineering and Applied Sciences, Dr. Rajan Batta, will inaugurate the proceedings.

We hope you enjoy the diverse swathe of presentations we have selected for this year's symposium. As always, participants are encouraged to ask questions about every project and idea – this is a place for discussion and discovery, much like the industry in which we work.

On behalf of the Transportation Informatics Tier I University Transportation Center, please enjoy the Fifth Annual Symposium on Transportation Informatics: "Research at the Intersection of Big Data and Connected & Automated Vehicles".

Adel W. Sadek, Ph.D.
Professor
Director, Transportation Informatics University Transportation Center
Associate Director, Institute for Sustainable Transportation & Logistics

ABOUT TRANSINFO

Transportation Informatics (TransInfo) University Transportation Center (UTC) leverages its partnership with top-tier transportation research universities to collaborate with government, industry, academia, and policy makers around the globe in search of transportation solutions by mining the wealth of big data available and employing a wide variety of methods, tools and models, including artificial intelligence (AI), machine learning, statistics, and database systems.

TransInfo has funded research projects in five research domains:

- Transportation Operations
- Safety, Efficiency and Sustainability
- Public Transportation
- Performance Measurement
- Travel Behavior Modeling

TransInfo is a consortium of four member national universities, University at Buffalo (lead university), Rensselaer Polytechnic Institute, George Mason University and the University of Puerto Rico-Mayagüez, and one non-member research corporation, CUBRC, located in Buffalo, N.Y.

Headquartered at the University at Buffalo, TransInfo is led by Adel Sadek, Professor in the Department of Civil, Structural and Environmental Engineering. In addition to faculty from the Department of Civil, Structural and Environmental Engineering, TransInfo also includes faculty from the Departments of Computer Science and Engineering, Industrial and Systems Engineering, and partners from both the public and private sector. TransInfo is funded by the USDOT's Office of the Assistant Secretary for Technology and Research (OST-R).

TRANSINFO FACULTY

UNIVERSITY AT BUFFALO

Adel Sadek
Director, TransInfo Tier I University Transportation Center; Founding Director, Stephen Still Institute for Sustainable Transportation and Logistics; Professor, Department of Civil, Structural and Environmental Engineering, School of Engineering and Applied Sciences

Panos Anastasopoulos
Associate Professor, Department of Civil, Structural and Environmental Engineering; Director, Engineering Statistics and Econometrics Application Research Lab; Director, Stephen Still Institute for Sustainable Transportation and Logistics, School of Engineering and Applied Sciences

Rajan Batta
Interim Dean, School of Engineering and Applied Sciences; SUNY Distinguished Professor, Department of Industrial and Systems Engineering, School of Engineering and Applied Sciences

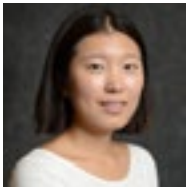
Lora Cavuoto
Associate Professor and Director of Undergraduate Studies, Department of Industrial and Systems Engineering, School of Engineering and Applied Sciences

Jing Gao
Associate Professor, Department of Computer Science and Engineering, School of Engineering and Applied Sciences

Venugopal (Venu) Govindaraju
Vice President for Research and Economic Development; Founding Director, Center for Unified Biometrics and Sensors (CUBS); Associate Director, Center of Excellence for Document Analysis and Recognition (CEDAR); SUNY Distinguished Professor, Department of Computer Science and Engineering, School of Engineering and Applied Sciences

Qing He
Assistant Professor, Stephen Still Institute for Sustainable Transportation and Logistics, School of Engineering and Applied Sciences

Daniel B. Hess
Associate Professor and Chair, Department of Urban and Regional Planning, School of Architecture and Planning



Jee Eun "Jamie" Kang
Assistant Professor, Industrial and Systems Engineering, School of Engineering and Applied Sciences

Sara Metcalf
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JiYoung Park
Assistant Professor, Department of Urban and Regional Planning, School of Architecture and Planning

Chunming Qiao
SUNY Distinguished Professor and Chair, Department of Computer Science and Engineering; Adjunct Professor, Department of Electrical Engineering, School of Engineering and Applied Sciences

Lu Su
Assistant Professor, Department of Computer Science and Engineering, School of Engineering and Applied Sciences

Jose Walteros
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Le Wang
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Qian Wang
Assistant Professor of Teaching, Department of Civil, Structural and Environmental Engineering, School of Engineering and Applied Sciences

Eun-Hye Enki Yoo
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RENSSELAER POLYTECHNIC INSTITUTE

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Manuel Rodriguez-Martinez
Professor, Department Computer Science and Engineering

Dr. Daniel Rodriguez-Roman
Assistant Professor, Department of Civil Engineering

AGENDA

THURSDAY, AUGUST 8, 2019

Davis Hall, Room 101, University at Buffalo, North Campus

8:00 a.m.

