Fred Feng

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Industrial and Manufacturing Systems Engineering
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Research interests

Advancing the safety of sustainable, active, and equitable mobility modes, such as cycling & walking, through developing data-driven insights, strategies & tactics, and technologies.

To this end, we use a variety of research methods including observational studies, laboratory experiments, applied statistics, causal inference, machine learning, computational human modeling, and human factors.

Employment

University of Michigan-Dearborn, Department of Industrial and Manufacturing Systems Engineering

Assistant Professor, September 2018–present

University of Michigan Transportation Research Institute (UMTRI)

Postdoctoral Research Fellow, May 2015–August 2018, Supervisor: Shan Bao

Education

Ph.D., **Industrial and Operations Engineering**, 2015
University of Michigan, Ann Arbor
Thesis: Queuing network modeling of human multitask performance and its application to usability testing of in-vehicle infotainment systems
Advisor: Yili Liu

M.S., **Mechanical Engineering**, 2009
Tsinghua University, China
Thesis: Driver drowsiness detection based on multi-sensor data fusion
Advisor: Bo Cheng

B.E., **Automotive Engineering**, 2006
Tsinghua University, China

Grants

External Grants

1. “Online driver model development to support shift schedule optimization and powertrain system improvements" Sponsor: Ford Motor Company, 24 months (2021-2023), PI: Fred Feng
2. “Research on the trending of micromobility: patterns and issues"
   Sponsor: Mcity tailored project by Honda, 9 months (2021-2022), PI: Shan Bao, Co-PI: Fred Feng
3. “A continued naturalistic bicycling study in Ann Arbor and bicycle corner case simulation in CARLA" Sponsor: Toyota Research Institute, 24 months (2019-2020), PI: Fred Feng
4. “Developing bicycle-related corner case scenarios and a bicyclist model for testing self-driving cars using naturalistic driving data and crash data"
   Sponsor: Toyota Research Institute, 7 months (2018-2019), Subaward, PI: Fred Feng
5. “A naturalistic bicycling study in the Ann Arbor area"
   Sponsor: Toyota Research Institute, 4 months (2018), Subaward, PI: Fred Feng

Campus Grants

1. “Collection and analysis of traffic data to examine the effectiveness of the Dearborn Healthy Streets program” Office of Metropolitan Impact (OMI) Community-Based Research Seed Grants ($8,180), 2021, PI: Fred Feng
2. “Center for Community Health and Equity Research” Research Planning Grants for Catalyzing Faculty Research Innovation and Collaboration ($9,968), 2020, Co-PI: Fred Feng
3. “A Browser-based Tool for Interactive Visualizations of Probability Distributions” Open Educational Resources (OER) Supplemental Materials Grant ($500), 2020, PI: Fred Feng

Publications

Refereed Journal Articles

1. Wenbo Sun, Matthew Aguirre, Jionghua Judy Jin, Fred Feng, Samer Rajab, Shigenobu Saigusa, Jovin Dsa, and Shan Bao. “Online distraction detection for naturalistic driving dataset using kinematic motion models and a multiple model algorithm”. *Transportation Research Part C: Emerging Technologies* 130.103317 (2021). doi: 10.1016/j.trc.2021.103317.
2. Bo Yu, Shan Bao, Fred Feng, and James Sayer. “Examination and prediction of drivers’ reaction when provided with V2I communication-based intersection maneuver strategies”. *Transportation Research Part C: Emerging Technologies* 106 (2019), pp. 17–28. doi: 10.1016/j.trc.2019.07.007.

3. Fred Feng, Shan Bao, Judy Jin, Wenbo Sun, Shigenobu Saigusa, Amin Tahmasbi-Sarvestani, and Jovin Dsa. "Estimation of lead vehicle kinematics using camera-based data for driver distraction detection". *International Journal of Automotive Engineering* 9.3 (2018), pp. 158–164. doi: 10.20485/jsaeijae.9.3_158.

4. Fred Feng, Shan Bao, Robert C Hampshire, and Michael Delp. "Drivers overtaking bicyclists-An examination using naturalistic driving data". *Accident Analysis & Prevention* 115 (2018), pp. 98–109. doi: 10.1016/j.aap.2018.03.010.

5. Fred Feng, Yili Liu, and Yifan Chen. "Effects of quantity and size of buttons of in-vehicle touch screen on drivers' eye glance behavior". *International Journal of Human–Computer Interaction* 34.12 (2018), pp. 1105–1118. doi: 10.1080/10447318.2017.1415688.

