Boris **Ivanovic**

Manager, Autonomous Vehicle Research · NVIDIA

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Education

Stanford University *September 2018 - December 2021*

Doctor of Philosophy (PhD) - Aeronautics and Astronautics *Stanford, CA - USA*

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

Stanford University *September 2016 - June 2018*

Master of Science (MS) - Computer Science *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 *September 2012 - June 2016*

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

[P4] trajdata: A Unified Interface to Multiple Human Trajectory Datasets
B. Ivanovic, G. Song, I. Gilitschenski, M. Pavone
arXiv:2307.13924

[P3] Language Conditioned Traffic Generation
S. Tan, **B. Ivanovic**, X. Weng, M. Pavone, P. Krähenbühl
arXiv:2307.07947

[P2] Language-Guided Traffic Simulation via Scene-Level Diffusion
Z. Zhong, D. Rempe, Y. Chen, **B. Ivanovic**, Y. Cao, D. Xu, M. Pavone, B. Ray
arXiv:2306.06344

[P1] Partial-View Object View Synthesis via Filtered Inversion
S. Fan-Yun, J. Tremblay, V. Blukis, K. Lin, D. Xu, **B. Ivanovic**, P. Karkus, S. Birchfield, D. Fox, R. Zhang, Y. Li, J. Wu, M. Pavone, N. Haber
arXiv:2304.00673

Journal Articles

[J1] 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) 6.2 (Apr. 2021) pp. 295–302. 2021

Conference Papers

[C24] Expanding the Deployment Envelope of Behavior Prediction via Adaptive Meta-Learning
B. Ivanovic, J. Harrison, M. Pavone
IEEE International Conference on Robotics and Automation (ICRA), 2023, London, UK

[C23] BITS: Bi-level Imitation for Traffic Simulation
D. Xu, Y. Chen, **B. Ivanovic**, M. Pavone
IEEE International Conference on Robotics and Automation (ICRA), 2023, London, UK

[C22] Tree-structured Policy Planning with Learned Behavior Models
Y. Chen, P. Karkus, **B. Ivanovic**, X. Weng, M. Pavone
IEEE International Conference on Robotics and Automation (ICRA), 2023, London, UK

[C21] Planning with Occluded Traffic Agents using Bi-Level Variational Occlusion Models
F. Christianos, P. Karkus, **B. Ivanovic**, S. V. Albrecht, M. Pavone
IEEE International Conference on Robotics and Automation (ICRA), 2023, London, UK

[C20] Robust and Controllable Object-Centric Learning through Energy-based Models
R. Zhang, T. Che, **B. Ivanovic**, R. Wang, M. Pavone, Y. Bengio, L. Paull
International Conference on Learning Representations (ICLR), 2023, Kigali, Rwanda

[C19] DiffStack: A Differentiable and Modular Control Stack for Autonomous Vehicles
P. Karkus, **B. Ivanovic**, S. Mannor, M. Pavone
Conference on Robot Learning (CoRL), 2022, Auckland, New Zealand

[C18] Task-Relevant Failure Detection for Trajectory Predictors in Autonomous Vehicles
A. Farid, S. Veer, **B. Ivanovic**, K. Leung, M. Pavone
Conference on Robot Learning (CoRL), 2022, Auckland, New Zealand

[C17] Heterogeneous-Agent Trajectory Forecasting Incorporating Class Uncertainty
B. Ivanovic, K-H. Lee, P. Tokmakov, B. Wulfe, R. McAllister, A. Gaidon, M. Pavone
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), 2022, Kyoto, Japan

[C16] Injecting Planning-Awareness into Prediction and Detection Evaluation
B. Ivanovic, M. Pavone
IEEE Intelligent Vehicles Symposium (IV), 2022, Aachen, Germany

[C15] MTP: Multi-hypothesis Tracking and Prediction for Reduced Error Propagation
X. Weng, **B. Ivanovic**, M. Pavone
IEEE Intelligent Vehicles Symposium (IV), 2022, Aachen, Germany

[C14] Sample-Efficient Safety Assurances using Conformal Prediction
R. Luo, S. Zhao, J. Kuck, **B. Ivanovic**, S. Savarese, E. Schmerling, M. Pavone
Workshop on the Algorithmic Foundations of Robotics (WAFR), 2022, College Park, MD, USA

[C13] Whose Track Is It Anyway? Improving Robustness to Tracking Errors with Affinity-Based Prediction
X. Weng, **B. Ivanovic**, M. Pavone
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2022, New Orleans, USA

