Zhiyu He

Shanghai Jiao Tong University
Shanghai, China
✉ *hzy970920@sjtu.edu.cn*
iwin-fins.com/sciencex_teams/zhiyu-he/

Education and Experience

2019–2022 (expected) **M.S. Student, Control Science and Engineering**.
Department of Automation, Shanghai Jiao Tong University
Advisor: Xinping Guan; (co)Advisor: Jianping He

2021 **Visiting Student**.
Automatic Control Laboratory (IfA), ETH Zürich
Advisor: Florian Dörfler; (co)Advisor: Saverio Bolognani

2015–2019 **B.Eng., Automation**.
Department of Automation & Zhiyuan College, Shanghai Jiao Tong University
Zhiyuan Honors Program of Engineering (Top 5%)
Average Score: 92/100, Ranking: 1/91

Publications and Preprints

Under Review

- **Zhiyu He**, Jianping He, Cailian Chen, Xinping Guan, "Distributed Nonconvex Optimization: Oracle-free Iterations and Globally Optimal Solution", ArXiv:2008.00252, submitted to IEEE Transactions on Automatic Control, second round of review. [pdf]
- **Zhiyu He**, Jianping He, Cailian Chen, Xinping Guan, "Dependable Distributed Nonconvex Optimization via Polynomial Approximation", ArXiv:2101.06127, submitted to IEEE Transactions on Automatic Control, second round of review. [pdf]
- **Zhiyu He**, Saverio Bolognani, Jianping He, Florian Dörfler, Xinping Guan, "Model-Free Nonlinear Feedback Optimization", ArXiv:2201.02395, submitted to IEEE Transactions on Automatic Control, first round of review. [pdf]

Published or Accepted

- **Zhiyu He**, Jianping He, Cailian Chen, Xinping Guan, "CPCA: A Chebyshev Proxy and Consensus based Algorithm for General Distributed Optimization", American Control Conference (ACC), 2020. [pdf]
- **Zhiyu He**, Jianping He, Cailian Chen, Xinping Guan, "Constrained Distributed Nonconvex Optimization over Time-varying Directed Graphs", IEEE Conference on Decision and Control (CDC), 2020. [pdf]
- Wenzhe Zheng, **Zhiyu He**, Jianping He, Chengcheng Zhao, "Accurate Resilient Average Consensus via Detection and Compensation.", IEEE Conference on Decision and Control (CDC), 2021. [pdf]

Selected Honors and Awards

2020 & 2018 &2016 China National Scholarship

2022 & 2019 Outstanding Graduate of Shanghai

2019 Zhiyuan Honor Degree of B.Eng. *(52/3500 recipients in class of 2019)*

2019 Zhiyuan Outstanding Student Scholarship *(30/3500 recipients in class of 2019)*

2017 Samsung Scholarship

2017 A-class Scholarship for Excellent Academic Performance *(Top 1% in SJTU)*

Research Experience

July. 2021 - Dec. 2021 **Model-Free Nonlinear Feedback Optimization**
Supervisor: Prof. Florian Dörfler and Dr. Saverio Bolognani, Automatic Control Laboratory (IfA), ETH Zürich

- Develop a model-free feedback optimization controller to drive systems to efficient operating points of nonconvex objectives by utilizing real-time measurements of system outputs and updating control inputs based on gradient estimates.
- Characterize the stability and the optimality of the closed-loop interconnection of the stable nonlinear dynamical system and the proposed controller.
- Extend the design to handle general constraints that affect multiple inputs with Frank-Wolfe type updates.

Mar. 2020 - Jan. 2021 **Dependable Distributed Nonconvex Optimization via Polynomial Approximation**
Supervisor: Prof. Jianping He and Prof. Xinping Guan, Dept. of Automation, SJTU

- Proposed an approximation-based algorithm to solve distributed optimization problems with nonconvex univariate objectives and set constraints, pursuing the guarantee of privacy preservation and robustness against network imperfections.
- Developed a new privacy-preserving mechanism with novel designs and improved performance to prevent sensitive local objective functions from being leaked, and analyzed the effect of privacy preservation through (α, β)-data-privacy.
- Addressed the robustness issue in face of various network imperfections, and proved that the proposed algorithm keeps effective and accurate when such imperfections are present.

Nov. 2018 - July. 2020 **Polynomial-approximation-based Algorithm for Distributed Optimization**
Supervisor: Prof. Jianping He and Prof. Xinping Guan, Dept. of Automation, SJTU

- Proposed a novel distributed optimization algorithm named CPCA, based on Chebyshev polynomial approximation, consensus and polynomial optimization via semidefinite programming.
- Proved that this algorithm obtains ϵ globally optimal solutions of nonconvex problems, where ϵ is any arbitrarily small given error tolerance, and showed that it achieves distributed termination once the precision requirement is met.
- Provided explicit orders of complexities of communication and zeroth-order oracle queries of the proposed algorithm.
- Pointed out that the notion of combining function approximation and consensus to deal with problems related to networked systems is of independent interest.

Febr. 2017 - Febr. 2018 **Predicting Protein Contact Maps Through Deep Learning Models**
Supervisor: Prof. Hongbin Shen, Dept. of Automation, SJTU

- Extracted useful features from the sequence information of proteins.
- Developed three models for predicting contact maps by using three both distinct and interrelated network structures of deep learning.
- Conducted extensive evaluations and comparison of the developed models.
- Modeled the spatial structures of specific proteins in the test sets based on the predicted contact maps.

Joint Work and Supervision

Dec. 2020 - Mar. 2021 **Accurate Resilient Average Consensus via Detection and Compensation**
With Wenzhe Zheng, first-year master student at Dept. of Automation, SJTU

- Addressed the problem of resilient average consensus for multi-agent systems with misbehaving nodes by detecting misbehaviors via two-hop information, mitigating corresponding impact and achieving accurate average consensus.

Mar. 2021 - Now **Resilient Approximation-based Distributed Optimization**
With Yilin Zhang, junior student at Joint Institute, SJTU

- Make the approximation-based distributed optimization algorithm resilient to adversaries, and characterize the sub-optimality by analyzing the sensitivity of the proposed algorithm.

Apr. 2021 - Now **Inference Attack in Privacy-Preserving Distributed Optimization**
With Jisheng Xu, junior student at Dept. of Automation, SJTU

- Infer the sensitive local information of the target agent based on noise-perturbed states and gradients communicated in privacy-preserving distributed optimization algorithms.

Invited Talk

Dec. 2021 "Non-Convex Optimization Algorithms in Network Systems", The 1st Distributed Control, Optimization, and Security Zhizhen Academic Forum For Postgraduates (Online), Shanghai Jiao Tong University, China. [video (in Chinese)]

July 2020 "Non-Convex Distributed Optimization: Novel ALgorithmic Design and Arbitrary Precise Solution", Intelligent Control Forum (Online), Peking University, China. [slides]

Additional Information

Skills and Languages

Programming Languages: MATLAB, Python, C++

Languages: Chinese, English (TOEFL:114, GRE:328+3.5)

Extracurricular Activities

2019 & 2018 & 2017: Volunteers of Shanghai International Marathon

Sept. 2015 - Oct. 2017: Member of the Press Office, Publicity Center of Youth League Committee, SEIEE, SJTU

2016 Student Librarian of SJTU