SARAH H. Q. LI

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I work on enabling **scalable multi-agent autonomy**, specifically in the presence of competitors and human-operated systems. My research leverages diverse techniques from **optimization**, **control theory**, and **game theory** to develop theoretical frameworks and algorithms that scalably integrates autonomy into existing infrastructure. My work is motivated by robotics, urban transportation, and warehouse automation.

Education

University of Washington. Seattle, USA.
Ph.D. in Aeronautics and Astronautics Engineering, **Expected 2022**
MS in Aeronautics and Astronautics Engineering, **March 2020**
Advisors: Behçet Açıkmeşe, Pierre-Loïc Garoche

University of British Columbia, Vancouver, Canada.
B.A.Sc in Engineering Physics, Minor in Honours Mathematics. **May 2017**
Advisor: Elizabeth Croft

Publications

Journals

[J1] **Set-based Value Operators for Non-Stationary Markovian Environments.**
S.H.Q. Li, A. Adjé, P. Garoche, B. Açkmee.
under review for Automatica

[J2] **Revisiting Disturbance Decoupling with Optimization Perspective.**
S. B. Sarslmaz, **S.H.Q. Li**, and B. Açkmee. .
under review for System & Control Letters

[J3] **Congestion-aware path coordination game with Markov decision process dynamics.**
S.H.Q. Li, D. Calderone, B. Açkmee.
2022 IEEE Control System Letters (L-CSS)

[J4] **Adaptive Constraint Satisfaction for MDP Congestion Games: Application to Transportation Networks.**
S.H.Q. Li, Y. Yu, D. Calderone, N. Miguel, L. J. Ratliff, B. Açkmee.
provisionally accepted for Automatica

[J5] **A Primal-Dual Approach to Markovian Network Optimization.**
Y. Yu, D. Calderone, **S.H.Q. Li**, L. J. Ratliff, B. Açkmee.
2022 Automatica

[J6] **Bounding Fixed Points of Set-based Bellman Operator and Nash Equilibria of Stochastic Games.**
S.H.Q. Li, A. Adjé, P. Garoche, B. Açkmee.
2020 Automatica

[J7] **Disturbance Decoupling For Gradient-based Multi-Agent Learning with Quadratic Costs.**
S.H.Q. Li, L. J. Ratliff, B. Açkmee.
2020 IEEE Control System Letters (L-CSS)

Peer-Reviewed Conference/Magazine Publications

[C1] **Re-Inventing the Food Supply Chain with IoT: A Data-Driven Solution to Reduce Food Loss.**
V. Ranganathan, P. Kumar, U. Kaur, **S.H.Q. Li**, T. Chakraborty, R. Chandra.
2022 IEEE Internet of Things Magazine

[C2] **Fixed Points of Set-based Bellman Operator.**
S.H.Q. Li, A. Adjé, P. Garoche, B. Açkmee.
2020 International Federation of Automatic Control (IFAC) World Congress

[C3] **Sensitivity Analysis for Markov Decision Process Congestion Games.**
S.H.Q. Li, D. Calderone, L.J. Ratliff, B. Açkmee.
2019 IEEE Conference on Decision and Control (CDC)

[C4] **Tolling for Constraint Satisfaction in Markov Decision Process Congestion Games.**
S.H.Q. Li, Y. Yu, D. Calderone, L.J. Ratliff, B. Açkmee.
2019 IEEE American Control Conference (ACC)

[C5] **Robot Programming through Augmented Trajectories in Augmented Reality.**
C.P. Quintero, **S.H.Q. Li**, M.K.X.J. Pan, W.P. Chan, H.F. M. Van der Loos, E. Croft.
2018 IEEE International Conference on Intelligent Robots and Systems (IROS)

[C6] **Schematic Driven Silicon Photonics Design.**
L. Chrostowski, Z. Lu, J. Flückiger, J. Pond, J. Klein, X. Wang, **S.H.Q. Li**, W. Tai, C. Kim, J. Ferguson, C. Cone.
2016 Smart Photonic and Optoelectronic Integrated Circuits (SPIE) Proceedings

Peer-Reviewed Workshops

[W1] **Stochastic Supply Chain Games with Networked Information Flow.**
S.H.Q. Li, L.J. Ratliff, P. Kumar.
2022 Workshop on Gamification and Multiagent Solutions for ICLR

[W2] **Robot programming through augmented trajectories.**
C.P. Quintero, **S.H.Q. Li**, C. Shing, W.P. Chan, S. Sheikholeslami, H.F.M. Van der Loos, E. Croft.
2018 Workshop on Virtual, Augmented, and Mixed Reality for HRI

[W3] **CAD-AR: An Intuitive Robotic Teaching Pendant for Skill-based Industrial Robot Programming.**
S.H.Q. Li, C. Shing, Y. Coady, H.F.M. Van der Loos, and E. Croft.
2017 IEEE International Conference on Intelligent Robots and Systems (IROS) Workshop

Intellectual Properties

[I1] **Reinforcement Learning Simulation of Supply Chain Graph.**
Peeyush Kumar, Sarah H.Q.Li, Vaishnavi Ranganathan, Lillian J. Ratliff, Ranveer Chandra, Vishal Jain, Mike Bassani, Jeremy Reynolds.
under review | Indian Patent Office 202141048296.