[C12] ScePT: Scene-consistent, Policy-based Trajectory Predictions for Planning
Y. Chen, **B. Ivanovic**, M. Pavone
IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2022, New Orleans, USA

[C11] Propagating State Uncertainty Through Trajectory Forecasting
B. Ivanovic, Y. Lin, S. Shrivastava, P. Chakravarty, M. Pavone
IEEE International Conference on Robotics and Automation (ICRA), 2022, Philadelphia, USA

[C10] Leveraging Neural Network Gradients within Trajectory Optimization for Proactive Human-Robot Interactions
S. Schaefer, K. Leung, **B. Ivanovic**, M. Pavone
IEEE International Conference on Robotics and Automation (ICRA), 2021, Xi'an, China

[C9] MATS: An Interpretable Trajectory Forecasting Representation for Planning and Control
B. Ivanovic, A. Elhafsi, G. Rosman, A. Gaidon, M. Pavone
Conference on Robot Learning (CoRL), 2020, Virtual

[C8] 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, Virtual

[C7] 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, Virtual

[C6] 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, Virtual

[C5] Map-Predictive Motion Planning in Unknown Environments
A. Elhafsi, **B. Ivanovic**, L. Janson, M. Pavone
IEEE International Conference on Robotics and Automation (ICRA), 2020, Virtual

[C4] 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

[C3] 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

[C2] 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

[C1] 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

Theses

[T2] Trajectory Forecasting in the Modern Robotic Autonomy Stack
B. Ivanovic
Stanford University, 2021

[T1] Streamlining the Training of 3D Scene Segmentation Models
B. Ivanovic
University of Toronto, 2016

Blog Posts

[B2] Back to the Future: Planning-Aware Trajectory Forecasting for Autonomous Driving
B. Ivanovic
Stanford Artificial Intelligence Lab (SAIL) Blog, 2020

[B1] 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

Invited Talks

Architecting Next-Generation Robotic Autonomy Stacks
UC Berkeley Semiautonomous Seminar, *August 2023*
Silicon Valley AI Meetup, *July 2023*
Apple Special Projects Group, *March 2023*

Building Mapless Next-Generation Autonomy Stacks
IV Workshop on Bridging the Gap Between Map-based and Map-less Driving, *June 2023*

Differentiable Robotics (with Peter Karkus)
ACC Workshop on Safe & Robust Learning for Perception-based Planning and Control, *July 2023*
ACC Workshop on Differentiable Programming for Modeling and Control of Dynamical Systems, *March 2023*

Effectively Integrating Behavior Prediction within the Modern Robotic Autonomy Stack
IV Social, Interactive and Safe Behaviors for AVs: Benchmarks, Models and Applications Workshop, *June 2023*
Waterloo.AI Seminar Series, *November 2022*
ICRA Workshop on Long-term Human Motion Prediction, *May 2022*

Experience

NVIDIA Research *June 2023 - Present*
Research Manager *Santa Clara, CA - USA*
- Working in the Autonomous Vehicle Research Group on behavior modeling, simulation, and end-to-end autonomy.

NVIDIA Research *January 2022 - June 2023*
Research Scientist *Santa Clara, CA - USA*
- Working in the Autonomous Vehicle Research Group on novel trajectory forecasting methods and their integration within the autonomy stack.

NVIDIA Research *March 2021 - September 2021*
Research Scientist Intern *Santa Clara, CA - USA*
- Worked in the Autonomous Vehicle Research Group on novel trajectory forecasting methods and their integration within the autonomy stack.

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.

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

NSERC Doctoral Canada Graduate Scholarship (CGS-D) *May 2020 - December 2021*
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

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

Service

Reviewing	**ICLR** (2022), **CVPR** (2021, 2022, 2023), **ECCV** (2022), **ICML** (2020, 2021, 2022, 2023), **NeurIPS** (2019, 2020, 2021, 2022, 2023), **L4DC** (2023), **RSS** (2020, 2021), **CoRL** (2023), **ICRA** (2020, 2021, 2022, 2023), **IROS** (2021, 2022, 2023), **CDC** (2021), **Humanoids** (2020), **IV** (2021, 2022), **ITSC** (2019), **TPAMI** (2020, 2022), **RA-L** (2020, 2021, 2022, 2023), **L-CSS** (2021), **TMLR** (2023), **Nature MI** (2022)
Fellowships	**NVIDIA** (2023, 2024)
Workshops	**Workshop on Long-term Human Motion Prediction** (ICRA 2023, ICRA 2024), **Learning-powered Prediction and Decision-making for Autonomous Driving** (ITSC 2023)