# IOANNIS EXARCHOS

Personal Information	Mountain View, CA, United States web: personal, Linkedin, Google scholar	e-mail: exarchos@gatech.edu iexarchos21@gmail.com	
Research Interests	Stochastic optimal control, reinforcement learning, optimization, robotics, machine/deep learning applications in control and neuroscience, differential game theory.		
Earned Degrees	<ul> <li>Georgia Institute of Technology</li> <li>1. Ph.D. Aerospace Engineering</li> <li>Focus: Stochastic Optimal Control, Machine Learning Applications in Control Advisors: Profs. Panagiotis Tsiotras, Evangelos A. Theodorou</li> <li>Dissertation title: Stochastic Optimal Control – A Forward and Backward Samp</li> </ul>	Atlanta, GA Dec. 2017	
	2. M.S. Mathematics Focus: Probability, Stochastic Processes	Dec. 2015	
	<b>3. M.S. Aerospace Engineering</b> Focus: Dynamical Systems and Control, Differential Game Theory	Dec. 2013	
	<ul> <li>University of Patras</li> <li>4. Eng.Dipl. Mechanical Engineering and Aeronautics</li> <li>GPA: 9.12/10, Valedictorian (top of graduating class)</li> <li>Advisor: prof. Spilios Fassois</li> <li>Thesis title: Uncertainty Analysis in Structures using Time Series Data: System</li> <li>Pooled ARX Models</li> </ul>	Patras, Greece Nov. 2010 Identification via Random Coefficient	
Research Experience	Microsoft Applied Scientist	Jun. 2021 – Oct. 2023	
	Senior Applied Scientist	Dec. 2023 – Present	

As an Applied Scientist at Microsoft, most of my work is focused on developing and optimizing bidding algorithms for online ad auctions. Keywords: auto-bidding controllers, pricing/revenue optimization, online advertising auctions, KPI forecasting, monetization.

#### Stanford University

Post-doctoral Fellow

Department of Computer Science

Project: Applications of deep reinforcement learning and stochastic optimal control in robotics. Investigation of control policy transferability between source (training) and target (testing) environments in simulation using techniques such as domain randomization and adaptation (transfer learning, simto-real gap).

PI: Prof. C. Karen Liu

## **Emory University**

Post-doctoral Fellow Feb. 2018 – Sep. 2019 Department of Biomedical Informatics Project: Machine Learning Algorithms for Closed-Loop Neuromodulation PIs: Dr. Robert E. Gross, MD, PhD and Dr. Jon T. Willie, MD, PhD Development of deep learning algorithms to aid in the design of closed-loop stimulation paradigms for the treatment of various neurological disorders such as epilepsy and narcolepsy through deep brain stimulation.

### Georgia Institute of Technology

Research Assistant, School of Aerospace Engineering Dynamics and Control Systems Lab

Oct. 2019 - Feb. 2021

Aug. 2011 – Dec. 2017

Teaching Experience	Georgia Institute of Technology Teaching Assistant, AE 6511: Optimal Guidance and Control Assignment grading, lectures, office hours.	Jan May 2014, Aug Dec. 2016	
	Teaching Assistant, AE 8803: Stoch. Optimal Control and Reinf. Learning Lecture on Stochastic Optimal Control via FBSDEs	Jan May 2017	
Graduate Level Courses	VEL Control Theory: Linear Systems, Nonlinear Control, Advanced Nonlinear Control, Robust Control, Optima Guidance and Control, Stochastic Optimal Control and Reinforcement Learning		
	Mathematics: Real Analysis, Operator Theory, Ordinary Differential Equations, Probability II, Stochastic Olus, Numerical Methods for PDEs		
	<b>Optimization and Machine Learning:</b> Linear Optimization, Nonlinear Optimization, Machine Learning for Control, Deep Learning for Perception (audit)		
	Neuroscience: Computational Neuroscience, Neuroanatomy and Systems Neuroscience (Emory University, audit)		
	Dynamics: Advanced Dynamics, Advanced Flight Dynamics		
Computer Skills	Languages: Python, MATLAB.Software: PyTorch, TensorFlow, PyBullet, DART, GPOPS, MATLAB, Mathematica.Platforms: Linux, Windows.		
Language Skills	English (fluent), Greek (native), German (advanced), Spanish (beginner)		
Publications	<ul> <li>[2024]</li> <li>M. Pereira, C. Duarte, I. Exarchos, and E. Theodorou, "Deep L<sup>1</sup> Stochastic Optimal Control Policies for Planetary Soft-landing", Journal of Guidance, Control, and Dynamics, Vol. 47, No.4, April 2024 [paper]</li> </ul>		
	[2022]		