Registration Opens

Coffee and continental breakfast provided

8:30 a.m. – 9:00 a.m.

Opening Session

Welcome and Introduction by Adel Sadek, Director, Transportation Informatics Tier I University Transportation Center, and Joah Sapphire, GDG IoT and University at Buffalo

Welcome Remarks:

- Rajan Batta, Interim Dean, School of Engineering and Applied Sciences, University at Buffalo
- Adam Fogel, Chief of Staff, Office of NYS Senator Tim Kennedy

9:00 a.m. – 10:20 a.m.

Session 1: Government Panel

MODERATOR:

Anthony Spada, CEO of AAA Western and Central New York

PRESENTATIONS:

Luis Taveras, Chief Information Officer, Management Information Systems, City of Buffalo

Bill Geary, Erie County Commissioner of the Department of Public Works

Dana Crisino, Director of Herkimer-Oneida MPO

Terence J. McDonnell, Staff Sergeant, New York State Police

Jonathan Manes, Professor, School of Law, University at Buffalo

10:20 a.m. – 10:40 a.m. Coffee Break

10:40 a.m. – 12:00 p.m.

Session 2: Industry Panel

MODERATOR:
Stephen Still, Professor of Practice, Institute for Sustainable Transportation and Logistics, University at Buffalo

PRESENTATIONS:
Yunjie Zhao, Research Scientist, Lyft

Michael Brown, Senior Engineer, SwRI

Brad Rutherford, Global Director of Channel Sales, Local Motors

Amy Lopez, Director Public Sector Services, INRIX

Steve Finch, Senior VP Automotive Services, AAA Western and Central New York

12:00 p.m. – 2:00 p.m.

Lunch & AV Demos
Located at the Center for Tomorrow, University at Buffalo, North Campus
* Bus transportation will be provided

- Demonstration of 3D Printed, All-Electric, Driverless Shuttle called "Olli", manufactured by Local Motors and Vehicle Operating System by Robotic Research
- Observation of Lincoln MKZ retrofitted by AutonomouStuff
- UB's Summer Transportation Institute students will join the lunch
  * See description of this group on page 17 of this program

2:00 p.m. – 2:45 p.m.

Session 3: Keynote Speaker

Alison Pascale, Senior Policy Strategist at Audi of America

2:45 p.m. – 3:00 p.m. Coffee Break

3:00 p.m. – 4:30 p.m.

Session 4: Technology and Academic Presentations and Panel

MODERATOR:

Adel Sadek, Director, Transportation Informatics Tier I University Transportation Center (UTC); Professor, Department of Civil, Structural and Environmental Engineering, University at Buffalo

PRESENTATIONS:

Yinhai Wang, Professor, Transportation Engineering; Founding Director of the Smart Transportation Applications and Research Laboratory (STAR Lab), University of Washington

Dr. Lei Lin, Research Scientist, Goergen Institute for Data Science, University of Rochester

Dr. John Handley, Research Scientist, Goergen Institute for Data Science, University of Rochester

Dr. Shan Huang, Infrastructure Engineer, Cresta; Head of Infrastructure, Alpha Health

Jamie Kang, Assistant Professor, Department of Industrial and Systems Engineering, School of Engineering and Applied Sciences, University at Buffalo
and Somayeh Dejbord, PhD student, Department of Industrial and Systems Engineering, University at Buffalo

PANEL DISCUSSION:

Steven Burr, Chief Architect, Chordant

Dr. John Handley, Research Scientist, Goergen Institute for Data Science, University of Rochester

Jamie Kang, Assistant Professor, Department of Industrial and Systems Engineering, School of Engineering and Applied Sciences, University at Buffalo

PANEL DISCUSSION (CONTINUED):

Alain Kornhauser, Professor of Operations Research & Financial Engineering, Princeton University; Director, Transportation Program, Faculty chair, Princeton Autonomous Vehicle Engineering (PAVE)

Yinhai Wang, Professor, Transportation Engineering; Founding Director of the Smart Transportation Applications and Research Laboratory (STAR Lab), University of Washington

4:30 p.m. **Symposium Closing Remarks**

Chunming Qiao, SUNY Distinguished Professor and Chair, Department of Computer Science and Engineering, University at Buffalo

4:30 p.m. – 6:00 p.m. **Reception and Poster Session**

Located in the Bansal Atrium, Davis Hall, University at Buffalo, North Campus

KEYNOTE SPEAKER

Alison Pascale

Senior Policy Strategist, Audi of America

Pascale has over 25 years of combined legislative and executive branch experience developing and implementing public policy with a focus on automotive safety, manufacturing, transportation policy and international trade. At Audi, Pascale works to advance federal and state policies that will accelerate the safe deployment of automated vehicle technologies. She engages and informs elected officials on vehicle technologies, develops and advises on public policy and legislative initiatives, builds and expands stakeholder coalitions, and initiates innovative approaches to prioritize vehicle safety.

