Filippos Fotiadis

Postdoctoral Researcher
Autonomous Systems Group
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Research Interests

My primary research interests lie in the intersection of game theory, control theory, and machine learning, with applications to the security, autonomy, and verification of cyber-physical systems. I develop algorithms that provably enable cyber-physical systems to operate safely and securely in uncertain and adversarial environments.

Education

Ph.D. in Aerospace Engineering, Georgia Institute of Technology 2019–2024
Advisor: Prof. Kyriakos G. Vamvoudakis
Thesis: Game-Theoretic Learning and Control for Resilience of Complex Adaptive Systems

M.S. in Mathematics, Georgia Institute of Technology 2019–2023

M.S. in Aerospace Engineering, Georgia Institute of Technology 2019–2022

Diploma (B.S. and M.S.) in Electrical & Computer Engineering, Aristotle University of Thessaloniki 2013–2018
Advisor: Prof. George A. Rovithakis
Thesis: Improving Robustness of Adaptive Dynamic Programming Controllers using Prescribed Performance Control

Professional & Research Experience

Postdoctoral Researcher, University of Texas at Austin 08/2024–
Autonomous Systems Group, PI: Prof. Ufuk Topcu

Graduate Research Assistant, Georgia Institute of Technology 08/2019–08/2024
Intelligent Cyber-Physical Systems Lab, PI: Prof. Kyriakos G. Vamvoudakis

Undergraduate Researcher, Aristotle University of Thessaloniki 02/2018–11/2018
Automation & Robotics Lab, PI: Prof. George A. Rovithakis

Intern on Physical Human-Robot Interaction, CERTH 07/2017–09/2017
Automation & Robotics Lab, PI: Prof. Zoe Doulgeri

Teaching Experience

Instructor, AE8750/8751: Robotics Research Fundamentals, Georgia Institute of Technology — Spring 2023

Assistant in Teaching, AE8803: Optimization-Based Learning Control and Games, Georgia Institute of Technology — Fall 2022/2023

Awards & Honors

CPS Rising Star (16% acceptance rate), University of Virginia — 2024

Georgia Tech Aerospace Engineering Fellowship — 2023–2024

Alexander S. Onassis Foundation Scholarship — 2020–2024

Outstanding Reviewer (top 1%), IEEE Control Systems Letters — 2023

Excellent Reviewer, Journal of Guidance, Control, and Dynamics — 2022

Gerondelis Foundation Graduate Study Scholarship — 2021

Publications

Books

1. A. Kanellopoulos, L. Zhai, **F. Fotiadis**, K. G. Vamvoudakis, "Control and Game Theoretic Methods for Cyber-Physical Security," *Elsevier*, 2024.

Book Chapters

1. **F. Fotiadis**, L. Zhai, K. G. Vamvoudakis, J. Hugues, "On the Impact of Sensor-Actuator Clock Offsets on Off-Policy Reinforcement Learning," to appear in *Smarter Cyber-Physical Systems: Enabling Methodologies and Applications*, eds. Y. Wan, K. G. Vamvoudakis, Y. Chen, F. L. Lewis, CRC Press, 2024.

Journal Publications

1. **F. Fotiadis**, A. Kanellopoulos, K. G. Vamvoudakis, U. Topcu, "Deception in Data-Driven Linear-Quadratic Control," *under review.*
2. N. Tukenmez, **F. Fotiadis**, J. M. Magalhães Júnior, K. G. Vamvoudakis, S. Bogosyan, "Intermittent Learning for Trajectory Tracking Control with an Experimental Validation on Microdrones," *under review.*
3. **F. Fotiadis**, K. G. Vamvoudakis, "Input-Output Data-Driven Sensor Selection for Cyber-Physical Systems," *under review.*
4. **F. Fotiadis**, K. G. Vamvoudakis, "A Physics-Informed Learning Framework to Solve the Infinite-Horizon Optimal Control Problem," *under review.*
5. S. Niu, A. Bouland, H. Wang, **F. Fotiadis**, A. Kurdila, A. L'Afflitto, S. T. Paruchuri, K. G. Vamvoudakis, "Convergence Rates of Online Critic Value Function Approximation in Native Spaces," *IEEE Control Systems Letters*, vol. 8, pp. 2145-2150, 2024.

