Yushan Li

Ph.D. Candidate

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Biography: I'm a Ph.D. candidate at Dept. of Automation, Shanghai Jiao Tong University, supervised by Prof. Xinping Guan and Prof. Jianping He. I'm also a member of Center for Intelligent Wireless Networks and Cooperative Control (*IWIN-Center*). My current research focuses on the inference attack and the security defense of networked control systems.

Education and Experience

2018–date **Ph.D. Candidate, Control Science and Engineering**
Department of Automation, Shanghai Jiao Tong University (SJTU)
Advisor: Xinping Guan Co-advisor: Jianping He

2019 Oct. – Nov. **Visiting Student**
School of Engineering, The University of Newcastle, Australia

2014–2018 **Bachelor's Degree, Automation**
School of Automation, Huazhong University of Science and Technology (HUST)
Experimental Class for Automation, Ranked 1st

Publications and Preprints

Publications ***Journal Articles***

[1] **Yushan Li**, Jianping He, Cailian Chen and Xinping Guan, "Intelligent Physical Attack against Mobile Robots with Obstacle-avoidance", IEEE Transactions on Robotics, 2022, In Press. [arXiv version]

Publications ***Conference Articles***

[1] **Yushan Li**, Jianping He, Cailian Chen and Xinping Guan, "Inferring Topology of Networked Dynamical Systems by Active Excitations", IEEE Conference on Decision and Control (CDC), 2022, In Press.

[2] **Yushan Li** and Jianping He, "Topology Inference for Networked Dynamical Systems: A Causality and Correlation Perspective", IEEE Conference on Decision and Control (CDC), 2021. [Link]

[3] **Yushan Li**, Qing Jiao, Han Wang and Jianping He, "Consensus and Approximation-based Distribution Statistics in Network Systems", American Control Conference (ACC), 2021. [Link]

[4] **Yushan Li**, Jianping He and Lin Cai, "Topology Inference on Partially Observable Mobile Robotic Networks under Formation Control", European Control Conference (ECC), 2021. [Link]

[5] **Yushan Li**, Jianping He, Cailian Chen and Xinping Guan, "Learning-based Intelligent Attack against Formation Control with Obstacle-avoidance", American Control Conference (ACC), 2019. [Link]

[6] **Yushan Li**, Han Wang, Jianping He and Xinping Guan, "Optimal Topology Recovery Scheme for Multi-robot Formation Control", IEEE International Symposium on Industrial Electronics (ISIE), 2019. [Link]

Preprints ***Under Review***

[1] **Yushan Li**, Jianping He, Cailian Chen, Xinping Guan, and Lin Cai, "Securing Formation Control of Mobile Robotic Networks Against Replacement Attack", submitted to IEEE Transactions on Control of Network Systems, 1st round of review.

[2] Jianping He, **Yushan Li**, Lin Cai, and Xinping Guan, "I Can Read Your Mind: Control Mechanism Secrecy of Networked Dynamical Systems under Inference Attacks", submitted to Proceedings of the IEEE, 1st round of review. [arXiv]

[3] **Yushan Li**, Jianping He, Cailian Chen and Xinping Guan, "On Topology Inference for Networked DynamicalSystems: Principles and Performances", submitted to IEEE Transactions on Information Theory, 1st round of review. [arXiv]

[4] **Yushan Li**, Jianping He, Xuda Ding, Lin Cai and Xinping Guan, "Sneak Attack against Mobile Robotic Networks", arXiv:2106.02240.[arXiv]

Honors and Awards

- 2021 Annual Triple-A Student of SJTU
- 2020 The Best Presentation Award (*Multi-robot System Platform*), Academic Annual Meeting of Shanghai Association of Automation. [Link]
- 2019 The National Scholarship for Graduate Student
- 2018 Outstanding Graduate & Qiming Honors Bachelor of HUST
- 2017 The National Engagement Scholarship for Undergraduate

Invited Talks

- 2021 May "Intelligent Physical Attacks against Mobile Robotic Networks", Network Intelligence Forum, Jiangnan University, Wuxi, China. [PDF]

Professional Services

Conference Organization

- 2021 Co-Founder and Student Chair, The 1st Distributed Control, Optimization, and Security Zhizhen Academic Forum For Postgraduates(Online), Shanghai Jiao Tong University, Shanghai, China. [Detailed Forum Information (in Chinese)]
- 2020 Technical Program Committee (TPC) Member, IEEE 92nd Vehicular Technology Conference (VTC2020-Fall), Virtual Conference. [Link]

Peer Reviewer

- From 2019 *Journals*: IEEE Transactions on Automatic Control; IEEE Transactions on Industrial Informatics; IEEE Transactions on Vehicular Technology; IEEE Open Journal of Vehicular Technology; KSII Transactions on Internet and Information Systems; International Journal of Intelligent Robotics and Applications; ACTA Automatica Sinica

Conferences: American Control Conference; IEEE Vehicular Technology Conference; IFAC Conference on Cyber-Physical and Human-Systems; The Chinese Automation Congress

Research Experience

2020 Sep. – 2021 Apr. **Topology Inference for Networked Dynamical Systems**
Supervised by Prof. Jianping He and Prof. Xinping Guan

- Revealed the principles of inferring the topology by utilizing causality and correlation, where the system is driven by unknown driving input, and the topology is directed.
- Analyzed the non-asymptotic performance of the proposed method, pointed out the equivalent conditions with benchmark methods, and proved the convergence and accuracy in different system stabilities.

2018 Sep. – 2019 Nov. **Intelligent Physical Attack Against Mobile Robots**
Supervised by Prof. Jianping He and Prof. Xinping Guan

- Investigated the possibility of achieving an intelligent and advanced physical attack against mobile robots, merely utilizing external observations and not relying on any prior information of the system dynamics.
- By characterizing the obstacle-avoidance behaviors and disguising the attacker as an obstacle, various avoidance reactions of the victim robot were excited. Based on observations over this process, the underlying mechanism was regressed.
- Two driving-to-trap attack algorithms were designed by taking the attack path length and activity period as the objectives, respectively. The performance bounds of the algorithms are further derived concerning the optimal cost in theory.

Joint Works

2020 Sep. – 2021 Oct. **Distributed Topology-preserving Collaboration Algorithm against Inference Attack**
With Zitong Wang, PhD Student in Class of 2020, Dept. of Automation, SJTU

Develop a distributed topology-preserving collaboration algorithm for multi-agent systems against the topology inference attacks. The novelties lie in:

- By adding well-designed noises to the system states, the irregularity of the state evolution is largely enhanced, weakening the inference performance.
- By dividing the noises into the random and disturbing terms with mutual compensation properties, the proposed algorithm guarantees the convergence of the system state.

2019 Sep. – 2020 Apr. **Topology Inference for Consensus-based Cooperation under Unmeasurable Input**
With Qing Jiao, PhD Student in Class of 2019, Dept. of Automation, SJTU

Infer the directed network topology from the observations that consist of a single, noisy and finite time-series system trajectory. The novelties lie in:

- Propose two-layer optimization-based topology inference algorithms, which eliminates the unknown influence of timeinvariant input on system dynamics.
- Design iterative estimation-based topology inference algorithm, which exploits the identifiability and estimability of more general time-varying input.

Other Activities

Teaching Assistant

2020–2021 Intelligent Optimization of Network Systems, Automation, AU339

Member of Academic Institutes

From 2020 Member of Youth Workers Committee of Shanghai Association of Automation

From 2019 IEEE Student Member