CHUCHU FAN

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RESEARCH INTEREST

Formal Verification; Controller Synthesis; Cyber-Physical Systems; Control Theory; Machine Learning; Robotics;

EDUCATION

University of Illinois at Urbana-Champaign   Aug. 2013 - May 2019
Ph.D. Candidate in Computer Engineering   *Advisor: Prof. Sayan Mitra*
- Thesis: Formal methods for safe autonomy: verification, synthesis, and applications
- Tools developed: DryVR; C2E2; RealSyn

Tsinghua University   Sep. 2009 - Jul. 2013
B.E. in Automation (with honor)   *Advisor: Prof. Haiming Lu and Mingguo Zhao*

University of Southern California   Jun. 2012 - Aug. 2012
Visiting Scholar in Computer Science   *Advisor: Prof. Laurent Itti*

HONORS AND AWARDS

Mavis Future Faculty Fellows (MF3) of UIUC	2018
M. E. Van Valkenburg Graduate Research Award from UIUC	2018
Selected Attendee of the 5th Heidelberg Laureate Forum	2017
Yi-Min Wang and Pi-Yu Chung Endowed Research Award from UIUC	2017
Rising Stars in EECS (Class of 2016)	2016
EMSOFT Best Paper Finalist	2016
Rambus Computer Engineering Fellowship from UIUC	2016
Travel Scholarship for CAV	2016,2017
Robert Bosch Best Verification Result Award in CPSweek	2015
First-class Scholarships honored by the Soar Foundation and by SAMSUNG	2011,2012
Best Hardware Award in Electronic Design Competition in Tsinghua	2011

PUBLICATIONS

JOURNAL

19. [**TECS'18**] <u>Chuchu Fan</u>, James Kapinski, Xiaoqing Jin and Sayan Mitra. "Simulation-driven reachability using matrix measures." *ACM Transactions on Embedded Computing Systems*, 2018. [pdf]

18. [**IEEEDT'18**] <u>Chuchu Fan</u>, Bolun Qi and Sayan Mitra. "Data-driven formal reasoning and their applications in safety analysis of vehicle autonomy features." *IEEE Design & Test*, 2018. [pdf]

17. [**NAHS'17**] Zhenqi Huang, <u>Chuchu Fan</u>, and Sayan Mitra. "Bounded Invariant Verification for Time-Delayed Nonlinear Networked Dynamical Systems." *IFAC Nonlinear Analysis: Hybrid Systems*, 2017. [pdf]

16. [**IEEEDT'15**] Zhenqi Huang, <u>Chuchu Fan</u>, Alexandru Mereacre, Sayan Mitra, and Marta Kwiatkowska. "Simulation-based Verification of Implantable Medical Devices with Guaranteed Coverage." *IEEE Design & Test*, 2015. [pdf]

15. [**SPL'13**] Qiang Ning, Kan Chen, Li Yi, <u>Chuchu Fan</u>, Yao Lu, Jiangtao Wen. "Image Super-Resolution via Analysis Sparse Prior." *IEEE Signal Processing Letters*, 2013. [pdf]

CONFERENCE

14. [**CAV'18**] <u>Chuchu Fan</u>, Umang Mathur, Sayan Mitra and Mahesh Viswanathan. "Controller Synthesis Made Real: Reach-avoid Specifications and Linear Dynamics." *Computer-Aided Verification*, 2018. [**Artifact Evaluated**] [pdf]

13. [**FM'18**] <u>Chuchu Fan</u>, Zhenqi Huang and Sayan Mitra. "Approximate Partial Order Reduction." *International Symposium on Formal Methods*, 2018. [pdf]

12. [**ADHS'18**] <u>Chuchu Fan</u>, Yu Meng, Jürgen Maier, Ezio Bartocci, Sayan Mitra and Ulrich Schmid. "Verifying nonlinear analog and mixed-signal circuits with inputs." *IFAC Conference on Analysis and Design of Hybrid Systems*, 2018. [pdf]

11. [**SEM'18**] Qiang Ning, Zhongzhi Yu, <u>Chuchu Fan</u>, and Dan Roth. "Exploiting Partially Annotated Data in Temporal Relation Extraction." *The Joint Conference on Lexical and Computational Semantics*, 2018. [pdf]

10. [**CAV'17**] <u>Chuchu Fan</u>, Bolun Qi, Sayan Mitra and Mahesh Viswanathan. "DRYVR:Data-driven verification and compositional reasoning for automotive systems." *Computer-Aided Verification*, 2017. [**Artifact Evaluated**] [pdf]

9. [**EMSOFT'16**] <u>Chuchu Fan</u>, James Kapinski, Xiaoqing Jin and Sayan Mitra. "Locally Optimal Reach Set Over-approximation for Nonlinear Systems." *International Conference on Embedded Software*, 2016. [**Best Paper Finalist**] [pdf]

8. [**CAV'16**] <u>Chuchu Fan</u>, Bolun Qi, Sayan Mitra, Mahesh Viswanathan and Parasara Sridhar Duggirala. "Automatic reachability analysis for nonlinear hybrid models with C2E2." *Computer-Aided Verification*, 2016. [pdf]

7. [**ATVA'15**] <u>Chuchu Fan</u> and Sayan Mitra. "Bounded Verification with On-the-Fly Discrepancy Computation." *Automated Technology for Verification and Analysis*, 2015. [pdf]