6. Fred Feng, Shan Bao, James R Sayer, Carol Flannagan, Michael Manser, and Robert Wunderlich. "Can vehicle longitudinal jerk be used to identify aggressive drivers? An examination using naturalistic driving data". *Accident Analysis & Prevention* 104 (2017), pp. 125–136. doi: 10.1016/j.aap.2017.04.012.

7. Fred Feng, Yili Liu, and Yifan Chen. "A computer-aided usability testing tool for in-vehicle infotainment systems". *Computers & Industrial Engineering* 109 (2017), pp. 313–324. doi: 10.1016/j.cie.2017.05.019.

8. Bo Cheng, Wei Zhang, Yingzi Lin, Ruijia Feng, and Xibo Zhang. "Driver drowsiness detection based on multisource information". *Human Factors and Ergonomics in Manufacturing & Service Industries* 22.5 (2012), pp. 450–467. doi: 10.1002/hfm.20395.

Refereed Conference Proceedings

1. Fred Feng and Ayah Hamad. "Development of a high fidelity virtual reality cycling simulator for road safety education and research". *Transportation Research Board 100th Annual Meeting*. 21-04340. 2021.

2. Fred Feng, Shan Bao, Colleen Hillard, Mark Gilbert, and Jacopo Serafin. "A naturalistic cycling study in Ann Arbor". *Transportation Research Board 99th Annual Meeting*. 20-03009. 2020.

3. Shan Bao, Fred Feng, Anuj Pradhan, Yu Zhang, Bochen Jia, and John Sullivan. "Examination of the effectiveness of multiple training methods on supporting drivers' better understanding towards level 2 automated vehicle systems". *Transportation Research Board 98th Annual Meeting*. 19-01321. 2019.

4. Fred Feng, Shan Bao, and Michael Delp. "Vehicle lane encroachment when drivers overtaking bicyclists-an examination using naturalistic driving data". *Transportation Research Board 97th Annual Meeting*. 18-06555. 2018.

5. Heejin Jeong, Fred Feng, and Yili Liu. "Computational modeling of driver lateral control on curved roads with integration of vehicle dynamics and reference trajectory tracking". *9th International Driving Symposium on Human Factors in Driver Assessment, Training and Vehicle Design*. 2017. doi: 10.17077/drivingassessment.1635.

6. Fred Feng, Shan Bao, James Sayer, and David LeBlanc. "Spectral power analysis of drivers' gas pedal control during steady-state car-following on freeways". *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*. Vol. 60. 1. 2016, pp. 729–733. doi: 10.1177/1541931213601167.

7. Yifan Chen, Basavaraj Tonshal, James Rankin, and Fred Feng. "Development of an integrated simulation system for design of speech-centric multimodal human-machine interfaces in an automotive cockpit environment". *ASME 2016 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference*. 2016. doi: 10.1115/DETC2016-59309.

8. Fred Feng, Yili Liu, Yifan Chen, Dimitar Filev, and Curtis To. "Computer-aided usability evaluation of in-vehicle infotainment systems". *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*. Vol. 58. 1. (Honorable mention of the best technical paper HFES David Meister Award). 2014, pp. 2285–2289. doi: 10.1177/1541931214581476.

9. Fred Feng and Yili Liu. "Computational modeling of feature and conjunction visual search tasks using Queuing Network-Model Human Processor (QN-MHP)". *2nd International Digital Human Modeling Symposium Proceedings*. [paper]. 2013.

10. Ruijia Feng, Guangyuan Zhang, and Bo Cheng. "An on-board system for detecting driver drowsiness based on multi-sensor data fusion using Dempster-Shafer theory". *2009 International Conference on Networking, Sensing and Control*. IEEE. 2009, pp. 897–902. doi: 10.1109/ICNSC.2009.4919399.

11. Guangyuan Zhang, Bo Cheng, Ruijia Feng, and Xibo Zhang. "A real-time adaptive learning method for driver eye detection". *2008 digital image computing: techniques and applications*. IEEE. 2008, pp. 300–304. doi: 10.1109/DICTA.2008.43.

12. Guangyuan Zhang, Bo Cheng, Ruijia Feng, and Jiawen Li. "Real-time driver eye detection method using Support Vector Machine with Hu invariant moments". *2008 International Conference on Machine Learning and Cybernetics*. Vol. 5. IEEE. 2008, pp. 2999–3004. doi: 10.1109/ICMLC.2008.4620921.

