IOANNIS EXARCHOS

PERSONAL INFORMATION

Amsterdam, Netherlands

e-mail: exarchos@gatech.edu
iexarchos21@gmail.com

web: personal, Linkedin, Google scholar

RESEARCH INTERESTS

Stochastic optimal control, reinforcement learning, optimization, robotics, machine/deep learning applications in control and neuroscience, differential game theory.

EARNED DEGREES

Georgia Institute of Technology
Atlanta, GA

1. Ph.D. Aerospace Engineering
Dec. 2017

Focus: Stochastic Optimal Control, Machine Learning Applications in Control
Advisors: Profs. Panagiotis Tsiotras, Evangelos A. Theodorou
Dissertation title: *Stochastic Optimal Control – A Forward and Backward Sampling Approach*

2. M.S. Mathematics
Dec. 2015

Focus: Probability, Stochastic Processes

3. M.S. Aerospace Engineering
Dec. 2013

Focus: Dynamical Systems and Control, Differential Game Theory

University of Patras
Patras, Greece

4. Eng.Dipl. Mechanical Engineering and Aeronautics
Nov. 2010

GPA: 9.12/10, *Valedictorian* (top of graduating class)
Advisor: prof. Spilios Fassois
Thesis title: *Uncertainty Analysis in Structures using Time Series Data: System Identification via Random Coefficient Pooled ARX Models*

RESEARCH EXPERIENCE

Microsoft
Data & Applied Scientist
June. 2021 – present

Stanford University
Post-doctoral Fellow
Oct. 2019 – Feb. 2021
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, sim-to-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
Aug. 2011 – Dec. 2017

TEACHING EXPERIENCE	**Georgia Institute of Technology**

Teaching Assistant, AE 6511: Optimal Guidance and Control — Jan. - May 2014,
  Assignment grading, lectures, office hours. — Aug. - Dec. 2016

Teaching Assistant, AE 8803: Stoch. Optimal Control and Reinf. Learning — Jan. - May 2017
  Lecture on Stochastic Optimal Control via FBSDEs

GRADUATE LEVEL COURSES

Control Theory: Linear Systems, Nonlinear Control, Advanced Nonlinear Control, Robust Control, Optimal Guidance and Control, Stochastic Optimal Control and Reinforcement Learning

Mathematics: Real Analysis, Operator Theory, Ordinary Differential Equations, Probability II, Stochastic Calculus, Numerical Methods for PDEs

Optimization and Machine Learning: 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

Pre-prints/in submission

1. **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", ***accepted*** at the *2022 International Conference on Robotics and Automation (ICRA)* [preprint]

2. M. Pereira, C. Duarte, **I. Exarchos**, and E. Theodorou, "Deep $\mathcal{L}^1$ Stochastic Optimal Control Policies for Planetary Soft-landing", submitted to *Journal of Guidance, Control, and Dynamics* [preprint]

[2021]

1. **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]

2. **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]

3. T. Chen, Z. Wang, **I. Exarchos**, and E. Theodorou, "Large-Scale Multi-Agent Deep FBSDEs", *2021 International Conference on Machine Learning (ICML)* [paper]

4. 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]

5. 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]

6. 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]

7. 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

8. **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]

9. 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

10. 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

11. **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

12. **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]

13. **I. Exarchos**, E. Theodorou, and P. Tsiotras, "Stochastic L^1-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

14. **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

15. 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]

16. **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

17. **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

18. **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

19. **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

20. **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.

HONORS AND
AWARDS

- Gerondelis Foundation Fellowship   2016-2017
- Excellent Reviewer for AIAA Journal of Guidance, Control, and Dynamics   2016-2018
- Onassis Foundation Scholar – Doctoral Fellowship   2011-2015
  The A. S. Onassis Foundation
- Academic Distinction   2012
  Technical Chamber of Greece
- Highest Honors (Valedictorian, top of graduating class)   2010
  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) Automatica, 2) IEEE Trans. Automatic Control, 3) Systems & Control Letters, 4) Journal of Guidance, Control, and Dynamics, 5) Dynamic Games and Applications, 6) IEEE Robotics and Automation Letters, 7) Optimal Control - Applications and Methods, 8) Entropy, 9) Int. Journal of Robust and Nonlinear Control, 10) Engineering Reports, 11) Numerical Mathematics: Theory, Methods and Applications, 12) East Asian Journal on Applied Mathematics, 13) Journal of Physics: Complexity, 14) SLEEP, 15) IEEE Conference on Decision and Control, 16) American Control Conference, 17) IFAC World Congress, 18) 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

Panagiotis Tsiotras, PhD
Professor
School of Aerospace Engineering
Georgia Institute of Technology
Atlanta, GA, USA
phone: +1 404 894 9526
e-mail: tsiotras@gatech.edu

C. Karen Liu, PhD
Associate Professor
Dept. of Computer Science
Stanford University
Stanford, CA, USA
e-mail: karenliu@cs.stanford.edu

Gari D. Clifford, DPhil
Associate Professor and Chair
Depts of Biomedical Informatics and Biomedical Engineering
Emory University and Georgia Institute of Technology
Atlanta, GA, USA
e-mail: gari@alum.mit.edu