Wenchao Li

CONTACT INFORMATION

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Dependable Computing Lab

RESEARCH INTERESTS

Formal Methods; A.I. Safety; Machine Learning; Human Cyber-Physical Systems; Design Automation

EMPLOYMENT

Boston University, Boston, Massachusetts, USA.
Assistant Professor of Electrical and Computer Engineering July 2016 – Current
Peter J. Levine Career Development Professor 2018 – Current

SRI International, Menlo Park, California, USA.
Computer Scientist 2013 – 2016

EDUCATION

University of California, Berkeley, California, USA.
Ph.D. in Electrical Engineering and Computer Sciences 2007 – 2013

- Dissertation: Specification Mining: New Formalisms, Algorithms and Applications
- **ACM Outstanding Ph.D. Dissertation Award in Electronic Design Automation**
- Committee: Sanjit A. Seshia (Advisor), Andreas Kuehlmann, Francesco Borrelli

University of California, Berkeley, California, USA.
M.S. in Electrical Engineering and Computer Sciences

- Thesis: Formal Methods for Reverse Engineering Gate-Level Netlists
- Committee: Sanjit A. Seshia (Advisor), Robert K. Brayton

University of California, Berkeley, California, USA.
B.S. in Electrical Engineering and Computer Sciences (with honors) 2003 – 2007
B.A. in Economics (with distinction) 2003 – 2007

HONORS AND AWARDS

Peter J. Levine Career Development Professor, Boston University 2018
Junior Fellow, Hariri Institute for Computing 2018
ACM SIGDA Outstanding Ph.D. Dissertation Award 2015
Leon O. Chua Award for Outstanding Achievement in Nonlinear Science, UC Berkeley 2013
Vodafone-US Foundation Fellows Initiative Scholarship 2007
Singapore Ministry of Education Scholarship 1999 – 2002

PEER-REVIEWED PUBLICATIONS

Google Scholar Profile

1. Kacper Wardega, Roberto Tron and **Wenchao Li**.
Resilience of Multi-Robot Systems to Physical Masquerade Attacks,
IEEE Workshop on the Internet of Safe Things (SafeThings), 2019 (to appear).
2. Chao Huang, Kacper Wardega, **Wenchao Li** and Qi Zhu.
Exploring Weakly-hard Paradigm for Networked Systems,
The 1st Workshop on Design Automation for CPS and IoT (DESTION), 2019 (to appear).
3. Kacper Wardega, Roberto Tron and **Wenchao Li**.
Masquerade Attack Detection Through Observation Planning for Multi-Robot Systems,
The 18th International Conference on Autonomous Agents and Multiagent Systems (AAMAS), 2019 (to appear).