13. Qingfeng Lin, Ruijia Feng, Bo Cheng, Junke Lai, Hong Zhang, and Bingsong Mei. "Analysis of causes of rear-end conflicts using naturalistic driving data collected by video drive recorders". *SAE Technical Paper*. 2008-01-0522. 2008. doi: 10.4271/2008-01-0522.

Book Chapters

1. Justin M Owens, Laura Sandt, Azra Habibovic, Sarah Rebolloso McCullough, Ryan Snyder, Robert Wall Emerson, Pravin Varaiya, Tabitha Combs, Fred Feng, Mohammed Yousuf, and Bernard Soriano. "Automated vehicles and vulnerable road users: envisioning a healthy, safe and equitable future". *Automated Vehicles Symposium 6*. Springer, 2019, pp. 61–71. doi: 10.1007/978-3-030-22933-7.

2. Anuj K Pradhan, John Sullivan, Chris Schwarz, Fred Feng, and Shan Bao. "Training and education: human factors considerations for automated driving systems". *Road Vehicle Automation 5*. Springer, 2018, pp. 77–84. doi: 10.1007/978-3-319-94896-6.

Technical Reports

1. Ruijia Feng, Basavaraj Tonshal, James Rankin, and Yifan Chen. "Speech centric multi-contour seat multimodal interaction study". *Ford Research and Advanced Engineering Technical Report*. SRR-2013-0132. 2013.

2. Yifan Chen, Ruijia Feng, Basavaraj Tonshal, James Rankin, Louis Tijerina, Jeff Greenberg, Stefan Wolter, and Teddy Xiong. "A survey of the emotive driver advisory system (EDAS) help function concept". *Ford Research and Advanced Engineering Technical Report*. SRR-2012-0069. 2012.

Patents & patent applications

1. Michael Delp, Ruijia Feng, and Shan Bao. "System, method, and computer-readable medium for autonomous vehicle response to bicycles at intersections". US10788834B2. (granted). 2020.

2. Michael Delp, Ruijia Feng, and Shan Bao. "System, method, and computer-readable medium for an autonomous vehicle to pass a bicycle". US20200012286A1. (pending). 2020.

3. Amin Tahmasbi-Sarvestani, Shan Bao, Fred Feng, Judy Jin, and Wenbo Sun. "Systems and methods for distracted driving detection". US20190337512A1. (pending). 2019.

Refereed Chinese Language Journal Articles & Conference Proceedings

1. Xibo Zhang, Bo Cheng, and Ruijia Feng. "Real-time detection of driver drowsiness based on steering performance". *Journal of Tsinghua University (Science and Technology)* 7 (2010), pp. 1072–1076. doi: 10.16511/j.cnki.qhdxxb.2010.07.025.

2. Bo Cheng, Ruijia Feng, Wei Zhang, Jiawen Li, and Xibo Zhang. "Driver drowsiness detection and warning system based on multi-source information fusion". *Journal of Highway and Transportation Research and Development* 26.S1 (2009), pp. 13–18.

3. Bo Cheng, Guangyuan Zhang, Ruijia Feng, Jiawen Li, and Xibo Zhang. "Real-time driver fatigue monitoring based on eye status detection". *Automotive Engineering* 30.11 (2008). (Chinese journal), pp. 1001–1005.

4. Ruijia Feng and Bo Cheng. "Rear-end collision warning algorithm design based on driver's braking behavior". *Society of Automotive Engineers (SAE) of China Congress*. Tianjin, China, 2007.

5. Bo Cheng, Guangyuan Zhang, Ruijia Feng, and Zhang Wei. "A review of the driver fatigue detection technology". *China International Conference of Automotive Safety Technology*. 2007.

