Stephanie Gil

Harvard University (Cambridge, MA)
Area of Computer Science
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Languages Spoken: English, Spanish

Education and Training

Massachusetts Institute of Technology   Cambridge, MA, USA
Ph.D in Aero/Astro Engineering and Computer Science and Artificial Intelligence Lab (CSAIL)
Thesis title: *Adaptive communication networks for heterogeneous teams of robots*   2014

M.S. in Aero/Astro Engineering and Computer Science and Artificial Intelligence Lab (CSAIL)
Thesis title: *Robust learning of probabilistic hybrid models*   2008

Cornell University   Ithaca, NY, USA
B.S. in Mechanical and Aerospace Engineering   2006
Magna Cum Laude Honors

Professional Experience

Harvard University   Cambridge, MA
*A*ssistant Professor of Computer Science in the Harvard John A. Paulson School of Engineering and Applied Sciences (SEAS)   July 2020 – present

Arizona State University   Tempe, AZ
*A*ssistant Professor of Computer Science in the School of Computing, Informatics, and Decision Systems Engineering (CIDSE)   Jan 2018 – June 2020

Stanford University   Palo Alto, CA
Visiting Assistant Professor, Department of Computer Science   Summer 2019

Massachusetts Institute of Technology   Cambridge, MA
Research Scientist, Computer Science and Artificial Intelligence Lab   2016 – 2017

Massachusetts Institute of Technology   Cambridge, MA
Postdoctoral Associate, Computer Science and Artificial Intelligence Lab   2014 – 2016

Research Experience

Arizona State University Tempe, AZ

Assistant Professor of Computer Science in the School of Computing, Informatics, and Decision Systems Engineering (CIDSE) Jan. 2018 – June 2020

- Investigation of the impact of communication networks on multi-robot system performance and security
- Design of distributed pose estimation for robots in complex indoor environments prone to outlier measurements
- Development of reinforcement learning methods for partially observable environments with an emphasis on distributed computation
- REACT Lab Group lead and Principle Investigator

Stanford University Palo Alto, CA

Visiting Assistant Professor, Department of Computer Science summer 2019

- Design of coordination controllers to support multi-agent manipulation
- Development of communication-as-a-sensor for robotic manipulation tasks
- Investigation of trust in multi-robot mapping

Arizona State University Tempe, AZ

Principle Investigator and Vision Lead for the ASU Drone Studio 2018–2019

- Presented research vision and future research roadmap to Fulton Schools administration to secure half of the funding for creating one of the largest motion capture studios in academia for air/ground multi-robot research `https://engineering.asu.edu/news/born-from-within/`

Massachusetts Institute of Technology Cambridge, MA

Research Scientist in Computer Science and Artificial Intelligence Lab (CSAIL) 2016 – 2017

- State estimation from noisy and unstructured data for Wi-Fi and EEG signals.
- Security for multi-agent systems (drone delivery, autonomous vehicles, IoT) using sensing and processing of wireless signals.
  Featured on MIT front page Spotlight: http://news.mit.edu/2017/security-multirobot-systems-hackers-0317
- Signal analysis, classification, and optimization of human EEG signals for binary communication with Baxter robot during human-robot collaborative task.
  Featured on MIT front page Spotlight: http://news.mit.edu/2017/brain-controlled-robots-0306
- NSF grant preparation for indoor positioning and human-robot communication projects.
- Implementation of semi-permanent testbed and distributed architecture for indoor positioning system for real time tracking.

