

IVAN PAPUSHA

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Education

California Institute of Technology · Pasadena, CA

- PhD, Control and Dynamical Systems, 2016
Thesis: Robustness, Adaptation, and Learning in Optimal Control
Advisor: Richard M. Murray

Stanford University · Stanford, CA

- MS, Electrical Engineering, 2011
- BS, Electrical Engineering (physics minor), 2011

Thomas Jefferson High School for Science and Technology · Alexandria, VA

- Advanced Studies Diploma, 2007

Positions held

<i>Senior Professional Staff</i> · Space Exploration Sector, JHU/APL, Laurel, MD	2018–
<i>Postdoctoral Fellow</i> · Institute for Computational Engineering and Sciences, UT Austin, TX	2016–2018
<i>Graduate Researcher</i> · CDS Department, Caltech, Pasadena, CA	2011–2016
<i>Research Analyst</i> · Prediction and Bidding Team, AOL Inc., Palo Alto, CA	2011
<i>Researcher</i> · AI Laboratory, Stanford University, Stanford, CA	2010
<i>Researcher</i> · Center for Integrated Systems, Stanford University, Stanford, CA	2009
<i>Engineering Technician</i> · Naval Research Laboratory, Washington, DC	2006, 2008

Tools and expertise

Software Engineering: Python, C, C++ (modern), Java, DevOps, Docker, SQL, node.js, React

Data Analysis: Matlab, Mathematica, convex optimization, numpy, scipy, pandas, HPC

Machine Learning: regression, classification, neural networks

Control Systems: robust/adaptive control, model predictive control, trajectory generation, hybrid systems

Formal Methods: model checking, SMT, Coq

Robotics: ROS, SolidWorks, microcontrollers, circuit board design/layout, 3D printing, mill/shop

Circuit Design: Verilog, ModelSim, Cadence, Eagle, SPICE

Earth and Space: AGI STK, NAIF SPICE, ArcGIS

Teaching

Course Developer/Instructor · Caltech 2015

- CDS270–2: Mathematical Methods in Control and System Engineering, Spring 2015

Teaching Assistant · Stanford, Caltech 2010–2014

- CDS101/110a: Introductory Control Theory, Fall 2013, Fall 2014
- EE102b: Signal Processing and Linear Systems II, Spring 2011
- EE364a: Convex Optimization I, Winter 2011
- EE263: Linear Dynamical Systems, Fall 2010

Awards and activities

National Defense Science and Engineering Graduate Fellowship (NDSEG), 2012–2015

Caltech Powell Foundation Fellowship, 2011

AFCEA Scholarship, 2008–2010

Professional: IEEE member

Personal: STEM outreach, private pilot (in-training), scuba, rock climbing

Software

- LANTERN-SMT: (“Safer than a torch”) encodes PyTorch modules as Z3 constraints.
<https://github.com/JHUAPL/lantern-smt>
- AMNET: Python toolbox for affine multiplexing networks.
<https://github.com/ipapusha/amnet>
- SYDAR: (“Synthesis Done Approximately Right”) approximate control synthesis for hybrid automata.
<https://github.com/u-t-autonomous/sydar>
- BOXQP: primal-dual quadratic program solver for Matlab with explicit offline factorization analysis.
<https://github.com/ipapusha/boxqp>
- PCPADMM: solver for the robust PCA problem via principal component pursuit.
http://ivanpapusha.com/code/pcp_admm.m

Publications

- [CJJ⁺17] M. Cubuktepe, N. Jansen, S. Junges, J.-P. Katoen, I. Papusha, H. A. Poonawala, and U. Topcu. *Sequential Convex Programming for the Efficient Verification of Parametric MDPs*, pp. 133–150. Springer, Apr. 2017. DOI: 10.1007/978-3-662-54580-5_8.
- [FPMM16] S. S. Farahani, I. Papusha, C. McGhan, and R. M. Murray. Constrained autonomous satellite docking via differential flatness and model predictive control. In *IEEE Conference on Decision and Control (CDC)*, pp. 3306–3311. Dec. 2016. DOI: 10.1109/CDC.2016.7798766.
- [FPT17] J. Fu, I. Papusha, and U. Topcu. Sampling-based approximate optimal control under temporal logic constraints. In *ACM International Conference on Hybrid Systems: Computation and Control (HSCC)*, pp. 227–235. Apr. 2017. DOI: 10.1145/3049797.3049820.
- [HPB14] M. B. Horowitz, I. Papusha, and J. W. Burdick. Domain decomposition for stochastic optimal control. In *IEEE Conference on Decision and Control (CDC)*, pp. 1866–1873. Dec. 2014. DOI: 10.1109/CDC.2014.7039670.
- [KWG⁺18] M. A. Kelly, D. Wu, A. Goldberg, I. Papusha, J. Wilson, J. Carr, J. Boldt, J. Greenberg, F. Morgan, S. Yee, A. Heidinger, and L. Mehr. Compact Midwave Imaging System (CMIS) for retrieval of Cloud Motion Vectors (CMVs) and Cloud Geometric Heights (CGHs). In *Proceedings of the SPIE*, vol. 10776. Oct. 2018. DOI: 10.1117/12.2324612.
- [Pap16] I. Papusha. *Robustness, Adaptation, and Learning in Optimal Control*. Ph.D. thesis, California Institute of Technology, May 2016. DOI: 10.7907/Z9F18WPB.
- [PFTM16] I. Papusha, J. Fu, U. Topcu, and R. M. Murray. Automata theory meets approximate dynamic programming: Optimal control with temporal logic constraints. In *IEEE Conference on Decision and Control (CDC)*, pp. 434–440. Dec. 2016. DOI: 10.1109/CDC.2016.7798307.
- [PLM14] I. Papusha, E. Lavretsky, and R. M. Murray. Collaborative system identification via parameter consensus. In *American Control Conference (ACC)*, pp. 13–19. Jun. 2014. DOI: 10.1109/ACC.2014.6858938.
- [PM15] I. Papusha and R. M. Murray. Analysis of control systems on symmetric cones. In *IEEE Conference on Decision and Control (CDC)*, pp. 3971–3976. Dec. 2015. DOI: 10.1109/CDC.2015.7402836.
- [PTCL18] I. Papusha, U. Topcu, S. Carr, and N. Lauffer. Affine multiplexing networks: System analysis, learning, and computation, Apr. 2018. [arXiv:1805.00164](https://arxiv.org/abs/1805.00164) [math.OC].
- [PWB⁺20] I. Papusha, R. Wu, J. Brulé, Y. Kouskoulas, D. Genin, and A. Schmidt. Incorrect by construction: Fine tuning neural networks for guaranteed performance on finite sets of examples. In *3rd Workshop on Formal Methods in ML-Enabled Autonomous Systems (FoMLAS)*. Jul. 2020. [arXiv:2008.01204](https://arxiv.org/abs/2008.01204) [cs.LG].
- [PWT18] I. Papusha, M. Wen, and U. Topcu. Inverse optimal control with regular language specifications. In *American Control Conference (ACC)*, pp. 770–777. Jun. 2018. DOI: 10.23919/ACC.2018.8431646.
- [WPT17] M. Wen, I. Papusha, and U. Topcu. Learning from demonstrations with high-level side information. In *International Joint Conference on Artificial Intelligence (IJCAI)*, pp. 3055–3061. Aug. 2017. DOI: 10.24963/ijcai.2017/426.