4. Chao Huang, **Wenchao Li** and Qi Zhu.
Formal Verification of Weakly-Hard Systems,
The 22nd ACM International Conference on Hybrid Systems: Computation and Control (HSCC), 2019 (to appear).
5. Weichao Zhou and **Wenchao Li**.
Safety-Aware Apprenticeship Learning,
International Conference on Computer Aided Verification (CAV), 2018.
6. Qi Zhu, Hengyi Liang, Licong Zhang, Debayan Roy, **Wenchao Li** and Samarjit Chakraborty.
Extensibility-Driven Automotive In-Vehicle Architecture Design,
The 54th ACM/IEEE Design Automation Conference (DAC), 2017. (*Invited*)
7. Bowen Zheng, Chung-Wei Lin, Hengyi Liang, Shinichi Shiraishi, **Wenchao Li** and Qi Zhu.
Delay-Aware Design, Analysis and Verification of Intelligent Intersection Management,
IEEE International Conference on Smart Computing (SMARTCOMP), 2017.
8. Sanjit A. Seshia, Shiyan Hu, **Wenchao Li** and Qi Zhu.
Design Automation of Cyber-Physical Systems: Challenges, Advances, and Opportunities,
Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD), Special Issue on Cyber-Physical Systems, Dec 2016. (**Keynote**)
9. Xiaodao Chen, Yuchen Zhou, Hong Zhou, Chaowei Wan, Qi Zhu, **Wenchao Li** and Shiyan Hu.
Analysis of Production Data Manipulation Attacks in Petroleum Cyber-Physical Systems,
IEEE/ACM International Conference on Computer-Aided Design (ICCAD), Nov 2016. (*Invited*)
10. Devesh Bhatt, Arunabh Chattopadhyay, **Wenchao Li**, David Oglesby, Sam Owre and Natarajan Shankar.
Contract-Based Verification of Complex Time-Dependent Behaviors in Avionic Systems,
The 8th NASA Formal Methods Symposium (NFM), Jun 2016.
11. Shalini Ghosh, Daniel Elenius, **Wenchao Li**, Patrick Lincoln, Natarajan Shankar and Wilfried Steiner.
ARSENAL: Automatic Requirements Specification Extraction from Natural Language,
The 8th NASA Formal Methods Symposium (NFM), Jun 2016.
12. **Wenchao Li**, Hassen Saïdi, Huascar Sanchez, Martin Schäf and Pascal Schweitzer
Detecting Similar Programs via the Weisfeiler-Leman Graph Kernel,
The 15th International Conference on Software Reuse (ICSR), Jun 2016.
13. **Wenchao Li**, Léonard Gérard and Natarajan Shankar.
Design and Verification for Multi-Rate Distributed Systems,
The 13th ACM/IEEE International Conference on Formal Methods and Models for Codesign (MEMOCODE), Sep 2015.
14. Bowen Zheng, **Wenchao Li**, Peng Deng, Léonard Gérard, Qi Zhu and Natarajan Shankar.
Design and Verification for Transportation System Security,
The 52nd ACM/IEEE Design Automation Conference (DAC), Jun 2015. (*Invited*)
15. **Wenchao Li**, Dorsa Sadigh, S. Shankar Sastry and Sanjit A. Seshia.
Synthesis for Human-in-the-Loop Control Systems,
The 20th International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS), Apr 2014.
16. Dorsa Sadigh, Katherine Driggs-Campbell, Alberto Puggelli, **Wenchao Li**, Victor Shia, Ruzena Bajcsy, Alberto Sangiovanni-Vincentelli, S. Shankar Sastry and Sanjit A. Seshia.
Data-Driven Probabilistic Modeling and Verification of Human Driver Behavior,
AAAI 2014 Symposium on Modeling in Human Machine Systems: Challenges for Formal Verification, Mar 2014.
17. Pramod Subramanyan, Nestan Tsiskaridze, **Wenchao Li**, Adrià Gascón, Wei Yang Tan, Ashish Tiwari, Natarajan Shankar, Sanjit A. Seshia and Sharad Malik.
Reverse Engineering Digital Circuits Using Structural and Functional Analyses,
IEEE Transactions on Emerging Topics in Computing: Special Issue on Nanoscale Architectures for Hardware Security, Trust and Reliability (TETC), Dec 2013.

18. Alberto Puggelli, **Wenchao Li**, Alberto Sangiovanni-Vincentelli and Sanjit A. Seshia.
Polynomial-Time Verification of PCTL Properties of MDPs with Convex Uncertainties,
The 25th International Conference on Computer Aided Verification (CAV), Jul 2013.

19. **Wenchao Li**, Adrià Gascón, Pramod Subramanyan, Wei Yang Tan, Ashish Tiwari, Sharad Malik, Natarajan Shankar and Sanjit A. Seshia.
WordRev: Finding Word-Level Structures in a Sea of Bit-Level Gates,
IEEE International Symposium on Hardware-Oriented Security and Trust (HOST), Jun 2013. (**Best Presentation Award**)

20. **Wenchao Li**, Susmit Jha and Sanjit A. Seshia.
Power-Aware Dynamic Control of Error-Resilience Mechanisms,
The 9th Workshop on Silicon Errors in Logic – System Effects (SELSE), Mar 2013.

21. **Wenchao Li** and Sanjit A. Seshia.
Sparse Coding for Specification Mining and Error Localization,
International Conference on Runtime Verification (RV), Sep 2012.

22. **Wenchao Li**, Zach Wasson and Sanjit A. Seshia.
Reverse Engineering Circuits Using Behavioral Pattern Mining,
IEEE International Symposium on Hardware-Oriented Security and Trust (HOST), Jun 2012. (**Best Paper Finalist**)

23. **Wenchao Li**, Sanjit A. Seshia and Somesh Jha.
CrowdMine: Towards Crowdsourced Human-Assisted Verification,
Design Automation Conference (DAC), Jun 2012.

24. **Wenchao Li**, Lili Dworkin and Sanjit A. Seshia.
Mining Assumptions for Synthesis,
ACM/IEEE International Conference on Formal Methods and Models for Codesign (MEMOCODE), Jul 2011.

25. **Wenchao Li**, Alessandro Forin and Sanjit A. Seshia.
Scalable Specification Mining for Verification and Diagnosis,
Design Automation Conference (DAC), Jun 2010.