Invited talks & seminars

- "Cycling safety: From crash data analysis to a naturalistic cycling study", Center for Connected and Automated Transportation (CCAT) Research Review, October 2021 (recording)
- "A Naturalistic Cycling Study in Ann Arbor, Michigan", Tran-SET Webinar Series, September 2021 (recording)

- "Sorry Mate I Didn't See You-Driver distraction and in-vehicle infotainment touch screen user interface design", General Motors Human Factors/User Experience Seminar, June 2020
- "Bicycling safety in the future of mobility" Next Generation Transportation Systems Seminar Series, University of Michigan, Ann Arbor, Civil and Environmental Engineering, September 2019
- "Bicycling safety and human-powered mobility in the era of automated driving." New Faculty Research Seminar Series, University of Michigan-Dearborn, November 2018
- Automated Vehicle Symposium Breakout Session: "AVs & Vulnerable road users: Envisioning a healthy, safe, and equitable future", July 2018
- Michigan Bicycle Conference: Bicycle Data and Research Workshop, June 2018
- Transportation Research Board Annual Meeting Workshop: "When AV and people meet – planning for the pedestrian/bike/autonomous vehicle interaction", January 2018
- Michigan Institute for Data Science (MIDAS) Mobile Sensor Meeting, November 2017
- "Here's the data, now what? Using large-scale naturalistic driving data to study driver behaviors and develop advance safety technologies" Next Generation Transportation Systems Seminar Series, University of Michigan, Ann Arbor, Civil and Environmental Engineering, April 2017

Press

- "Bike safety research is going 'high-res' with this new technology" University of Michigan-Dearborn, July 2021
- "Making it safer to bike alongside autonomous cars" University of Michigan Business Engagement Center, May 2020
- "Painted white lines are not cyclist-protecting forcefields, agree experts" Forbes, April 2019
- "Unlucky for bicyclists, every 13th passing motorist is looking elsewhere" Forbes, October 2018

Teaching

IMSE 586 Big Data Analytics and Visualization, F2018, F2019, F2020, F2021

Graduate course, University of Michigan-Dearborn

Topics: This course provides students with hands-on experience of using analytical and predictive modeling techniques and software (Python and its libraries). Topics include data manipulation, visualization, and applied statistical learning methods including linear regression, classification, dimensionality reduction, clustering, and time-series analysis.

IMSE 440 Applied Statistical Models in Engineering, W2020, W2021

Undergraduate course, University of Michigan-Dearborn

Topics: Simple and multiple linear regression models, analysis of variance, model diagnosis, evaluation, and selection, logistic regression, and an introduction to design of experiments. The course also provides an introduction and hands-on activities of analyzing data in Python.

IMSE 317 Engineering Probability and Statistics, W2019, F2020, W2021, F2021

Undergraduate course, University of Michigan-Dearborn

Topics: Descriptive statistics and data visualization, set theory, permutations and combinations, Bayes' theorem, independence, discrete and continuous random variables, conditional and joint probability, central limit theorem, point estimation, confidence intervals, hypothesis testing.

IOE 366 Linear Statistical Models, F2017

Undergraduate course, University of Michigan, Ann Arbor. Co-instructed with Shan Bao

Topics: Linear statistical models and their application to engineering data analysis. Linear regression and correlation, multiple linear regression, stepwise selection, analysis of variance, introduction to design of experiments, data exploration techniques.

IMSE 577 User Interface Design and Analysis, W2017

Graduate course, University of Michigan-Dearborn. Co-instructed with Shan Bao

Topics: Current theories, methodologies, and techniques on the design, analysis, and evaluation of user interfaces and Human-Computer Interaction.

IOE 474 Simulation (Graduate Student Instructor), F2010, F2011, F2012, W2011, W2012, W2013

Undergraduate course, University of Michigan, Ann Arbor

Topics: Simulation of complex discrete-event systems with applications in industrial and service organizations. Topics include modeling and programming simulations in high-level computer packages, input distribution modeling, generating random numbers, and statistical analysis of simulation outputs.

Highlight: IOE Department 2012 Graduate Student Instructor of the Year Award (anonymously voted by students, one recipient per year)

Guest lecturer

- IMSE 501 Human Factors & Ergonomics, University of Michigan-Dearborn, F2020, W2021, F2021
- IE 490 Computational Human Factors, Purdue University, Spring 2020
- IE 690 Sensing Approaches For Human Factors Research, Purdue University, Spring 2018
- IOE 836 Seminar in Human Performance, University of Michigan, Ann Arbor, F2016, F2017

- IE 486 Work Analysis and Design II, Purdue University, Spring 2017
- IE 590 Human Factors and Medical Devices, Purdue University, Spring 2017
- IE 386 Work Analysis and Design I, Purdue University, Spring 2016, Fall 2016