Massachusetts Institute of Technology Cambridge, MA

Postdoc in Computer Science and Artificial Intelligence Lab (CSAIL) *2014 – 2016*

- Advisor: Prof. Daniela Rus
- Cyber-security for multi-agent systems via the development of novel technologies for wireless signal fingerprinting

- Investigation of techniques for accurate indoor localization using wireless signals
- Test deployment of large-scale localization system for user studies and robustness testing
- Development of estimation and optimization techniques for de-noising wireless signal data and improving location accuracy

Massachusetts Institute of Technology Cambridge, MA

Ph.D in Aeornautical and Astronautical Engineering and CSAIL 2009 – 2014

- Advisor: Prof. Daniela Rus
- Control for swarm-based Wi-Fi connectivity using real-time channel feedback with implementation on hybrid AscTec hummingbird and iCreate Roomba platforms
- Development and rigorous analysis of distributed control of aerial vehicles for providing multi-hop communication over mobile ground clients
- Nonlinear and convex optimization for deriving distributed position controller for multi-robot collaboration tasks and implementation of algorithms on quadrotor and Kuka Youbot hardware platforms
- Data analysis for real-time collaborative decision making over large and/or dynamic data sets
- Development of "*big data*" tools called *coresets* for dynamic k-center problems to distill large data sets to meaningful sparse data sets for improving efficiency and practicality of algorithms dealing with dynamic data
- Development and rigorous analysis of distributed control of aerial vehicles for providing multi-hop communication over mobile ground clients

Massachusetts Institute of Technology Cambridge, MA

M.S. in Aeornautical and Astronautical Engineering and CSAIL 2006 – 2008

- Advisor: Prof. Brian Williams
- M.S. Thesis: *Robust Learning of Probabilistic Hybrid Models*
- Developed robust methods for automatically learning control parameters (both discrete transition probabilities and continuous linear system matrices) for switching linear systems with autonomous mode transitions
- Estimation and modelling for hybrid systems using Hybrid Markov Models and Expectation Maximization optimization
- Detection and model learning of failure modes for hybrid dynamic systems (nominal and failure modes of operation)

Cornell University Ithaca, NY

Research Assistant 2002 –2006

- Student researcher on the NASA 2003 Mars Exploration Rover on the panoramic camera team (Advisor: Prof. Jim Bell)
- Investigation of odd-legged locomotion in dynamic systems using Open Dynamics Engine (ODE) and genetic algorithms (Advisor: Prof. Hod Lipson)

Entrepreneurship

Ubiety Indoor Positioning Technology
Cambridge, Massachusetts

Entrepreneur and Co-Inventor
2015 – 2017

- Lead entrepreneur and co-inventor of Ubiety indoor positioning technology based on years of our MIT research of Wi-Fi signals and positioning algorithms.
- Sought and was granted funding through the Deshpande Center for development of initial indoor positioning prototype.
- Sought and was granted funding through National Science Foundation (NSF) for conducting in-depth customer discovery for Ubiety in the healthcare market.

NSF Innovation Corps
Nationwide U.S.

Entrepreneurial Lead for Ubiety Startup
2016

- Led market research for Wi-Fi based indoor positioning technology in emergency and surgery departments in hospitals across the U.S.
- Conducted customer discovery for Ubiety technology via 100+ face-to-face interviews with potential customers from C-level hospital executives, to managers and end-users of the technology in hospitals across the entire U.S.
- Used findings from customer discovery process to effect design change in the Ubiety indoor positioning prototype and drive new testbed deployment at MIT.

Microsoft NERD Cambridge and Hynes Convention Center
Cambridge, Massachusetts

ReThink Music Hackathon Winner
2012

- Designed and implemented a Kinect-based virtual band that receives and interprets cues from dancing (www.kinectbomba.com)
- Developed gesture recognition via a state machine triggered by user motions where a python-implemented algorithm is used to train the system to recognize and add new multi-step dance moves to a gesture library

International Collaborations

National University of Singapore
Singapore

Future Urban Mobility Project
2010 – 2011

- Investigated control of a team of aerial vehicles for providing communication in urban environments with "no-fly" regions

- Implemented and tested *CarSpeak*, a communication system for autonomous driving applications using the NUS autonomous golf-car vehicle for testing blind spot safety handling (Jan 2012)

University of Limerick
Limerick, Ireland

Energy Harvester Development
Summer 2006, Summer 2007

- Investigated different methods of energy conversion using shock amplification technology developed by Goyal et. al. Preliminary investigation used for winning grant from Irish Government.

