SHUO YANG

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RESEARCH INTEREST

I have general interest in formal methods, learning, control, and algorithmic game theory, with their applications to robotic and multi-agents systems.

EDUCATION

University of Pennsylvania Aug. 2021 - present
Ph.D. in Electrical and Systems Engineering *Advisor: Prof. Rahul Mangharam*
xLAB for Safe Autonomous Systems

Shanghai Jiao Tong University Sept. 2017 - June. 2021
B.Eng. in Automation *Advisor: Prof. Xiang Yin*
Thesis: Verification and synthesis of opacity for cyber-physical systems [pdf]
Outstanding Bachelor Thesis Award of SJTU

PROFESSIONAL EXPERIENCE

Toyota Research Institute of North America May 2023 - Aug. 2023
Research Scientist Intern *Mentors: Dr. Bardh Hoxha & Dr. Georgios Fainekos*
Future Mobility Research Department

Duke University June. 2020 - Oct. 2020 (Remote)
Visiting Scholar *Mentor: Prof. Michael Zavlanos*

PUBLICATIONS

(* indicates equal contribution) [Google Scholar]

1. Shuo Yang, Yu Chen, Xiang Yin, Rahul Mangharam. "Learning Local Control Barrier Functions for Safety Control of Hybrid Systems." submitted, 2024. [pdf] [code]
2. Shuo Yang, Mitchell Black, Georgios Fainekos, Bardh Hoxha, Hideki Okamoto, Rahul Mangharam. "Safe Control Synthesis for Hybrid Systems through Local Control Barrier Functions." 2024 American Control Conference (ACC). [pdf]
3. Luigi Berducci, Shuo Yang, Rahul Mangahram, Radu Grosu. "Learning Adaptive Safety for Multi-Agent Systems." submitted, 2023. [pdf] [code]
4. Jiangwei Wang, Shuo Yang, Ziyan An, Songyang Han, Zhili Zhang, Rahul Mangharam, Meiyi Ma, Fei Miao. "Multi-Agent Reinforcement Learning Guided by Signal Temporal Logic Specifications." submitted, 2023. [pdf]
5. Xiatao Sun*, Shuo Yang*, Rahul Mangharam. "MEGA-DAgger: Imitation Learning with Multiple Imperfect Experts." submitted, 2023. [pdf] [code]
6. Shuo Yang, George J. Pappas, Rahul Mangharam, Lars Lindemann. "Safe Perception-Based Control under Stochastic Sensor Uncertainty using Conformal Prediction." *IEEE Conference on Decision and Control (**CDC**)*, 2023. [pdf] [code]
7. Zhijie Qiao, Xiatao Sun, Shuo Yang, Helen Loeb, Rahul Mangharam. "Autonomous Vehicle Education Using a Virtual Reality Driving Simulator." *CPS-IoT Week Humans in Cyber-Physical Systems Workshop*, 2023.

8. Yu Chen*, Shuo Yang*, Rahul Mangharam, Xiang Yin. "You Don't Know When I Will Arrive: Unpredictable Controller Synthesis for Temporal Logic Tasks." *22nd IFAC World Congress (**IFAC WC**)*, 2023. [pdf]

9. Hongrui Zheng*, Zirui Zang*, Shuo Yang*, Rahul Mangharam. "Towards Explainability in Modular Autonomous Vehicle Software." *IEEE Intelligent Vehicles Symposium (**IV**)*, 2023. [pdf]

10. Xiatao Sun, Mingyan Zhou, Zhijun Zhuang, Shuo Yang, Johannes Betz, Rahul Mangharam. "A Benchmark Comparison of Imitation Learning-based Control Policies for Autonomous Racing." *IEEE Intelligent Vehicles Symposium (**IV**)*, 2023. [pdf]

11. Shuo Yang*, Shaoru Chen*, Victor M. Preciado, Rahul Mangharam. "Differentiable Safe Controller Design through Control Barrier Functions." *IEEE Control Systems Letters (**L-CSS**)*, 2022. [pdf][code]

12. Shuo Yang, Xiang Yin. "Secure Your Intention: On Notions of Pre-Opacity in Discrete-Event Systems." (Full Paper), *IEEE Transactions on Automatic Control (**TAC**)*, 2022. [pdf]

13. Shuo Yang*, Junyao Hou*, Xiang Yin, Shaoyuan Li. "Opacity of Networked Supervisory Control Systems over Insecure Communication Channels." *IEEE Transactions on Control of Network Systems (**TCNS**)*, 2021. [pdf]

14. Shuo Yang, Xiang Yin, Shaoyuan Li, Majid Zamani. "Secure-by-Construction Optimal Path Planning for Linear Temporal Logic Tasks." *IEEE Conference on Decision and Control (**CDC**)*, 2020. [pdf]

RESEARCH AND WORKING EXPERIENCES

Toyota Research Institute of North America May 2023 - Aug. 2023
Research Scientist Intern (Mentors: Georgios Fainekos & Bardh Hoxha) *Ann Arbor, USA*

I study safe autonomous driving on multi-frictions road and propose a local control barrier functions (CBFs)-based safe framework to provide formal safety guarantees. The proposed algorithm is verified on numerical simulations. Sample publication: ACC 2024.

