

Somil Bansal

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AFFILIATION	University of Southern California <i>Assistant Professor, Ming Hsieh Department of Electrical and Computer Engineering</i> <i>Assistant Professor, Department of Computer Science (by courtesy)</i> <i>Director, Safe and Intelligent Autonomy Laboratory</i>	Fall 2021 - Present
RESEARCH INTERESTS	I am broadly interested in robotics and autonomous systems. Specifically, my research focuses on understanding how machine learning methods can be combined with classical, model-based planning and control methods with the goal of: 1. enabling robots to make intelligent decisions in a data-efficient manner, especially when they rely on perception and vision sensors; 2. assuring robot safety while it relies on learning for decision-making.	
EDUCATION	University of California, Berkeley <i>Ph.D. in Electrical Engineering and Computer Sciences</i> Advisor: Claire Tomlin CGPA : 4.0/4.0	2015 - 2020
	University of California, Berkeley <i>MS in Electrical Engineering</i> Advisor: Claire Tomlin CGPA : 4.0/4.0	2012 - 2014
	Indian Institute of Technology, Kanpur <i>B.Tech. in Electrical Engineering</i> CGPA : 9.8/10	2008 - 2012
WORK EXPERIENCE	Waymo, Mountain View <i>Research Scientist</i>	September 2020 - July 2021
	Skydio, Redwood City <i>Computer Vision and Planning Intern</i> Developed and experimentally evaluated algorithms that combine machine learning and planning for autonomous drone navigation in <i>a priori</i> unknown environments.	May 2018 - Aug 2018
	Applied Predictive Technologies, San Francisco <i>Business Consultant</i> Led data-driven analyses to design business initiatives/promotions and to forecast their performance.	Aug 2014 - Sep 2015
	Broadcom, Sunnyvale <i>Performance Engineering Intern</i> Conducted quantitative analyses to identify performance bottlenecks in existing products.	Summer 2013
	University of Western Ontario, London, Canada <i>Research Intern</i> Proposed a novel approach for vector-fitting in the presence of noise for high-frequency applications.	Summer 2011

AWARDS
& HONORS

- Eli Jury Award** Department of EECS, UC Berkeley, 2020
“For outstanding achievement in the area of systems, control, or signal processing.”
- RSS Pioneer** RSS, 2019
“A cohort of the world’s top early career researchers in robotics.”
- Outstanding Graduate Student Instructor Award** UC Berkeley, 2019
- Graduate Student Gold Fellowship** Department of EECS, UC Berkeley, 2013
- Excellence Award in Community Services** IIT Kanpur, 2012
“For outstanding work in various aspects of community services.”
- Academic Excellence Award (Dean’s List)** IIT Kanpur, 2010, 2011.
- MITACS Globalink Fellowship** IIT Kanpur, 2011
For undergraduate research at University of Western Ontario, London, Canada.
- Amit Saxena Memorial Award** IIT Kanpur, 2011

TEACHING
EXPERIENCE

- EE482: Linear Control Systems** USC, Fall 2021
Instructor
- EE221A: Linear System Theory** UC Berkeley, Fall 2016, 2018
Graduate Student Instructor
Received the *Outstanding Graduate Student Instructor Award*.
- MTH101: Introduction to Real Analysis and Calculus** IIT Kanpur, Fall 2009, 2010
Academic Mentor
- MTH102: Basics of Complex Analysis and Linear Algebra** IIT Kanpur, Spring 2010, 2011
Academic Mentor

LEADERSHIP
& SERVICE

- Area Chair**
- Conference on Robot Learning, 2020, 2021.
 - IEEE International Conference on Robotics and Automation, 2021.
 - International Conference on Hybrid Systems: Computation and Control, 2020.

