

# Boris Ivanovic

PHD CANDIDATE IN AERONAUTICS AND ASTRONAUTICS · DEEP LEARNING AND ROBOTICS

Stanford, California, USA

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## Education

### Stanford University

Doctor of Philosophy (PhD) - Aeronautics and Astronautics

September 2018 - Present

Stanford, CA - USA

- Conducting research at the intersection of robotics and deep learning under Prof. Marco Pavone.
- Head Course Assistant for AA 274A: *Principles of Robot Autonomy I*.

### Stanford University

Master of Science (MS) - Computer Science

September 2016 - June 2018

Stanford, CA - USA

- Conducted research in machine learning, computer vision, robotics, and data science.
- Course Assistant for CS231A: *Computer Vision From 3D Reconstruction to Recognition*.

### University of Toronto

Bachelor of Applied Science (BASc) with High Honours - Engineering Science - GPA: 3.93

September 2012 - June 2016

Toronto, ON - Canada

- Undergraduate thesis with Professors Raquel Urtasun and Sanja Fidler in Visual SLAM and 3D Scene Segmentation.
- Award-winning TA for CSC411: *Introduction to Machine Learning*.
- Won the final AER201: *Engineering Design* competition.
- Ranked in the top 10% of Engineering Science students.

## Publications

### Preprints

Leveraging Neural Network Gradients within Trajectory Optimization for Proactive Human-Robot Interactions

S. Schaefer, K. Leung, **B. Ivanovic**, M. Pavone

(In Submission) *IEEE International Conference on Robotics and Automation (ICRA)*, 2021

### Journal Articles

Multimodal Deep Generative Models for Trajectory Prediction: A Conditional Variational Autoencoder Approach

**B. Ivanovic\***, K. Leung\*, E. Schmerling, M. Pavone (\* denotes equal contribution)

*IEEE Robotics and Automation Letters (RA-L)* (2020). 2020

### Conference Papers

MATS: An Interpretable Trajectory Forecasting Representation for Planning and Control

**B. Ivanovic**, A. Elhafi, G. Rosman, A. Gaidon, M. Pavone

*Conference on Robot Learning (CoRL)*, 2020

Evidential Sparsification of Multimodal Latent Spaces in Conditional Variational Autoencoders

M. Itkina, **B. Ivanovic**, R. Senanayake, M. J. Kochenderfer, M. Pavone

*Advances in Neural Information Processing Systems (NeurIPS)*, 2020

Risk-Sensitive Sequential Action Control with Multi-Modal Human Trajectory Forecasting for Safe Crowd-Robot Interaction

H. Nishimura, **B. Ivanovic**, A. Gaidon, M. Pavone, M. Schwager

*IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2020

Trajectron++: Dynamically-Feasible Trajectory Forecasting With Heterogeneous Data

T. Salzmann\*, **B. Ivanovic\***, P. Chakravarty, M. Pavone (\* denotes equal contribution)

**3rd place in the ICRA 2020 nuScenes Prediction Challenge**

*European Conference on Computer Vision (ECCV)*, 2020

Map-Predictive Motion Planning in Unknown Environments

A. Elhafi, **B. Ivanovic**, L. Janson, M. Pavone

*IEEE International Conference on Robotics and Automation (ICRA)*, 2020

The Trajectron: Probabilistic Multi-Agent Trajectory Modeling with Dynamic Spatiotemporal Graphs

**B. Ivanovic**, M. Pavone

*IEEE/CVF International Conference on Computer Vision (ICCV), 2019, Seoul, South Korea*

## BaRC: Backward Reachability Curriculum for Robotic Reinforcement Learning

**B. Ivanovic**, J. Harrison, A. Sharma, M. Chen, M. Pavone

*IEEE International Conference on Robotics and Automation (ICRA), 2019, Montreal, Canada*

## Generative Modeling of Multimodal Multi-Human Behavior

**B. Ivanovic**, E. Schmerling, K. Leung, M. Pavone

*IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2018, Madrid, Spain*

## ADAPT: Zero-Shot Adaptive Policy Transfer for Stochastic Dynamical Systems

J. Harrison, A. Garg, **B. Ivanovic**, Y. Zhu, S. Savarese, L. Fei-Fei, M. Pavone

*International Symposium on Robotics Research (ISRR), 2017, Puerto Varas, Chile*

## Blog Posts

### Back to the Future: Planning-Aware Trajectory Forecasting for Autonomous Driving

**B. Ivanovic**

*Stanford Artificial Intelligence Lab (SAIL) Blog, 2020*

### How to Deploy Deep Learning Models with AWS Lambda and TensorFlow

**B. Ivanovic**, Z. Ivanovic

**5th most viewed blog post in all of AWS in 2018**

*Amazon Web Services (AWS) AI Blog, 2017*

## Experience

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### Toyota Research Institute

*June 2020 - September 2020*

#### Research Scientist Intern

*Los Altos, CA - USA*

- Worked with Adrien Gaidon on novel trajectory forecasting methods in the Machine Learning Research team.