University of Pennsylvania, Dept. Electrical & Systems Engineering Aug. 2021 - Present
Research Assistant (Advisor: Rahul Mangharam) *Philadelphia, USA*

- My research focuses on the intersection of learning, control, and formal methods, with the applications to robotic and multi-agents systems.
- How to ensure safety for learning-enabled autonomous systems? Sample publications: L-CSS 2022 and code, ICRA 2024 and code, CDC 2023 and code.
- Imitation learning and reinforcement learning for autonomous systems. Sample publications: ICRA 2024, IV 2023, pre-print.
- Working on learning-based algorithmic multi-agent games to understand the complex interactions among multi-agents.

Shanghai Jiao Tong University, Dept. Automation Mar. 2019 - June 2021
Research Assistant (Advisor: Xiang Yin) *Shanghai, China*

- My research focuses on the security properties in cyber-physical systems and robot path planning.
- Security-aware analysis and applications in discrete-event systems. Sample publications: TAC 2022, TCNS 2021, CDC 2020.

SELECTED HONORS AND AWARDS

Global Young PhD Fellow of Linear Capital 2024
ACC Student Travel Grant 2023
The Dean's Fellowship from University of Pennsylvania 2021
Solomon M. Swaab Fellowship from University of Pennsylvania 2021
Outstanding Graduate of SJTU 2021
Outstanding Bachelor Thesis Award of SJTU (top 1%) 2021
Person of the Year of SJTU (highest honor for SJTU students) 2020
COMAP Meritorious Winner in Mathematical Contest in Modelling (top 7.09%) 2020
3rd Prize of National College Student Physics Competition 2020
Excellent Academic Scholarship from SJTU 2018, 2019
3rd Prize of National High School Mathematics Competition 2016

TALKS AND PRESENTATIONS

1. Carnegie Mellon University (Intelligent Control Lab), Pittsburgh, Jan 2024
   Safe Learning-Based Control for Hybrid Systems (Host: Prof. Changliu Liu)
2. University of Pennsylvania (ASSET Seminar), Philadelphia, Sept 2023
   with Prof. Rahul Mangharam (Host: Prof. Rajeev Alur)
   Safe and Performant Control for Learning-Enabled Autonomous Systems
3. University of Pennsylvania (FM & ML Seminar), Philadelphia, Sept 2023 (Host: Prof. Eric Wong)
   Safe Learning-Enabled Autonomous Systems
4. University of Michigan, Ann Arbor, July 2023 (Host: Prof. Necmiye Ozay)
   Safe Learning-Based Control for Autonomous Systems
5. American Control Conference, San Diego, May 2023
   Differentiable Safe Controller Design through Control Barrier Functions
6. CPS-IoT Week Humans in CPS Workshop, San Antonio, May 2023
   MEGA-DAgger: Imitation Learning with Multiple Imperfect Experts
7. CPS-IoT Week Humans in CPS Workshop, San Antonio, May 2023
   Autonomous Vehicle Education Using a Virtual Reality Driving Simulator
8. RTSS Explainability Workshop, remote, Dec 2022
   Towards Explainability in Modular Autonomous Vehicle Software
9. 59^{th} IEEE Conference on Decision and Control (CDC), remote, Dec 2020
   Secure-by-Construction Optimal Path Planning for Linear Temporal Logic Tasks

ACADEMIC SERVICES

Program Committee	Tiny Papers @ ICLR 2023, 2024 (Area Chair)
Reviewer	American Control Conference (ACC) IEEE Conference on Decision and Control (CDC) International Conference on Learning Representations (ICLR) Advances in Neural Information Processing Systems (NeurIPS) AAAI Conference on Artificial Intelligence (AAAI) IEEE Transactions on Automatic Control (TAC) IEEE Transactions on Intelligent Vehicles (TIV) IEEE Robotics and Automation Letters (RA-L) IEEE Control Systems Letters (L-CSS) Nonlinear Analysis: Hybrid Systems (NAHS) International Conference on Robotics and Automation (ICRA) International Conference on Hybrid Systems: Computation and Control (HSCC) IROS 2023 Workshop on Multi-agent Dynamic Games (MAD-Games) NeurIPS 2023 AI for Science Workshop (AI4Science) etc.

TEACHING EXPERIENCES

Teaching Assitant *Fall 2023, UPenn*
ESE 5000: Linear Systems Theory (Instructor: Prof. George J. Pappas)
Responsibilities: teach 5 recitations, design assignments, hold office hours, etc.

Teaching Assitant *Fall 2023, UPenn*
ESE 5420: Statistics for Data Science (Instructor: Prof. Hamed Hassani)

Teaching Assitant *Fall 2020, SJTU*
MA 238: Discrete Mathematics (Instructor: Prof. Xiang Yin)

Lecturer *Summer 2018, High School Affiliated to SJTU*
Mathematics Competition

SELECTED ACTIVITY EXPERIENCES

Global Education and Training at University of Illinois at Urbana-Champaign 2019
Volunteer of the Shanghai International Marathon 2018, 2019

LANGUAGE, SKILLS AND INTERESTS

Language	Chinese (native), English (fluent), French (basic)
Programming	Python, C++, R, MATLAB, LaTeX
Framework & Toolkit	NumPy, JAX, PyTorch, ROS, Docker, Git
Interests	Basketball, Literature, Music, Board Games, Video Games, etc.

Last update: Jan 2024