2. I. Exarchos, K. Wang, B. Do, F. Stroppa, M. M. Coad, A. M. Okamura, and C. K. Liu, "Task-specific Design Optimization and Manufacturing for Inflated-Beam Soft Robots with Growable Discrete Joints", 2022 International Conference on Robotics and Automation (ICRA) [paper]

#### [2021]

- 3. I. Exarchos, M. Pereira, Z. Wang, and E. Theodorou, "NOVAS: Non-convex Optimization via Adaptive Stochastic Search for End-to-End Learning and Control", 2021 International Conference on Learning Representations (ICLR) [paper]
- I. Exarchos, Y. Jiang, W. Yu, and C. K. Liu, "Policy Transfer via Kinematic Domain Randomization and Adaptation", 2021 International Conference on Robotics and Automation (ICRA), [paper]
- 5. T. Chen, Z. Wang, I. Exarchos, and E. Theodorou, "Large-Scale Multi-Agent Deep FBSDEs", 2021 International Conference on Machine Learning (ICML) [paper]
- K. Werling, D. Omens, J. Lee, I. Exarchos and C. K. Liu, "Fast and Feature-Complete Differentiable Physics for Articulated Rigid Bodies with Contact", *Robotics: Science and Systems* 2021 [paper]
- 7. Y. Jiang, M. Guo, J. Li, **I. Exarchos**, J. Wu, and C. K. Liu, "DASH: Modularized Human Manipulation Simulation with Vision and Language for Embodied AI", *The 20th Annual Symposium on Computer Animation (SCA)* [paper]

#### [2020]

8. M. Pereira, Z. Wang, **I. Exarchos**, and E. Theodorou, "Safe Optimal Control Using Stochastic Barrier Functions and Deep Forward-Backward SDEs", 2020 Conference on Robot Learning (CoRL), selected for plenary presentation, November 16 - 18, 2020, [paper]

- S. Park, M. J. Connoly, I. Exarchos, A. Fernandez, M. Ghetiya, C. Gutekunst, and R. E. Gross, "Optimizing Neuromodulation based on Surrogate Neural States for Seizure Suppression in a Rat Temporal Lobe Epilepsy Model", *Journal of Neural Engineering*, Vol. 17, No. 4, July 2020, doi: 10.1088/1741-2552/ab9909
- I. Exarchos, A. A. Rogers, L. M. Aiani, R. E. Gross, G. D. Clifford, N. P. Pedersen, and J. T. Willie, "Supervised and Unsupervised Machine Learning for Automated Scoring of Sleep-Wake and Cataplexy in a Mouse Model of Narcolepsy", *SLEEP*, Vol. 43, No. 5, May 2020, doi: 10.1093/sleep/zsz272

#### [2019]

- Z. Wang, K. Lee, M. Pereira, I. Exarchos, and E. Theodorou, "Deep Forward-Backward SDEs for Min-Max Control", 58th IEEE Conference on Decision and Control (CDC), Nice, France, December 11-13, 2019, pp. 6807-6814, doi: 10.1109/CDC40024.2019.9028871
- M. Pereira, Z. Wang, I. Exarchos, and E. Theodorou, "Learning Deep Stochastic Optimal Control Policies using Forward-Backward SDEs", *Proceedings of Robotics: Science and Systems* XV, Freiburg im Breisgau, Germany, June 22-26, 2019, doi: 10.15607/RSS.2019.XV.070
- I. Exarchos, E. Theodorou, and P. Tsiotras, "Stochastic Differential Games A Sampling Approach via FBSDEs", *Dynamic Games and Applications*, Vol. 9. No. 2, June 2019, pp. 486-505, doi: 10.1007/s13235-018-0268-4
- I. Exarchos, E. Theodorou, and P. Tsiotras, "Optimal Thrust Profile for Planetary Soft Landing under Stochastic Disturbances", *Journal of Guidance, Control, and Dynamics*, Vol. 42, No. 1, 2019, pp.209-216, doi: 10.2514/1.G003598

[2018]

