# Yang Hu

🖥 https://huyangsh.github.io   ✉ huyangshcn@gmail.com   ☏ +86-15221879652
🏠 Room 2802, Building 2, Lane 168, Benxi Road, Yangpu District, Shanghai, PRC

## EDUCATION

**B.E. of Computer Science and Technology**                          **2018 ~ 2022 (expected)**

*Tsinghua University, Beijing, PRC*                          (***GPA: <u>3.95</u>; rank: <u>1 / 54</u>***)

- Affiliation: Institute of Interdisciplinary Information Sciences (IIIS), known as ***<u>"Yao Class"</u>*** .

## RESEARCH INTERESTS

My research interests lie in the science of intelligent systems and decision making, such as ***<u>optimal control theory</u>***, ***<u>reinforcement learning</u>*** and ***<u>optimization</u>***. I am particularly interested in studying and improving the efficiency and complexity of RL and control algorithms, and in combining learning with control in unknown systems.

## HONORS AND AWARDS

**Undergraduate:**

**National Scholarship for Undergraduates**                          **2019 & 2021**

- The ***<u>highest honor</u>*** for undergraduates (1 student per grade per department).

**First-class Scholarship at Tsinghua (in memory of Nanxiang Jiang)**                          **2020**

- The ***<u>highest honor</u>*** for junior-year students at Tsinghua (1 junior student per department).

**Silver Medal of "Yao Award" at IIIS, Tsinghua**                          **2021**

- Awarded to outstanding senior students at "Yao Class" (1 gold, 2 silver, 4 bronze).

**Second-class Scholarship for Freshmen**                          **2018**

**Scholarship for the Cultivation of Outstanding Talents**                          **2018 ~ 2021**

**High school:**

First Prize of National Mathematical Olympiad (First Round)                          2016 & 2017

First Prize of National Olympiad in Informatics in Provinces (NOIP)                          2015 & 2017

Silver Medal of Russian Mathematical Olympiad (10th Grade, Final Round)                          2017

## RESEARCH EXPERIENCE

**Undergraduate Research Assistant**                          **Sept. 2019 ~ Dec. 2020**

*IIIS, Tsinghua University* (*Advisor: Prof. Chongjie Zhang*)

- Focus on the empirical side of Reinforcement Learning.
- In the project, I helped to implement and improve algorithms in multi-agent reinforcement learning (MARL), and design an efficient distributed architecture for MARL.

**Undergraduate Research Assistant**                          **July 2020 ~ Dec. 2020**

*IIIS, Tsinghua University* (*Advisor: Prof. Yang Yu*)

- Focus on the social-economical applications of Reinforcement Learning.
- In the project (see [2]), we design a new DDPG-based algorithm that learns optimal pandemic-control policies to solve the problem of inter-regional collaborative pandemic control, and discuss sociological implications of collaborative behavior in multi-agent settings.

**Research Internship (remote)**                                **Jan. 2021 ~ present**

*CMS, California Institute of Technology* (*Advisor: Prof. Adam Wierman*)

- Focus on optimal control theory, esp. Model Predictive Control (MPC).
- Prove novel theoretical performance guarantees for MPC in linear time-varying (LTV) systems.
- In the project (see [1]), we provide the first theoretical performance guarantees (i.e., input-to-state stability, dynamic regret and competitive ratio) for MPC controllers in LTV systems with general well-conditioned costs. We introduce a new perturbation-based analysis framework that is general for analysis of controllers, and reveal a new reduction from MPC to SOCO.

**Research Internship (remote)**                                **Aug. 2021 ~ present**

*ECE, Carnegie Mellon University* (*Advisor: Prof. Guannan Qu, co-advisor: Prof. Adam Wierman*)

- Focus on optimal control theory, esp. the stabilization of linear systems.
- In the project (see [3]), we study the sample complexity of adaptively stabilizing linear time-invariant (LTI) systems. We introduce a novel spectral-decomposition-based approach to learn stabilizing controllers and provide theoretical stabilization guarantees for it.

## PUBLICATIONS

[1] Y. Lin*, *__Yang Hu__*\*, H. Sun*, G. Shi*, G. Qu*, A. Wierman. Perturbation-based Regret Analysis of Predictive Control in Linear Time Varying Systems, 2021, arXiv preprint arXiv: 2106.10497.
<small>Co-first authors are marked with asterisks (*).</small>
*Accepted by __NeurIPS'2021__ as __Spotlight__ (__top 3%__ of all submissions).*

[2] *__Yang Hu__*, Z. Zhu, S. Song, X. Liu, Y. Yu. Calculus of Consent via MARL: Legitimating the Collaborative Governance Supplying Public Goods, 2021, arXiv preprint arXiv: 2111.10627.
*Accepted by __NeurIPS'2021 PERLS Workshop__ as Poster.*

[3] *__Yang Hu__*, G. Qu, A. Wierman. On the Sample Complexity of Stabilizing LTI Systems, 2021.
*Manuscripts in preparation (accessible via personal website).*

## COURSE PROJECTS

**Performance Improvement of Episodic Memory Deep Q-Networks**
*Project of the course "Artificial Intelligence: Principles and Techniques"*

- Attempt multiple approaches to improve the performance of EMDQN by better utilizing the similarity of states and improving the efficiency of episodic memory.

**A Survey on the Representation Learning of Large-Scale Networks**
*Project of the course "Numerical Analysis"*

- Survey, implementation and comparison of multiple network embedding algorithms.

**A 2-Player No-limit Texas Holdem Bot Based on Monte-Carlo CFR and Hand-crafted Rules**
*Project of the course "Game Theory"*

- Design and train an agent for 2-player Texas Holdem, using a simplified counterfactual regret minimization (CFR) approach that is compatible with small-scale training.

## SELECTED COURSES

**Mathematics:** *Calculus A1* (A+), *Calculus A2* (A), *Linear Algebra* (A), *Abstract Algebra* (A+), *Mathematics for Computer Science* (A).

**Theory:** *Algebra and Computation* (A), *Algorithm Design* (A), *Network Science* (A+), *Quantum*

*Computer Science* (A+), *Theory of Computation* (A), *Distributed Computing* (A).

**AI and Control:** *Artificial Intelligence: Techniques and Principles* (A), *Machine Learning* (A), *Intelligent Systems and Robotics* (on-going).

## SERVICES

**Volunteer at the Tsinghua Undergraduate Admissions Office in Shanghai**     **2019 & 2020**

- Receive "outstanding service award" in year 2019.

**Writing assistant at the Tsinghua Teaching Center for Writing**     **2021 ~ present**

## REFERENCES

**Adam Wierman**, Professor of Computing and Mathematical Sciences

*Department of Computing and Mathematical Sciences*

*California Institute of Technology, Pasadena, CA*

*(626) 395-6569, adamw@caltech.edu*

**Guannan Qu**, Assistant Professor

*Department of Electrical and Computer Engineering*

*Carnegie Mellon University, Pittsburgh, PA*

*(617) 949-0308, gqu@andrew.cmu.edu*

**Chongjie Zhang**, Assistant Professor

*Institute of Interdisciplinary Information Sciences* (*IIIS*)

*Tsinghua University, Beijing, PRC*

*+86-17310090375, chongjie@tsinghua.edu.cn*

**Yang Yu**, Assistant Professor

*Institute of Interdisciplinary Information Sciences* (*IIIS*)

*Tsinghua University, Beijing, PRC*

*+86-18513112656, yangyu1@tsinghua.edu.cn*