External Reviewer for Conferences

- IEEE International Conference on Robotics and Automation (> 20)
- Conference on Robot Learning (> 20)
- IEEE Conference on Decision and Control (> 15)
- American Control Conference (> 5)
- International Conference on Intelligent Robots and Systems (> 5)
- Robotics: Science and Systems (> 5)
- International Conference on Hybrid Systems: Computation and Control (2)

External Reviewer for Journals

- IEEE Robotics and Automation Letters (> 15)
- Transactions on Automatic Control (> 5)
- IEEE Transactions on Robotics (> 5)
- IEEE Control Systems Letters (> 5)
- Journal of Machine Learning Research (2)

Organized Workshops and Tutorials

- [Deployable Decision Making in Embodied Systems](#)
Conference on Neural Information Processing Systems (NeurIPS), 2021
- [Safe Real-World Robot Autonomy](#)
International Conference on Intelligent Robots and Systems, 2021
- [Robust Autonomy: Safe Robot Learning and Control in Uncertain Real-World Environments](#)
Robotics: Science and Systems 2019, 2020
- [Hamilton-Jacobi Reachability: A Brief Overview and Recent Advances](#)
IEEE Conference on Decision and Control, 2017
- [Design of Robotics and Embedded systems, Analysis, and Modeling \(DREAM\) Seminar](#)
UC Berkeley, 2017-2019

MEDIA ATTENTION

- [AI helps robots navigate around humans in offices](#) , VentureBeat 2020.
- [A framework for indoor robot navigation among humans](#), TechXplore 2020.
- [A new approach for robot navigation in novel environments](#), TechXplore 2019.

INVITED TALKS

Scaling Safety Analysis for Robotics: High-Dimensional Systems to Real-Time Computation
University of California, Santa Barbara, 2022.

Safe and Data Efficient Visual Learning for Robotics
Swiss Federal Institute of Technology Lausanne (EPFL), 2021.

Scaling Safety Analysis for Robotics
Workshop on Safe Autonomous Systems, Seoul National University, 2021.

Scaling Hamilton-Jacobi Reachability Analysis for Robotics
Princeton University, 2021.
Semiautonomous Seminar, UC Berkeley, 2021.
University of California, San Diego, 2020.

Safe and Data-Efficient Learning for Robotics
GRASP Student Faculty Industry (SFI) Seminar Series, University of Pennsylvania, 2021.

Safe and Data-Efficient Learning for Robotics
Google Robotics Seminar, 2020.
Waymo, 2020.
Facebook AI Research Seminar, 2020.

Scaling Hamilton-Jacobi Reachability Analysis for Robotics: Multi-agent Systems to Real-time Computation
Institute for Pure & Applied Mathematics (IPAM), 2020.

Safe and Data-Efficient Learning for Robotics
Yale University, Department of Mechanical Engineering and Materials Science, 2020.
Georgia Tech University, School of Electrical and Computer Engineering, 2020.
Cornell University, Department of Electrical and Computer Engineering, 2020.
Cornell University, Department of Computer Science, 2020.
Harvard University, School of Engineering And Applied Sciences, 2020.
University of British Columbia, Department of Computer Science, 2020.
University of Southern California, Department of Electrical and Computer Engineering, 2020.

Safe Learning-Enabled Decision Making for Robotics in Novel Environments
ETH Zurich, Department of Mechanical and Process Engineering, 2019.

Safe Learning-Enabled Decision Making for Autonomous Navigation in Novel Environments

University of Toronto, UTIAS, 2019.
 CITRIS/CPAR Control Theory and Automation Symposium, 2019.
 Workshop on Algorithms and Architectures for Learning-in-the-loop Systems in Autonomous Flight, ICRA 2019.

Combining Optimal Control and Learning for Visual Navigation in Novel Environments

Simons Institute Annual Industry Day, 2019.

Deep Learning Quadrotor Dynamics for Flight Control

CITRIS-Honeywell Drones: Technology, Policy and Society Conference, 2018.

Overcoming Model Bias in Model-Based Learning

Berkeley Artificial Intelligence/ Berkeley Deep Drive Workshop, UC Berkeley, 2016.

RESEARCH MENTORSHIP

PhD Students

- Mert Albaba (USC ECE, 2021).
- Javier Borquez (USC ECE, 2021).
- Kaustav Chakraborty (USC ECE, 2020).

Masters Students

- Varun Tolani (UC Berkeley EECS, MSc, 2018), Research assistant at UC Berkeley.
- Anjian Li (Simon Fraser University CS, MSc, 2019).
- Ted Xiao (UC Berkeley EECS, MSc, 2017), Researcher at Google Brain.