26. Susmit Jha, **Wenchao Li** and Sanjit A. Seshia.
Localizing Transient Faults Using Dynamic Bayesian Networks,
IEEE International High Level Design Validation and Test Workshop (HLDVT), Nov 2009.

27. **Wenchao Li**, Marco D. Natale, Wei Zheng, Paolo Giusto, Alberto Sangiovanni-Vincentelli and Sanjit A. Seshia.
Optimizations of an Application-Level Protocol for Enhanced Dependability in FlexRay,
Design, Automation and Test in Europe (DATE), Apr 2009.

28. Daniel Holcomb, **Wenchao Li** and Sanjit A. Seshia.
Design as You See FIT: System-Level Soft Error Analysis of Sequential Circuits,
Design, Automation and Test in Europe (DATE), Apr 2009.

29. Orna Kupferman, **Wenchao Li** and Sanjit A. Seshia.
A Theory of Mutations with Applications to Vacuity, Coverage, and Fault Tolerance,
IEEE International Conference on Formal Methods in Computer-Aided Design (FMCAD), Nov 2008.

30. Sanjit A. Seshia, **Wenchao Li** and Subhasish Mitra.
Verification-Guided Soft Error Resilience,
Design, Automation and Test in Europe (DATE), Apr 2007.

31. Roozbeh Jafari, **Wenchao Li**, Ruzena Bajcsy, Steven Glaser and Shankar Sastry.
Physical Activity Monitoring for Assisted Living at Home,
Body Sensor Networks Conference (BSN), Mar 2007.

Technical Reports

32. Daniel Holcomb, **Wenchao Li** and Sanjit A. Seshia.
Algorithms for Green Buildings: Learning-Based Techniques for Energy Prediction and Fault Diagnosis,
Technical Report, University of California, Berkeley, UCB/EECS-2009-138, Oct 2009.

33. Orna Kupferman, **Wenchao Li** and Sanjit A. Seshia.
On the Duality between Vacuity and Coverage,
Technical Report, University of California, Berkeley, UCB/EECS-2008-26, Mar 2008.

Funding

Contract-Based and Scenario-Driven Safety Analysis of Learning-Enabled Cyber-Physical Systems, **Toyota InfoTechnology Center, USA**, $60,000 (Industry Gift), 2018.

Safe Learning for Intelligent Transportation Systems, **Toyota InfoTechnology Center, USA**, $40,000 (Industry Gift), 2018.

Hariri Institute Research Incubation Award, **The Rafik B. Hariri Institute for Computing and Computational Science & Engineering**, $24,655 (with Prof. Roberto Tron), 2018.

CPS: Breakthrough: Collaborative Research: A Framework for Extensibility-Driven Design of Cyber-Physical Systems, **National Science Foundation**, Lead PI, $225,000 (total: $425,000), 9/16 – 8/19.

Dynamic Adaptive Embedded Software (DyAdEm), **DARPA/AFRL** (subcontract from SRI International), ∼$250,000 (total: ∼$5,100,000), 7/16 – 10/19.

Programmers Assistant Synthesizing Code via Abstraction & Logical Inference (PASCALI), **DARPA/AFRL** (subcontract from SRI International), ∼$200,000 (total: ∼$6,300,000), 7/16 – 10/18.

Previous Internship Experiences

Computer Science Laboratory, SRI International, Menlo Park, CA
Student Associate Spring 2013 & Summer 2012

Embedded Systems and Reconfigurable Computing, Microsoft Research, Redmond, WA
Research Intern Summer 2009

Talks and Presentations

Invited Talks and Seminars

1. *Towards Assured Autonomy: From System Design to Algorithm,*
Dept. of Computer Science, Yale University, Jan 19, 2018.
2. *Towards Dependable Robot Software,*
Dept. of Electrical Engineering, University of California, Los Angeles, Apr 4, 2016.
3. *Human-Centric Formal Methods: From Circuits to Cyber-Physical Systems,*
Given at the following venues:
   - Dept. of Electrical and Computer Engineering, Northeastern University, Apr 11, 2016.
   - Dept. of Electrical, Computer, and Energy Engineering, University of Colorado, Boulder, Apr 7, 2016.
   - Dept. of Electrical and Computer Engineering, University of British Columbia, Mar 14, 2016.
   - Dept. of Electrical and Computer Engineering, New York University, Mar 8, 2016.
   - Dept. of Electrical and Computer Engineering, Utah University, Mar 3, 2016.
   - Dept. of Electrical and Computer Engineering, Boston University, Feb 29, 2016.
   - School of Electrical and Computer Engineering, Cornell University, Feb 22, 2016.
   - Dept. of Electrical and Computer Engineering, University of Massachusetts, Amherst, Dec 4, 2015.
   - Dept. of Electrical Engineering, University of California, Los Angeles, Mar 2, 2015.
4. *Specification Mining: New Formalisms, Algorithms and Applications,*
Research in Software Engineering (RiSE), Microsoft Research, Mar 27, 2014.