- Designed and implemented two prototypes, velocity based and acceleration based, to test the effectiveness of shock amplification vs. simple energy transfer
- Presented work to Microelectromechanical Systems (MEMS) group and initiated collaboration with MEMS group on energy scavenger project

IMPACT

Funding

- Amazon Research Award

- Alfred P. Sloan Fellowship

- NSF CAREER for *Multi-agent decision making and optimization using communication as a sensor*

- MIT Lincoln Labs Line Project for *distributed multi-robot mapping*

- NSF iCorps

- MIT Deshpande

Coverage

- MIT front page twice in 2017

Research covered in:

- Wired

- Forbes

- BBC

- New Scientist

- The Financial Times

- NPR

- Newsweek

- Inverse

- Exhaustive list at `https://gil.seas.harvard.edu`

Professional Organizations and Service

Panel Service

- National Science Foundation Information and Intelligent Systems Division 2020

- National Science Foundation Information and Intelligent Systems Division 2019

- National Science Foundation Information and Intelligent Systems Division 2018

Associate Editor
- Autonomous Robots Journal 2020 – Present
- IEEE International Conference on Robotics and Automation (ICRA) 2019 – Present

Program Committee
- 2nd Conference on Learning for Dynamics and Control - L4DC 2020 2019 – 2020
- **Program Chair** for Southwest Robotics Symposium (SWRS) 2019 2018 – 2019
- International Symposium on Distributed Autonomous Robotic Systems 2018 – 2019

Reviewer
- Journal of Optimization Theory and Applications
- International Journal of Robotics Research
- Automatica
- IEEE International Conference on Robotics and Automation
- IEEE International Conference on Intelligent Robots and Systems
- The Symposium on Distributed Autonomous Robotic Systems

Workshops Organized

Robots for Search and Rescue January 2020
Arizona State University in collaboration with the Department of Emergency and Military Affairs (DEMA)
ABC15 news coverage:https://tinyurl.com/wrx3ez5a
FOX5 news coverage:https://tinyurl.com/29kvwf56

Southwest Robotics Symposium January 2019
Arizona State University

Communication-Aware Robotics: New Tools for Robot networks, Autonomous vehicles, and Localization July 2014
Robotics Science and Systems

Networked Multi-Agent Systems: From Theory to Practice May 2013
IEEE International Conference on Robotics and Automation

Selected Invited Talks

[T1] "' Towards Achieving Secure Consensus and Trusted Data Exchange for Multi-Robot Teams',"
Stanford IT Forum , Stanford University, Palo Alto, CA July 2019.

[T2] "'Trusted Autonomy and Communication in Multi-Robot Systems via Coordinated Control',"
Semi-Autonomous Seminar , University of California at Berkeley, Berkeley, CA July 2019.

[T3] "'Trusted Autonomy and Communication in Multi-Robot Systems via Coordinated Control',"
Robotics Lunch , Stanford University, Palo Alto, CA June 2019.

[T4] "'Multi-robot coordination and security'," **Robotics Colloquium** , University of Washington, Seattle, WA April, 2019.

[T5] "'Security and Coordination for Multi-robot systems through coordinated control'," **Robotics Colloquium** , Northeastern University, Boston, MA November, 2018.

[T6] "'Cybersecurity in robot swarms'," **Blockchain for Robotics** , Massachusetts Institute of Technology Media Lab, Cambridge, MA December, 2018.

[T7] "'communication-aware robotic systems'," **Seminar, School of Computing, Informatics, and Decision Systems Engineering**, Arizona State University, AZ March 29, 2017.

[T8] "'communication-aware robotic systems'," **Stanford School of Engineering Seminar**, Stanford University, CA March 14-15, 2016.