Workshops & tutorials

- "Introduction to data visualization on the web with D3.js", MIDAS Anual Symposium (upcoming)
- "Introduction to data analysis in Python", NxtGen STEM Scholars (a program for underrepresented minority incoming freshmen), July 2021
- "Introduction to data analysis in Python", Big Data Summer Institute, June 2021 (recordings)
- "Machine learning pipelines and automated hyperparameter tuning", Ford Themed Learning Series, April 2021
- "Introduction to machine learning in Python with scikit-learn", Dearborn Artificial Intelligence Symposium, December 2020 (recording)
- "Introduction to Python for Community and K-12 Teachers & Students", MIDAS Anual Symposium November 2020 (recording)
- "Introduction to Data Analysis in Python", IMSE Department Workshop, March 2020 (recording)

Students & Committees

Ph.D. students (current)

- Hanumad Vasanth Munnamgi (2019-present)
- Ayah Hamad (2021-present)
- Mathi Padmanaban (2021-present)

Master's students

- Thesis students
  - Ayah Hamad, 2019-2021
  - Mathi Padmanaban, 2020-2021
- Capstone project students
  - Diana Mann, 2020; Linyan Wang, 2019

Undergraduate students

- Daniel Maudlin, 2021, Colleen Hillard, 2018-2020; Hamze Berro, 2019; Mitesh Patel, 2016

Ph.D. Committees

- Jackie Ayoub, ISE, UM-Dearborn. Chair: Feng Zhou
- Dr. Zunya Shi, ISE, University of Michigan-Dearborn. Ph.D. defense, 2021. Chair: Abdallah Chehade
- Dr. Kassem Moustafa, ISE, University of Michigan-Dearborn. Ph.D. defense, 2020. Chair: Zhen Hu

Major awards

- Michael H. Scheller Fellowship, 2012-2013, 2014-2015
- University of Michigan IOE Department Graduate Student Instructor of the Year Award, 2012
- University of Michigan Industrial and Operations Eng. Departmental Fellowship, 2009-2011
- Comprehensive Excellence Scholarship for Graduate Student at Tsinghua University, 2007
- Mitsubishi Scholarship for Outstanding Mechanical Eng. Student at Tsinghua University, 2006

Affiliations at the University of Michigan

- Michigan Institute for Data Science (MIDAS)
- Michigan Institute for Computational Discovery and Engineering (MICDE)
- University of Michigan Injury Prevention Center
- University of Michigan Poverty Solutions
- Dearborn Artificial Intelligence Research (DAIR) Center

Professional membership

- Human Factors and Ergonomics Society (HFES)
- Association of Pedestrian and Bicycle Professionals (APBP)

Reviewer

- Accident Analysis & Prevention
- Transportation Research Part C: Emerging Technologies
- Transportation Research Part F: Traffic Psychology and Behaviour
- International Journal of Human-Computer Interaction
- Applied Ergonomics
- IEEE Transactions on Intelligent Transportation Systems

- IEEE Intelligent Transportation Systems Magazine
- IEEE Access
- Transportmetrica A: Transport Science
- Transportation Research Board (TRB) Annual Meeting
- Human Factors and Ergonomics (HFES) Annual Meeting
- International ACM Conference on Automotive User Interfaces (AutoUI)
- International Cycling Safety Conference

Other services

Conference committees

- Scientific Committee, International Cycling Safety Conference, 2020
- Program Committee, International ACM Conference on Automotive User Interfaces (AutoUI), 2018, 2020, 2021

Campus services:

- IMSE Department Faculty Secretary (2019-present)
- Member, IMSE Department Social Media Committee (2019-present)
- Department Liaison, HUB for Teaching and Learning (2021-present)
- Member, College of Engineering and Computer Science Online Education Strategic Planning Committee (2021-present)
- Digital Ambassador, College of Engineering and Computer Science (2020-present)
- Faculty Research Committee, College of Engineering and Computer Science, 2020-2020

Local community services

- Board of directors, Washtenaw Bicycling and Walking Coalition, 2020-present
- Member, Healthy Environments Action Team, Healthy Dearborn Coalition, 2020-present
- Member, Dearborn Healthy Streets Project Planning Team, 2021-present

Workshop organizer

- "Automated vehicles are pretty much here: How can human factors research help prepare drivers, lawmakers, educators, and the public?", Automated Vehicle Symposium 2017
- "Acquisition and maintenance of driving skills in the climate of driver support, driver assist, and automation systems", Transportation Research Board Annual Meeting 2017

Webmaster: Surface Transportation Technical Group, Human Factors and Ergonomics Society, 2016-2018

Coaching: Volunteer coach for the University of Michigan Cycling Team (club sports), 2017-present

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