Sarah H.Q. Li

PhD Candidate in Aeronautics and Astronautics

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Research Interest. My goal is to enable **scalable, safe, and resource-efficient multi-agent autonomy** in large-scale and human-interactive settings such as urban air mobility, autonomous driving, and automated warehouses. To achieve this, I aim to advance individual autonomous techniques through the lens of global performance and to improve global performance through individual-aware system design. My research is grounded in dynamics, safety, and uncertainty constraints in urban and aeronautical environments as well as insights from **optimization**, **control theory**, and **game theory**.

Education

University of Washington. Seattle, USA.

Ph.D. in Aeronautics and Astronautics Engineering,   **Expected January 2023**
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. Açıkmeşe.
under review for Automatica

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

[J3] **Adaptive Constraint Satisfaction for MDP Congestion Games: Application to Transportation Networks.**
S.H.Q. Li, Y. Yu, D. Calderone, N. Miguel, L. J. Ratliff, Behçet Açıkmeşe.
provisionally accepted for Automatica

[J4] **Congestion-aware path coordination game with Markov decision process dynamics.**
S.H.Q. Li, D. Calderone, Behçet Açıkmeşe.
2022 IEEE Control System Letters (L-CSS)

[J5] **A Primal-Dual Approach to Markovian Network Optimization.**
Y. Yu, D. Calderone, **S.H.Q. Li**, L. J. Ratliff, Behçet Açıkmeşe.
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, Behçet Açıkmeşe.
2020 Automatica

[J7] **Disturbance Decoupling For Gradient-based Multi-Agent Learning with Quadratic Costs.**
S.H.Q. Li, L. J. Ratliff, Behçet Açıkmeşe.
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.**
<u>**S.H.Q. Li**</u>, A. Adjé, P. Garoche,B. Açıkmeşe.
2020 International Federation of Automatic Control (IFAC) World Congress

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

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

[C5] **Robot Programming through Augmented Trajectories in Augmented Reality.**
C.P. Quintero, <u>**S.H.Q. Li**</u>, 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, <u>**S.H.Q. Li**</u>, 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.**
<u>**S.H.Q. Li**</u>, L.J. Ratliff, P. Kumar.
2022 Workshop on Gamification and Multiagent Solutions for ICLR

[W2] **Robot programming through augmented trajectories.**
C.P. Quintero, <u>**S.H.Q. Li**</u>, 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.**
<u>**S.H.Q. Li**</u>, 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

[T1] *Seminar Talk*, EPFL   **06/2022**
        Scalable multi-robot trajectory planning under stochastic demands.

[T2] *Rising Stars*, University of Colorado, Boulder   **05/2022**
        Architecting co-existence: scalable integration of autonomy in shared spaces..

[T3] *Biotech Day*, W.F. West High School   **05/2022**
      The game of life: how game theory affects our everyday lives.

[T4] *Seminar Talk,* Oden Institute, University of Texas, Austin   **03/2022**
      **Non-cooperative decision-making in cyber-physical systems: optimality, sensitivity, and
      robustness.**

[T5] *Conference Talk,* Zonta International District 8 Fall Conference   **10/2021**
      Regulating and predicting societal-level behavior of autonomous multi-agent systems.

[T6] *Semiautonomous Seminar,* UC Berkeley   **09/2021**
      **Adaptive Constraint Satisfaction for MDP Congestion Games: Application to Transportation
      Networks.**

[T7] *Reinforcement Learning Reading Group*, Microsoft Research, Redmond   **09/2021**
      Information-Sharing in Actor-Critic Games: Application to Supply Chain Networks.

[T8] *Coffee talk*, Advanced Concepts Team, European Space Agency   **03/2021**
      Incentivizing autonomous vehicles and spacecraft toward constraint satisfaction.

[T9] *Guest lecture*, EE 546: Optimization and Learning for Control   **02/2020**
      Set-based dynamic programming for robust Markov decision processes.

[T10] *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.