[T9] "'communication-aware robotic systems'," **Caltech Space Engineering Seminar**, California Institute of Technology, CA April 8, 2016.

[T10] "'cybersecurity in robot swarms'," **School of Interactive Computing Seminar**, Georgia Institute of Technology, GA March 10-11, 2016.

[T11] "'cybersecurity in robot swarms'," **School of Computer Science Seminar**, University of California at Los Angeles, CA April 28, 2016.

[T12] "'adaptive communication networks for heterogeneous teams of robots'," **USC Symposium on the Futures of Robotics**, Los Angeles, CA April 14,2014.

Courses Taught

Harvard University, Cambridge, MA
CS 286: "Multi-Robot Systems: Control, Communication, and Security"

Arizona State University, Tempe, AZ
CSE 591/494: "Coordination and Control of Multi-Robot Systems"
CSE 574: "Planning and Learning Methods in AI"
CSE 471: "Introduction to Artificial Intelligence"

Honors, Awards, and Accomplishments

ONR Young Investigators Award   2021
Office of Naval Research

Amazon Research Awards   2021
Amazon Robotics

2020 Sloan Research Fellow   2020
Alfred P. Sloan Foundation

Early Career Development (CAREER) Award   2019
National Science Foundation

Innovation Corps (i-Corps)   2016
National Science Foundation

Deshpande Grant Awardee   2015
Massachusetts Institute of Technology

National Science Foundation Graduate Research Fellowship   2006–2011
National Science Foundation

Graduate Research Fellowship   2006–2010
Bell Labs

Graduate Research Fellowship   2006–2007
Massachusetts Institute of Technology

Publications

Refereed Journal Publications and Book Chapters

[J1] M. Yemini, A. Nedic, A. Goldsmith, and S. Gil, "Characterizing trust and resilience in distributed consensus for cyberphysical systems," *Conditionally accepted, IEEE Transactions on Robotics (TRO)*, 2020. [Online]. Available: https://arxiv.org/abs/2103.05464

[J2] F. Mallmann-Trenn, M. Cavorsi, and S. Gil, "Crowd vetting: Rejecting adversaries via collaboration–with application to multi-robot flocking," *Conditionally accepted, IEEE Transactions on Robotics (TRO)*, 2020. [Online]. Available: https://arxiv.org/abs/2012.06291

[J3] S. Bhattacharya, S. Badyal, T. Wheeler, S. Gil, and D. Bertsekas, "Reinforcement learning for pomdp: Partitioned rollout and policy iteration with application to autonomous sequential repair problems," *IEEE Robotics and Automation Letters*, vol. 5, no. 3, pp. 3967–3974, 2020.

[J4] J. DelPreto, A. F. Salazar-Gomez, S. Gil, R. M. Hasani, F. H. Guenther, and D. Rus, "Plug-and-Play Supervisory Control Using Muscle and Brain Signals for Real-Time Gesture and Error Detection," *Autonomous Robots, Conditionally Accepted.*

[J5] S. Bhattacharya, T. Wheeler, S. Gil, and D. Bertsekas, "Reinforcement Learning for POMDP: Rollout and Policy Iteration with Application to Autonomous Sequential Repair Problems," *IEEE Robotics and Automation Letters (RA-L),* **Submitted**, 2020.

[J6] S. Gil, C. Baykal, and D. Rus, "Resilient Multi-agent Consensus using Wi-Fi Signals," *IEEE Control Systems Letters (L-CSS)*, vol. 3, no. 1, pp. 126–131, 2018.

[J7] S. Gil, S. Kumar, D. Katabi, and D. Rus, "Adaptive communication in multi-robot systems using directionality of signal strength," *The International Journal of Robotics Research*, vol. 34, no. 7, pp. 946–968, 2015.

[J8] ——, "Guaranteeing spoof-resilient multi-robot networks," in *Autonomous Robots,* special issue: Robotics Science and Systems, 2017.