### Amazon.com

*June 2017 - September 2017*

#### Prime Air SDE Intern

*Seattle, WA - USA*

- Worked with Principal Research Scientist Ishay Kamon in the Autonomy team.
- Designed and implemented a novel state-of-the-art deep learning approach for a specific computer vision task within the team, outperforming existing models by 10x. The project was completed successfully and a full-time Research Scientist return offer was extended.

### Stanford University

*January 2017 - June 2017*

#### Independent Research Project

*Stanford, CA - USA*

- Worked in the Computer Vision and Geometry Lab (CVGL) and Autonomous Systems Lab (ASL) with Professors Silvio Savarese and Marco Pavone on making reinforcement learning more robust with control theory.
- Tackled the problem of policy transfer in reinforcement learning, applying model-predictive control to provide safety guarantees when transferring a learned policy from one environment to another with different dynamics.

### Stanford University

*September 2016 - June 2017*

#### Research Assistant

*Stanford, CA - USA*

- Worked in the Stanford Network Analysis Project (SNAP) Lab with Professor Jure Leskovec on analyzing large-scale physical activity data with modern data science methods.
- Efficiently cleaned, preprocessed, and distilled 3 TB of user physical activity data from over 2 million users of a mobile fitness app. Obtained scientific results with data visualization, statistical analyses, and computational methods (e.g., hierarchical bootstrapping).

### Amazon.com

*May 2016 - August 2016*

#### Prime Air SDE Intern

*Seattle, WA - USA*

- Worked with former NASA Astronaut Neil Woodward in the Flight Test team.
- Designed and built fault-tolerant, scalable software and hardware to autonomously collect and process relevant flight test data from numerous locations for internal consumption.

### ETH Zurich

*May 2015 - August 2015*

#### Summer Research Intern

*Zurich - Switzerland*

- Worked with Professor Raffaello D'Andrea in the Institute for Dynamic Systems and Control, specifically the Flying Machine Arena.
- Removed superfluous code from an open source motor controller and implemented new features such as motor calibration, emergency safety states, and a better motor startup routine in C. Simulated dynamic motor and propeller system responses in Python.

## Amazon.com

May 2014 - July 2014

### SDE Intern

Seattle, WA - USA

- Worked in the Demand Forecasting team creating a real-time demand forecasting simulation tool. Used the Hadoop MapReduce framework to process large amounts of simulation data generated by a machine learning module. The project was completed successfully and a return offer was extended.

## Awards

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### NSERC Doctoral Canada Graduate Scholarship (CGS-D)

May 2020

National Sciences and Engineering Research Council (NSERC)

Canada

The CGS-D Program promotes continued excellence in Canadian research by rewarding high-calibre Canadian doctoral students pursuing studies at home or abroad.

### Engineering Science Award of Excellence

May 2016

University of Toronto

Toronto, ON - Canada

Received for maintaining a CGPA greater than 3.90.

### Computer Science TA Award

May 2016

University of Toronto

Toronto, ON - Canada

Received for being the best Computer Science TA in the Winter 2016 semester.

### NSERC Master's Postgraduate Scholarship (CGS-M) (Declined)

April 2016

National Sciences and Engineering Research Council (NSERC)

Canada

The CGS-M Program provides financial support to high-calibre scholars who are engaged in eligible master's programs in Canada.

### Dean's Honour List

September 2012 - June 2016

University of Toronto

Toronto, ON - Canada

Placed on the Dean's Honour List for all undergraduate semesters.

### University of Toronto Scholarship

September 2012

University of Toronto

Toronto, ON - Canada

Received for being one of the top 300 entrants to the University of Toronto in 2012.

## Skills

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<b>Programming</b>	Python, Java, C/C++, MATLAB, R, Scala, Verilog, Assembly, Web (HTML5/CSS3/JavaScript)
<b>Learning &amp; Robotics</b>	PyTorch, TensorFlow, MXNet, Theano, MuJoCo, Box2D, MazeBase, ROS
<b>Data Science</b>	NumPy, Pandas, Seaborn, Matplotlib, StatsModels
<b>Libraries/SDKs</b>	Amazon Web Services SDK, Hadoop, Spark, Node.js, Google Web Tools, Android SDK