Fred Feng

University of Michigan-Dearborn
Industrial and Manufacturing Systems Engineering
4901 Evergreen Rd, Dearborn, MI 48128
fredfeng@umich.edu
https://www.umich.edu/~fredfeng
https://github.com/frfeng
https://twitter.com/fredfeng

Research interests

Methods: Behavioral data analytics, statistical learning, causal inference, data visualization, human performance modeling, human factors, human-machine interaction

Applications: Human-centered mobility, road safety, bicycling & pedestrian safety, driver behavior, sustainable transportation, automated vehicles

Employment

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

Assistant Professor, September 2018–present

University of Michigan Transportation Research Institute (UMTRI), Human Factors group

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

Assistant Professor @ University of Michigan-Dearborn

1. "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

Campus Internal Grants

1. "A Browser-based Tool for Interactive Visualizations of Probability Distributions"
   UM-Dearborn Open Educational Resources (OER) Supplemental Materials Grant ($500), 2020

Before becoming a faculty member, I was the primary proposal writer of the grants listed below. Note most grants did not allow non-faculty researchers to be PIs.

Postdoctoral Fellow @ University of Michigan Transportation Research Institute (UMTRI)

1. "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, Inc., 15 months (2018-2019), PI: Shan Bao
2. "A naturalistic bicycling study in the Ann Arbor area"
   Sponsor: Toyota Research Institute, Inc., two years (2017-2018), PI: Shan Bao
3. "The study on vehicle drivers and bicyclists interactions and communications"
   Sponsor: Toyota Research Institute, Inc., one year (2017), PI: Shan Bao
4. "Studying interactions between motor vehicles and bicyclists under existing infrastructure using large-scale naturalistic driving data"
   Sponsor: University of Michigan Mcity, one year (2017), PI: Shan Bao
5. "Evaluation of the efficacy of multiple training strategies on drivers' safe operation and trust calibration of Level 2 & 3 automated vehicle systems"
   Sponsor: University of Michigan Mcity, two years (2016-2017), PI: Shan Bao

PhD student @ University of Michigan, Ann Arbor

1. "Computational driver modeling and software for the optimization of multimodal interactions between the driver and in-vehicle infotainment systems"
   Sponsor: Ford Motor Company, two years (2015-2016), PI: Yili Liu
2. "Computational Cognitive Modeling and Software for the Optimization of Multimodal Interactions between Driver and In-Vehicle Infotainment Systems"
   Sponsor: Ford Motor Company, two years (2013-2014), PI: Yili Liu

Publications

Refereed Journal Articles

1. 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.

2. 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.

3. 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.

4. 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.

5. 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.

6. 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.

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

2. 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.

3. 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.

4. 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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.

11. 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.

12. 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.

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

- "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

- "Painted White Lines Are Not Cyclist-Protecting Forcefields, Agree Experts" Forbes, April 2019 https://www.forbes.com/sites/carltonreid/2019/04/16/painted-white-lines-are-not-cyclist-protecting-forcefields-agree-experts/
- "Unlucky for bicyclists, every 13th passing motorist is looking elsewhere" Forbes, October 2018 https://www.forbes.com/sites/carltonreid/2018/10/10/unlucky-for-bicyclists-every-13th-passing-motorist-is-looking-elsewhere/

Teaching

IMSE 586 Big Data Analytics and Visualization, Fall 2018, 2019

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, Winter 2020

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, Winter 2019

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, Fall 2017

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, Winter 2017

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), Fall 2010, 2011, 2012, Winter 2011, 2012, 2013

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

- IOE 836 Seminar in Human Performance, University of Michigan, Ann Arbor, Fall 2016, 2017
- IE 386 Work Analysis and Design I, Purdue University, Spring 2016, Fall 2016
- IE 486 Work Analysis and Design II, Purdue University, Spring 2017
- IE 490 Computational Human Factors, Purdue University, Spring 2020
- IE 590 Human Factors and Medical Devices, Purdue University, Spring 2017
- IE 690 Sensing Approaches For Human Factors Research, Purdue University, Spring 2018

Workshops and tutorials

- "Introduction to Data Analysis in Python", Winter 2020 (https://youtu.be/7IsFmtvBOyc)

Students

Ph.D. students (current)

- Hanumad Vasanth Munnamgi

Master's students

- Ayah Hamad, 2019-2020; Diana Mann, 2020; Linyan Wang, 2019

Undergraduate students

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

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 (https://midas.umich.edu/)
- University of Michigan Injury Prevention Center (https://injurycenter.umich.edu/)
- Dearborn Artificial Intelligence Research (DAIR) Center (https://dair.iselab.us/)

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
- International Journal of Human-Computer Interaction
- Transportation Research Record
- Applied Ergonomics
- IEEE Intelligent Transportation Systems Magazine
- IEEE Access
- Human Factors and Ergonomics

Other services

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