- I. Exarchos, E. Theodorou, and P. Tsiotras, "Stochastic L<sup>1</sup>-Optimal Control via Forward and Backward Sampling", Systems & Control Letters, Vol. 118, July 2018, pp. 101-108, doi: 10.1016/j.sysconle.2018.06.005
- I. Exarchos and E. Theodorou, "Stochastic Optimal Control via Forward and Backward Stochastic Differential Equations and Importance Sampling", *Automatica*, Vol. 87, January 2018, pp. 159-165, doi: 10.1016/j.automatica.2017.09.004
- H. Brar, I. Exarchos, Y. Pan, E. Theodorou, and B. Mahmoudi, "Seizure Reduction using Model Predictive Control", 40th Annual International Conference of the IEEE Engineering in Medicine and Biology Society, Honolulu HI, July 17-21, 2018, pp. 3152-3155, doi: 10.1109/EMBC.2018.8512911

[2016 and prior]

- I. Exarchos, E. Theodorou, and P. Tsiotras, "Game-Theoretic and Risk-Sensitive Stochastic Optimal Control via Forward and Backward Stochastic Differential Equations", 55th IEEE Conference on Decision and Control (CDC), Las Vegas NV, December 12-14, 2016, pp. 6154-6160, doi: 10.1109/CDC.2016.7799215
- I. Exarchos and E. Theodorou, "Learning Optimal Control via Forward and Backward Stochastic Differential Equations", *The American Control Conference (ACC)*, Boston MA, July 6-8, 2016, pp. 2155-2161, doi: 10.1109/ACC.2016.7525237
- I. Exarchos, P. Tsiotras, and M. Pachter, "UAV Collision Avoidance based on the Solution of the Suicidal Pedestrian Differential Game", AIAA Guidance, Navigation, and Control Conference (SciTech), San Diego CA, January 4-8, 2016, pp. 1-16, doi: 10.2514/6.2016-2100
- I. Exarchos, P. Tsiotras, and M. Pachter, "On the Suicidal Pedestrian Differential Game", Dynamic Games and Applications, Vol. 5, No. 3, September 2015, pp. 297-317, doi: 10.1007/s13235-014-0130-2
- I. Exarchos and P. Tsiotras, "An Asymmetric Version of the Two Car Game", 53rd IEEE Conference on Decision and Control (CDC), Los Angeles CA, December 15-17, 2014, pp. 4272-4277, doi:10.1109/CDC.2014.7040055

INVITED TALKS AND LECTURES

1. Sampling-based Methods in Optimal Control, Lecture for CS 348E – Character Animation: Modeling, Simulation, and Control of Human Motion, Department of Computer Science, Stanford University, May 2020.

2. Stochastic Optimal Control- Overview and Recent Advances, Invited talk at the Center for Cyber-Physical Systems and Internet of Things, Ming Hsieh Department of Electrical and Computer Engineering, University of Southern California, January 2019.

#### • Gerondelis Foundation Fellowship 2016-2017 • Excellent Reviewer for AIAA Journal of Guidance, Control, and Dynamics 2017-2018 • Onassis Foundation Scholar – Doctoral Fellowship 2011-2015 The A. S. Onassis Foundation • Academic Distinction 2012Technical Chamber of Greece 2010 • Highest Honors (Valedictorian, top of graduating class) University of Patras • G. and A. Skouras Foundation Fellowship 2010 • Annual National Fellowship (3 consecutive years) 2006-2009 Greek State Scholarship Foundation (IKY) • Annual Award for Academic Excellence (4 consecutive years) 2006-2010 Greek State Scholarship Foundation (IKY)

SERVICE Reviewer for: 1) AAAI Conference on Artificial Intelligence, 2) Automatica, 3) IEEE Trans. Automatic Control, 4) Systems & Control Letters, 5) Journal of Guidance, Control, and Dynamics, 6) Dynamic Games and Applications, 7) IEEE Robotics and Automation Letters, 8) Optimal Control - Applications and Methods, 9) Entropy, 10) Int. Journal of Robust and Nonlinear Control, 11) Engineering Reports, 12) Numerical Mathematics: Theory, Methods and Applications, 13) East Asian Journal on Applied Mathematics, 14) Journal of Physics: Complexity, 15) SLEEP, 16) IEEE Conference on Decision and Control, 17) American Control Conference, 18) IFAC World Congress, 19) Mathematical Problems in Engineering.

### REFERENCES Evangelos A. Theodorou, PhD Associate Professor School of Aerospace Engineering Georgia Institute of Technology Atlanta, GA, USA phone: +1 404 894 8197 e-mail: evangelos.theodorou@ae.gatech.edu

HONORS AND

AWARDS

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### Panagiotis Tsiotras, PhD

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#### Gari D. Clifford, DPhil

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