Industrial Experiences

Effect of information structure in multi-agent reinforcement learning **06/2021 - 09/2021**
Microsoft Research, Redmond — Research for Industry

Develop a game-theoretical model for agricultural supply chains with structured information-flow.
Design learning objectives to reduce carbon mission and food waste in agricultural supply chains.

Optimization-based multi-disciplinary system design **05/2020 - 09/2020**
Loon, an Alphabet company — system engineering

Develop an optimization-based algorithm to size stratospheric balloons.
Explore data-driven methods to accelerate the balloon design process.
Assist and conduct wind tunnel tests of stratospheric balloon prototypes.

Multi-thread motor interface firmware development **05/2016 – 12/2016**
Zaber Technologies Inc. — firmware intern

Develop high-precision motor controllers with C++ on STM32 ARM MCU's for stepper/linear/servo actuators.

FPGA data transfer optimization **07/2015 – 08/2015**
Deutsches Elektronen Synchrotron (DESY) — research intern

Optimize experimental data transfer speed to Gbs/second by resolving FPGA clock mis-synchronization.
Implemented on CERN's Large Hadron Collider (LHC) for the detector Compact Muon Solenoid.

RADAR-SAT constellation mission (RCM) **05/2014 – 12/2014**
Macdonald, Dettwiler and Associates — software intern

Develop scheduling algorithm for the RCM distributed satellite network using C++ and PostgreSQL.

Satellite Synthetic-Aperture Radar (SAR) big data visualization optimization **01/2013 – 04/2013**
3vGeomatics — visualization intern

Optimize visualization algorithms to load millions of SAR data points in seconds via Google Maps.

Honors & Awards

- Condit Graduate Fellowship in Aeronautics and Astronautics (top graduating PhD student each year). **2022**
- Rising Stars, Academic Career Workshop in Cyber-physical systems. **2022**

- Rising Stars, Academic Career Workshop in Aerospace Engineering. **2022**
- Zonta International Amelia Earhart Fellowship (up to 35 recipients globally each year). **2020**
- Outstanding Female Engineer Award University of Washington Society of Women Engineers. **2020**
- Student Travel Award, IEEE Conference on Decision and Control **2019**
- Aeronautics & Astronautics Top Scholar Award (one graduate student each academic year). **2017**
- John Collison Memorial Scholarship in Mathematics (one undergraduate student each academic year). **2015**
- Loran Provincial Scholar (Awarded to one high school student provincially each year). **2011**
- President's Entrance Scholarship and Major Entrance Scholarship, University of British Columbia. **2011**

Services

- Women in Aerospace UW **2021-2022**
- UW Aeronautics and Astronautics Faculty Search Committee Student Representative **2020**
- Volunteer at University District Food Bank and University of Washington Farm **2018-2019**
- Sergeant-At-Arms, Walter Gage Toastmasters Club **2016**
- Radio DJ, CFUV 101.9 FM Victoria, Canada **2010-2011**

Review Activities

- IEEE Control System Letters (L-CSS)
- IEEE Transactions on Control and Networked Systems (TCNS)
- IEEE Transactions on Automatic Control (TAC)
- Automatica
- IEEE American Control Conference (ACC)
- IEEE Conference on Control Technology and Applications (CCTA)
- IEEE Conference on Decision and Control (CDC)
- Learning for Dynamics and Control Conference (L4DC)
- IFAC Conference on Networked Systems (NECSYS)

Invited Talks

1. *Seminar Talk*, EPFL **06/2022**
   Scalable multi-robot trajectory planning under stochastic demands.
2. *Rising Stars*, University of Colorado, Boulder **05/2022**
   Architecting co-existence: scalable integration of autonomy in shared spaces..
3. *Biotech Day*, W.F. West High School **05/2022**
   The game of life: how game theory affects our everyday lives.
4. *Seminar Talk,* Oden Institute, University of Texas, Austin **03/2022**
   Non-cooperative decision-making in cyber-physical systems: optimality, sensitivity, and robustness.
5. *Conference Talk,* Zonta International District 8 Fall Conference **10/2021**
   Regulating and predicting societal-level behavior of autonomous multi-agent systems.
6. *Semiautonomous Seminar,* UC Berkeley **09/2021**
   Adaptive Constraint Satisfaction for MDP Congestion Games: Application to Transportation Networks.
7. *Reinforcement Learning Reading Group*, Microsoft Research, Redmond **09/2021**
   Information-Sharing in Actor-Critic Games: Application to Supply Chain Networks.
8. *Coffee talk*, Advanced Concepts Team, European Space Agency **03/2021**
   Incentivizing autonomous vehicles and spacecraft toward constraint satisfaction.
9. *Guest lecture*, EE 546: Optimization and Learning for Control **02/2020**
   Set-based dynamic programming for robust Markov decision processes.
10. *Poster Talk*, NSF Smart and Connected Communities (S&CC). **04/2019**
    Markovian Network Equilibrium.

    Additionally, all first authored conference/workshop papers were invited talks at the corresponding conference.