[J9] S. Gil, S. Prentice, N. Roy, and D. Rus, *Decentralized Control for Optimizing Communication with Infeasible Regions.* Cham: Springer International Publishing, 2017, pp. 363–381.

Refereed Conference Papers

[C1] S. Bhattacharya, S. Kailas, S. Badyal, S. Gil, and D. Bertsekas, "Multiagent rollout and policy iteration for pomdp with application to multi-robot repair problems," *Accepted, Conference on Robot Learning (CoRL)*, 2020. [Online]. Available: https://arxiv.org/abs/2011.04222

[C2] M. Yemini, S. Gil, and A. Goldsmith, "Exploiting local and cloud sensor fusion in intermittently connected sensor networks," *CoRR*, vol. abs/2005.12495, 2020. [Online]. Available: https://arxiv.org/abs/2005.12495

[C3] W. Wang, N. Jadhav, N. Hughes, M. Mazumder, and S. Gil, "Active Rendezvous for Multi-robot Pose Graph Optimization using Sensing over Wi-Fi," in *Proceedings of the International Symposium on Robotics Research (ISRR)*, 2019.

[C4] T. Wheeler, E. Bharathi, and S. Gil, "Switching topology for resilient consensus using Wi-Fi Signals," in *Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)*, 2019.

[C5] A. Salazar, J. Delpreto, S. Gil, F. Guenther, and D. Rus, "Correcting robot mistakes in real time using eeg signals," in *IEEE International Conference on Robotics and Automation (ICRA)*, 2017.

[C6] S. Gil, S. Kumar, D. Katabi, and D. Rus, "Guaranteeing spoof-resilient multi-robot networks," in *Robotics Science and Systems (RSS)*, 2015.

[C7] S. Kumar, S. Gil, D. Katabi, and D. Rus, "Accurate indoor localization with zero startup cost, **best presentation, 2nd place**," in *ACM Mobicom*, 2014.

[C8] S. Gil, S. Kumar, D. Katabi, and D. Rus, "Adaptive communication in multi-robot systems using directionality of signal strength," in *International Symposium on Robotics Research (ISRR)*, 2013.

[C9] D. Feldman, S. Gil, B. Julian, R. Knepper, and D. Rus, "K-robots clustering of moving sensors using clustering," in *IEEE International Conference on Robotics and Automation (ICRA)*, 2013.

[C10] S. Gil, D. Feldman, and D. Rus, "Communication coverage for independently moving robots," in *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2012.

[C11] S. Kumar, L. Shi, N. Ahmed, S. Gil, D. Katabi, and D. Rus, "Carspeak: A content-centric network for autonomous driving," in *ACM SIGCOMM*, 2012.

[C12] S. Gil, S. Prentice, N. Roy, and D. Rus, "Decentralized control for optimizing communication with infeasible regions," in *International Symposium on Robotics Research (ISRR)*, 2011.

[C13] S. Gil, M. Schwager, B. Julian, and D. Rus, "Optimizing communication in air-ground robot networks using decentralized control," in *IEEE International Conference on Robotics and Automation (ICRA)*, 2010.

[C14] S. Gil and B. Williams, "Beyond local optimality: An improved approach to hybrid model learning," in *Proceedings of the 48th IEEE Conference on Decision and Control*, 2009.

[C15] L. Blackmore, S. Gil, S. Chung, and B. Williams, "Model learning for switching linear systems with autonomous mode transitions," in *Proceedings of the 46th IEEE Conference on Decision and Control*, 2007.

Patent Filings

[P1] S. Gil, S. Kumar, D. Katabi, and D. Rus, "Adaptive communcation system for router systems," Massachusetts Institute of Technology Technology Licensing Office (TLO), 10 2015, uS patent filing US 14/923,953.

[P2] S. Kumar, S. Gil, D. Katabi, and D. Rus, "Indoor localilzation of a multi-antenna receiver," Massachusetts Institute of Technology Technology Licensing Office (TLO), 4 2015, international patent filing US 026404.