Undergraduate Students

- Khalil Sarwari (UC Berkeley EECS Undergraduate, 2019).
- Lucas Medino (UC Berkeley EECS, Visiting Researcher, 2019).
- Eli Bronstein (UC Berkeley EECS Undergraduate, 2019), Waymo.
- Nathan Blair (UC Berkeley EECS Undergraduate, 2018-2019).
- Jonathan Lee (UC Berkeley EECS Undergraduate, 2017-2018), PhD student at Stanford.
- Frank Jiang (UC Berkeley EECS Undergraduate, 2015-2016), PhD student at KTH Royal Institute of Technology, Sweden.

OUTREACH

Girls in Engineering Camp

UC Berkeley, 2019

A week-long, non-residential summer camp for San Francisco Bay Area students entering 6th, 7th, and 8th grades to explore different aspects of what it means to be an engineer.

Inclusion@RSS

RSS, 2019

Mentored several early career graduate students who belong to traditionally underrepresented groups in robotics.

Berkeley School Volunteers

Berkeley, 2017-2018

Volunteer teacher for middle school students in public schools.

National Social Service Volunteer (Prayas Program)

IIT Kanpur, 2008-2012

Taught underrepresented and underprivileged K-12 students who could not afford quality education. I was awarded the **IIT Kanpur excellence award in community services** for my efforts.

PEER-REVIEWED CONFERENCE PUBLICATIONS

DeepReach: A Deep Learning Approach to High-Dimensional Reachability

Somil Bansal, Claire J. Tomlin

International Conference on Robotics and Automation (ICRA), 2021

A Hamilton-Jacobi Reachability-Based Framework for Predicting and Analyzing Human Motion for Safe Planning

Somil Bansal, Andrea Bajcsy, Ellis Ratner, Anca D. Dragan, Claire J. Tomlin
International Conference on Robotics and Automation (ICRA), 2020

Generating Robust Supervision for Learning-Based Visual Navigation Using Hamilton-Jacobi Reachability

Anjian Li, *Somil Bansal*, Georgios Giovanis, Varun Tolani, Claire J. Tomlin, Mo Chen
Conference on Learning for Dynamics and Control (L4DC), 2020

Combining Optimal Control and Learning for Visual Navigation in Novel Environments

Somil Bansal, Varun Tolani, Saurabh Gupta, Jitendra Malik, Claire J. Tomlin
Conference on Robot Learning (CoRL), 2019

An Efficient Reachability-Based Framework for Provably Safe Autonomous Navigation in Unknown Environments

Andrea Bajcsy, *Somil Bansal*, Eli Bronstein, Varun Tolani, Claire J. Tomlin
IEEE Conference on Decision and Control (CDC), 2019

Reachability-Based Safety Guarantees Using Efficient Initializations

Sylvia Herbert, *Somil Bansal*, Shromona Ghosh, Claire J. Tomlin
IEEE Conference on Decision and Control (CDC), 2019

Closed-Loop Model Selection for Kernel-based Models Using Bayesian Optimization

Thomas Beckers, *Somil Bansal*, Claire J. Tomlin, Sandra Hirche
IEEE Conference on Decision and Control (CDC), 2019

A New Simulation Metric to Determine Safe Environments and Controllers for Systems with Unknown Dynamics

Shromona Ghosh, *Somil Bansal*, Alberto Sangiovanni-Vincentelli, Sanjit Seshia, Claire Tomlin
ACM International Conference on Hybrid Systems: Computation and Control (HSCC), 2019

Goal-Driven Dynamics Learning via Bayesian Optimization

Somil Bansal, Roberto Calandra, Ted Xiao, Sergey Levine, Claire Tomlin
IEEE Conference on Decision and Control (CDC), 2017

Hamilton-Jacobi Reachability: A Brief Overview and Recent Advances

Somil Bansal, Mo Chen, Sylvia Herbert, Claire Tomlin
IEEE Conference on Decision and Control (CDC), 2017

FaSTrack: a Modular Framework for Fast and Guaranteed Safe Motion Planning

Sylvia Herbert, Mo Chen, Soojean Han, *Somil Bansal*, Jaime F. Fisac, Claire Tomlin
IEEE Conference on Decision and Control (CDC), 2017

Safe Sequential Path Planning of Multi-Vehicle Systems Under Disturbances and Imperfect Information

Somil Bansal, Mo Chen, Jaime F. Fisac, Claire Tomlin
American Control Conference (ACC), 2017

Learning Quadrotor Dynamics Using Neural Network for Flight Control

Somil Bansal, Anayo K. Akametalu, Frank Jiang, Forrest Laine, Claire Tomlin
IEEE Conference on Decision and Control (CDC), 2016