5. *Dealing with the Missing Pieces: Specification Mining and Model Checking with Uncertainties,*
Computer Science Laboratory, SRI International, May 3, 2013.
6. *Analysis and Synthesis of Formal Specifications for Dependable Computing,*
Systems and Technology Group, IBM Poughkeepsie, Dec 12, 2012.
7. *Verification-Guided Soft Error Resilience,*
ASIC Engineering, NVIDIA, Feb 2009.
8. *Verification-Guided Error Resilience,*
Dagstuhl Seminar on Verifying Reliability, Schloss Dagstuhl, Germany, Aug 20, 2012.

Selected Conference and Workshop Presentations

9. *Towards Assured Autonomy: From Software Architecture to Algorithm,*
IEEE International Workshop on Design Automation for Cyber-Physical Systems, Jun 24, 2018.
10. *Safety-Aware Apprenticeship Learning,*
The 30th International Conference on Computer Aided Verification, Jul 15, 2018.
11. *Design and Verification of Multi-Rate Distributed Systems,*
The 13th ACM/IEEE International Conference on Formal Methods and Models for System Design (MEMOCODE), Sep 21, 2015.
12. *WordRev: Finding Word-Level Structures in a Sea of Bit-Level Gates,*
IEEE International Symposium on Hardware-Oriented Security and Trust (HOST), Jun 2, 2013.
13. *Sparse Coding for Specification Mining and Error Localization,*
The 12th International Conference on Runtime Verification (RV), Sep 26, 2012.
14. *Reverse Engineering Circuits Using Behavioral Pattern Mining,*
IEEE International Symposium on Hardware-Oriented Security and Trust (HOST), Jun 3, 2012.
15. *Mining Assumptions for Synthesis,*
The 9th ACM/IEEE International Conference on Formal Methods and Models for System Design (MEMOCODE), Jul 11, 2011.
16. *Scalable Specification Mining for Verification and Diagnosis,*
The 47th ACM/IEEE Design Automation Conference (DAC), Jun 2010.
17. *Localizing Transient Faults Using Dynamic Bayesian Networks,*
IEEE International High Level Design Validation and Test Workshop (HLDVT), Nov 2009.
18. *Optimizations of an Application-Level Protocol for Enhanced Dependability in FlexRay,*
Design, Automation and Test in Europe (DATE), Apr 2009
19. *A Theory of Mutations with Applications to Vacuity, Coverage, and Fault Tolerance,*
International Conference on Formal Methods in Computer Aided Design (FMCAD), Nov 20, 2008.

Teaching Experience

Teaching at Boston University

- EC330: Applied Algorithms for Engineers — Fall 2018
Undergraduate course on algorithms. Topics covered include the general concept of algorithms, efficiency and run-time of algorithms, graph algorithms, priority queues, search trees, various approaches to design of algorithms and data structures, together with their applications to numerical and non-numerical problems.
- EC700: Computer-Aided Verification and Synthesis — Fall 2017
Advanced graduate course on computer-aided verification and synthesis. The topics covered include formal specifications, modeling formalisms, verification techniques, inductive synthesis, and emerging applications such as autonomous robots and vehicles.
- EC535: Introduction to Embedded Systems — Spring 2017
Graduate course on embedded systems. The topics covered include system specification languages, embedded computer architecture, real-time operating systems, hardware-software co-design, modeling formalisms, verification techniques, and embedded system applications.

- EC551: Advanced Digital Design with Verilog and FPGAs Fall 2016
  Graduate course on digital design and computer-aided design algorithms for FPGAs. The topics covered include hardware description language (Verilog), specification, design, simulation, verification and synthesis of digital designs on FPGAs.