6. [**HSB'15**] Md. Ariful Islam, Richard Defrancisco, <u>Chuchu Fan</u>, Radu Grosu, Sayan Mitra and Scott Smolka. "Model Checking Tap Withdrawal in C. Elegans." *Hybrid Systems Biology*, 2015. [pdf]

5. [**CAV'15**] Parasara Sridhar Duggirala, <u>Chuchu Fan</u>, Sayan Mitra, and Mahesh Viswanathan. "Meet a Powertrain Verification Challenge." *Computer-Aided Verification*, 2015. [**Artifact Evaluated**] [pdf]

4. [**ARCH'15**] <u>Chuchu Fan</u>, Parasara Sridhar Duggirala, Sayan Mitra, and Mahesh Viswanathan. "Progress on Powertrain Verification Challenge with C2E2." *Applied Verification for Continuous and Hybrid Systems*, 2015. [**Best Verification Result Award**] [pdf]

3. [**CAV'14**] Zhenqi Huang, <u>Chuchu Fan</u>, Alexandru Mereacre, Sayan Mitra, and Marta Kwiatkowska. "Invariant verification of nonlinear hybrid automata networks of cardiac cells." *Computer-Aided Verification*, 2014. [pdf]

TUTORIAL

2. [**CCA'16**] Parasara Sridhar Duggirala, <u>Chuchu Fan</u>, Sayan Mitra, and others. "Tutorial: Software tools for hybrid systems verification, transformation, and synthesis: C2E2, HyST, and TuLiP." *IEEE Conference on Control Applications*, 2016. [pdf]

BOOK CHAPTER

1. <u>Chuchu Fan</u> and Sayan Mitra. "Data-driven Safety Verification of Complex Cyber-Physical Systems." *Design Automation of Cyber-Physical Systems*, Springer, (To Appear).

GRANTS

2. [**co-PI**] with Sayan Mitra, Siebel Energy Institute Research Grants, "A Formal Verification and Synthesis Tool for Safety Critical Power Grid Infrastructures and Cyber-Physical Systems", 2018.

1. [**PI**] NSF SBIR-1549058, "SBIR Phase I: Debugging Smart Cyber-Physical Systems", 2016.

PATENTS

2. "Bounded Verification through Discrepancy Computations", TF14195-02(US), granted Feb. 2016.

1. "Image Super-Resolution via Analysis Sparse Prior", CN103049885, granted Apr. 2013.

INDUSTRIAL EXPERIENCES

Rational Cyphy Inc. (Champaign, IL)   Jan. 2016 - Jun. 2016
Technical Director
- Leading a group of software engineers to develop and commercialize formal verification tools

Toyota Technical Center, Model Based Development Group (Los Angeles, CA)   Jan. 2015 - May 2015
Research Intern   Mentor: James Kapinski
- Project: Verification of parametric complex nonlinear systems

Microsoft Research Asia, Mobile and Sensing Systems Group (Beijing, China)   Jan. 2012 - Jun. 2012
Research Intern
- Projects: Hardware design of wireless sensor networks and wearable health monitoring systems

ACADEMIC SERVICES

- **Repeatability Evaluation Committee Member** (HSCC'18, HSCC'19)

- **Chair of Social Media** (HSCC'18)

- **Artifact Evaluation Committee Member** (CAV'17)

- **Reviewer for the following journals**: International Journal on Formal Methods in System Design, IET Cyber-Physical Systems: Theory & Applications, IEEE Trans. on Intelligent Vehicles, Mobile Information Systems, and Journal of Discrete Event Dynamic Systems.

- **Reviewer for the following conferences**: CAV'16,17, HSCC'15,16,17,18, EMSOFT'18, RTSS'14,16,17, IC-CPS'16,17, FORMATS'15, ARCH'15, and QEST'14.

- **Teaching Assistant** at UIUC: ECE313 (Probability)

- **Lecturer** at UIUC: ECE584 (Embedded System Verification)

INVITED TALKS

5. "Data-driven Verification of Cyber-physical systems", *Vanderbilt University*, Nashville, TN, 2017.

4. "Locally Optimal Reach Set Over-approximation for Nonlinear Systems", *Feedback Friday of UIUC*, Urbana, IL, 2016.

3. "Simulation-driven Verification of Cyber-Physical Systems", *French-American Doctoral Exchange Seminars*, Grenoble, France, 2016.

2. "Bounded Verification with Application on Toyota Powertrain Control Benchmarks", *CSL Social Hours*, Urbana, IL, 2016.

1. "Local Discrepancy Computation in Simulation-guided Verification", *Midwest Verification Day*, Urbana, IL, 2015.

MENTORING, LEADERSHIP & ACTIVITIES

- **French-American Doctoral Exchange Program** (Class of 2016): Representative Ph.D Student working on Cyber-Physical System from the U.S.

- **Undergraduate Student Research Mentor** (Aug. 2015 - Present): Bolun Qi (joins Facebook Inc.), Yu Meng (pursuing master's degree in UIUC), Nishant Dash (undergrad at UIUC), Minghao Jiang (ongoing), Rongzhou Li (ongoing), Yangge Li (on going)

- **Vice Chair of the Automation Student Association of Science and Technology at Tsinghua University** (Jul. 2010 - Jul. 2012): Responsible for organizing technology activities for over 600 students; directed the Future Intelligent Robot Club sponsored by Texas Instruments.

- **Volunteer Teacher** (Jun. 2010 - Sep. 2010): In the Chun-Lei Education Support Program for underdeveloped areas in southwest China.