Plug-and-Play Model Predictive Control for Electrical Vehicle Charging and Voltage Control in Smart Grids

Somil Bansal, Melanie Zeilinger, Claire Tomlin
IEEE Conference on Decision and Control (CDC), 2014

Application to Walking Robots

Jason Choi, Ayush Agrawal, Koushil Sreenath, Claire J. Tomlin, *Somil Bansal*
IEEE Robotics and Automation Letters (RA-L), 2022

Visual Navigation Among Humans with Optimal Control as a Supervisor

Varun Tolani, *Somil Bansal*, Aleksandra Faust, Claire J. Tomlin
IEEE Robotics and Automation Letters (RA-L), 2021

Provably Safe and Scalable Multi-Vehicle Trajectory Planning

Somil Bansal, Mo Chen, Ken Tanabe, Claire Tomlin
IEEE Transactions on Control Systems Technology (TCST), 2020

A Robust Control Framework for Human Motion Prediction

Andrea Bajcsy, *Somil Bansal*, Ellis Ratner, Claire J. Tomlin, Anca D. Dragan
IEEE Robotics and Automation Letters (RA-L), 2020

FaSTrack: a Modular Framework for Real-Time Motion Planning and Guaranteed Safe Tracking

Mo Chen, Sylvia Herbert, Haimin Hu, Ye Pu, Jaime F. Fisac, *Somil Bansal*, SooJean Han, Claire Tomlin
IEEE Transactions on Automatic Control (TAC), 2020

Robust Sequential Path Planning Under Disturbances and Adversarial Intruder

Mo Chen, *Somil Bansal*, Jaime F. Fisac, Claire Tomlin
IEEE Transactions on Control Systems Technology (TCST), 2017

Decomposition of Reachable Sets and Tubes for a Class of Nonlinear Systems

Mo Chen, Sylvia Herbert, Mahesh Vashishtha, *Somil Bansal*, Claire Tomlin
IEEE Transactions on Automatic Control (TAC), 2017

Plug-and-Play Model Predictive Control for Load Shaping and Voltage Control in Smart Grids

Caroline L. Floch, *Somil Bansal*, Claire Tomlin, Scott Moura, Melanie Zeilinger
IEEE Transactions on Smart Grid, 2017

BOOK
 CHAPTERS

Control and Safety of Autonomous Vehicles with Learning-Enabled Components

Somil Bansal, Claire Tomlin
Safe, Autonomous and Intelligent Vehicles, Springer, Page 57-75, 2019.

WORKSHOP
 PUBLICATIONS

Combining Optimal Control and Learning for Visual Navigation in Novel Environments

Somil Bansal, Varun Tolani, Saurabh Gupta, Jitendra Malik, Claire Tomlin
 Workshop on Deep Learning for Visual Navigation
Conference on Computer Vision and Pattern Recognition (CVPR), 2019

Safe Learning-Enabled Decision Making for Autonomous Navigation in Novel Environments

Somil Bansal, Claire Tomlin
 Workshop on Algorithms and Architectures for Learning-in-the-loop Systems in Autonomous Flight
International Conference on Robotics and Automation (ICRA), 2019

Advancing the Runtime of Hamilton-Jacobi Reachability Analysis

Somil Bansal, Claire Tomlin
 Workshop on Towards Online Optimal Control of Dynamic Robots
International Conference on Robotics and Automation (ICRA), 2019

TECHNICAL
REPORTS

SPEC: An Approach to Determine Safe Environments and Controllers for Systems with Unknown Dynamics

Somil Bansal, Shromona Ghosh, Alberto Sangiovanni-Vincentelli, Sanjit Seshia, Claire Tomlin
Technical report, May 2020

Context-Specific Validation of Data-Driven Models

Somil Bansal, Shromona Ghosh, Alberto Sangiovanni-Vincentelli, Sanjit Seshia, Claire Tomlin
Technical report, March 2018

Safe and Resilient Multi-vehicle Trajectory Planning Under Adversarial Intruder

Somil Bansal, Mo Chen, Claire Tomlin
Technical report, November 2017

MBMF: Model-Based Priors for Model-Free Reinforcement Learning

Somil Bansal, Roberto Calandra, Kurtland Chua, Sergey Levine, Claire Tomlin
Technical report, June 2017