Advising and Mentoring Experience

Ph.D. Advisees at Boston University

- Weichao Zhou, Fall 2018 – Current
- Panagiota Kiourti, Fall 2018 – Current
- Jiameng Fan, Fall 2017 – Current
- Kacper Wardega, Fall 2017 – Current

M.Eng./M.S. Students at Boston University

- Xiaoyue Wang, Fall 2016 – Spring 2018
- Weichao Zhou, Fall 2016 – Spring 2018
- Hongchen Guo, Fall 2016 – Spring 2017
- Yaqin Huang, Fall 2016 – Spring 2017
- Qifan He, Summer 2017
- Akash Mehta, Spring 2017 – Spring 2018
- Muhammad Zuhayr Raghib, Spring 2017 – Spring 2018

Visiting Students

- Panyang Qi (from Peking University), Summer 2018
- Yishuang Lin (from University of Science and Technology of China), Summer 2018

High School Students

- Edward Yang (through the BU RISE program), Summer 2018
- Eddie Hew (through the BU RISE program), Summer 2017

Ph.D. Prospectus/Dissertation Committees

- Sadra Sadraddini (ME, BU)
- Giuseppe Bombara (ECE, BU)
- Prashant Vaidyanathan (ECE, BU)

M.S. Thesis Committees

- Weichao Zhou, Spring 2018
- Yannan Bai, Spring 2018
- Kiran Vishal Thanjavur Bhaaskar, Spring 2017

Professional Services

Editorial Positions

- Associate Editor, Electronic Newsletter, ACM Special Interest Group on Design Automation.
- Guest Editor, Special Issue on Cyber-Physical Aspects of EVs and HEVs, IET Cyber-Physical Systems: Theory & Applications.
- Guest Editor, Special Issue on (Industrial) Internet of Things for Smart & Sensing Systems: Issues, Trends and Applications, IEEE Internet of Things Journal.

Technical Program Committee Member

- Design Automation Conference (DAC), 2019, 2018
- International Conference On Computer Aided Design (ICCAD), 2018
- International Conference on Embedded Software (EMSOFT), 2018

- International Conference on Cyber-Physical Systems (ICCPS), 2018
- Design, Automation and Test in Europe (DATE), 2017
- NASA Formal Methods Symposium (NFM), 2017
- Automated Formal Methods Workshop (AFM), 2017
- International Conference on Embedded Software and Systems (ICESS), 2016, 2015
- International Workshop on Formal Techniques for Safety-Critical Systems (FTSCS), 2015
- Workshop on Design Automation for Understanding Hardware Designs at DATE, 2017, 2016, 2014

Panelist

- NSF Panel, 2018
- NSF Panel, 2017

Session Chair

- International Conference on Computer-Aided Design (ICCAD), 2014

Publicity Chair

- 30th ACM SIGDA University Demonstration, 2018

Reviewer for Journals and Conference Articles (apart from TPC and editorial services)

- *Journals*: Transactions on Information Forensics & Security (T-IFS), Proceedings of the IEEE (PIEEE), ACM Transactions on Cyber-Physical Systems (TCPS), IEEE Transactions on Big Data (TBD), IEEE Computer Architecture Letters (CAL), ACM Transaction on Embedded Computing (TECS), IEEE Transactions on Multi-Scale Computing Systems (TMSCS), IEEE Transactions on Automation Science and Engineering (T-ASE), IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD), IEEE Transactions on Emerging Topics in Computing (TETC), IEEE Transactions on Computers (TC), IEEE Embedded System Letters (ESL), ACM Transaction on Design Automation of Electronic Systems (TODAES), IET Cyber-Physical Systems: Theory & Applications, Integration, the VLSI Journal, Journal of Intelligent Manufacturing (JIMS), Integration, the VLSI Journal.
- *Conferences*: Computer Aided Design (CAV), International Test Conference (ITC), International Conference on Computer-Aided Design (ICCAD), Nasa Formal Methods (NFM), USENIX Security Symposium (USENIX), Formal Methods in Computer-Aided Design (FMCAD), Hybrid Systems: Computation and Control (HSCC), Automated Software Engineering (ASE), International Conference on Tools and Algorithms for the Construction and Analysis of Systems (TACAS), International Conference on Formal Methods and Models for System Design (MEMOCODE), Formal Modeling and Analysis of Timed Systems (FORMATS), International Symposium on Circuits and Systems (ISCAS), International Conference on Logic for Programming, Artificial Intelligence and Reasoning (LPAR), International Colloquium on Theoretical Aspects of Computing (ICTAC), International Symposium on Industrial Embedded Systems (SIES), International Conference on Quantitative Evaluation of SysTems (QEST), International Conference on Embedded Software and Systems (ICESS).

University and Department Services

- Publicity Committee, ECE Department, Boston University, 2017 – current
- Doctoral Committee, ECE Department, Boston University, 2016 – current
- Master Committee, ECE Department, Boston University, 2016 – 2017