Prior to coming to Audi, Pascale was Director of Governmental Affairs, Policy and Strategic Planning at the National Highway Traffic Safety Administration (NHTSA). In her senior leadership position at NHTSA, Pascale developed and implemented initiatives to reform the agency; played a key role in developing agency guidance on highly automated vehicles; and implemented changes to improve NHTSA's defects and recall mission. Pascale also oversaw all aspects of NHTSA's interactions with Congress.

Pascale previously was a senior advisor to Senator Carl Levin from Michigan, worked in the House of Representatives and at the Government Accountability Office and was a Presidential Management Fellow. She holds undergraduate and graduate degrees from American University in International Studies and International Relations.

She lives in Arlington, Virginia, with her husband and two children. When not at the office she can be found on the tennis court, traveling with her family or on a lake in Maine.

POSTERS

Abhishek Gupta

3D Road Geometry Features Estimation Using Smartphones

As the automobile sector is gradually moving towards complete autonomy, there is an ever-increasing requirement for scalable and cost efficient solutions to collect rich and accurate data about road networks, including road geometry features. However, the task is a challenging one. Firstly, the scale of current road networks is huge. Secondly, road networks are dynamic in nature, the properties of which are ever-changing, due to construction of new roads and maintenance of the existing ones. In this work, we study the feasibility of using smartphones as a sensing platform for the task of 3D road geometry features estimation. Real world experiments using naturalistic smartphone data on a test route of 10kms indicate that smartphones can be an answer for scalable and cost effective solution for 3D Road Geometry Features estimation.

Foad Hajiaghajani

Tailgating Risk-Aware Beacon Rate Adaptation for Distributed Congestion Control in VANETs

Vehicular safety applications require vehicles to maintain a high awareness level of the local neighborhood through broadcasting safety beacons on the control channel. However, the existing 10-MHz control channel in the IEEE 802.11p based Dedicated Short Range Communication (DSRC) standard can be easily congested by frequent beaconing in a dense environment, which, therefore, degrades the performance of network and safety level of vehicles. Existing congestion mitigation approaches aim to fairly distribute the channel resources based on channel load measurements, but fail to incorporate road safety requirements of vehicles. In this work, we model the VANET congestion control problem as a utility maximization problem leveraging i) the contribution of every vehicle to channel load with respect to its location, and ii) a car-following risk factor which is defined as the rear-end crash risk perceived by every vehicle. A distributed game-theoretic rate adaptation mechanism is then proposed to address the problem. Numerical results demonstrate that the proposed scheme dominates 802.11p CSMA/CA based beaconing mechanism.

POSTERS (CONTINUED)

Junxuan Huang

On Sensor Fusion in Autonomous Vehicles

In this poster, we present sensor fusion in autonomous vehicles. We focus on the application of sensor fusion based on key sensors such as cameras, radars and lidars in three fundamental tasks of autonomous vehicles: segmentation, object detection, and localization.

Srinivas Ravi

Lidar Simulation in Unity

We developed a depth buffer based Lidar sensor in Unity game engine - which is used to realize a realistic driving environment in the simulator. Most autonomous vehicles use Lidar as one of the primary sensors. Thus this effort helps in realizing the iCAVE2's focus on creating a realistic simulator for testing and evaluation of autonomous vehicles in the simulated environment.

SUMMER TRANSPORTATION INSTITUTE AT UB

ABOUT THE CAMP

The Summer Transportation Institute at UB has been active for five years, and is a highly competitive scholarship program that provides 30 high school students with a great chance to investigate careers and educational opportunities in today's transportation industry and beyond.

Students participate in discussions, hands-on design competitions, and trips to study local and regional transportation hotspots. They also spend time with industry role models and a diverse group of students.

Scholarship funding for 2019 is provided by the Stephen Still Institute for Sustainable Transportation and Logistics. Past funding was provided by a Federal Highway Administration grant.

Contact Qian Wang for more information: qw6@buffalo.edu

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