6. **F. Fotiadis**, A. Kanellopoulos, K. G. Vamvoudakis, J. Hugues, "On the Effect of Clock Offsets and Quantization on Learning-based Adversarial Games," *Automatica*, vol. 167, paper 111762, 2024.
7. **F. Fotiadis**, G. A. Rovithakis, "Input-Constrained Prescribed Performance Control for High-order MIMO Uncertain Nonlinear Systems via Reference Modification," *IEEE Transactions on Automatic Control*, vol. 69, no. 5, pp. 3301-3308, 2024.
8. **F. Fotiadis**, K. G. Vamvoudakis, Z.-P. Jiang, "Data-Driven Actuator Allocation for Actuator Redundant Systems," *IEEE Transactions on Automatic Control*, vol. 69, no. 4, pp. 2249-2264, 2024.
9. **F. Fotiadis**, K. G. Vamvoudakis, "Learning-based Actuator Selection for Increased Attack Resilience of Uncertain Systems," *Automatica*, vol. 159, paper 111332, 2024.
10. **F. Fotiadis**, K. G. Vamvoudakis, "Recursive Reasoning with Reduced Complexity and Intermittency for Non-Equilibrium Learning in Stochastic Games," *IEEE Transactions on Neural Networks and Learning Systems*, vol. 34, no. 11, pp. 8467-8481, 2023.
11. **F. Fotiadis**, K. G. Vamvoudakis, "Concurrent Receding Horizon Control and Estimation against Stealthy Attacks," *IEEE Transactions on Automatic Control*, vol. 68, no. 6, pp. 3712-3719, 2023.
12. K. G. Vamvoudakis, **F. Fotiadis**, A. Kanellopoulos, N.-M. T. Kokolakis, "Nonequilibrium Dynamical Games: A Control Systems Perspective," *Annual Reviews in Control*, vol. 53, pp. 6-18, 2022.
13. **F. Fotiadis**, G. A. Rovithakis, "Prescribed Performance Control for Discontinuous Output Reference Tracking," *IEEE Transactions on Automatic Control*, vol. 66, no. 9, pp. 4409-4416, 2021.
14. **F. Fotiadis**, K. G. Vamvoudakis, "Detection of Actuator Faults for Continuous-Time Systems with Intermittent State Feedback," *Systems and Control Letters*, vol. 152, pp. 104938, 2021.

Conference Publications

1. K. G. Vamoudakis, **F. Fotiadis**, T. Başar, V. Gupta, J. Poveda, M. Tang, M. Krstic, Q. Zhu, "Deception in Game Theory and Control: A Tutorial," *under review*.
2. X. Liu, J. Li, **F. Fotiadis**, M. O. Karabag, J. Milzman, D. F. Keil, U. Topcu, "Policies with Sparse Inter-Agent Dependencies in Dynamic Games: A Dynamic Programming Approach," *under review*.
3. **F. Fotiadis**, K. G. Vamvoudakis, "Input-Output Data-Driven Sensor Selection," to appear in *IEEE Conference on Decision and Control*, Milan, Italy, 2024.
4. **F. Fotiadis**, G. A. Rovithakis, K. G. Vamvoudakis, "Embedding Learning-based Optimal Controllers with Assured Safety," to appear in *IEEE Conference on Decision and Control*, Milan, Italy, 2024.
5. A. Kanellopoulos, **F. Fotiadis**, K. G. Vamvoudakis, H. Sandberg, "Unpredictable Switching for Cyber-Physical Security Against Worst-case Attackers," to appear in *IEEE Conference on Decision and Control*, Milan, Italy, 2024.
6. N. Tukenmez, **F. Fotiadis**, J. M. Magalhães Júnior, K. G. Vamvoudakis, S. Bogosyan, "Reward Drops in Learning-based Control with an Experimental Validation on Microdrones," to appear in *IEEE Conference on Decision and Control*, Milan, Italy, 2024.

7. **F. Fotiadis**, A. Kanellopoulos, K. G. Vamvoudakis, J. Hugues, "Poisoning Actuation Attacks Against the Learning of an Optimal Controller," *Proc. American Control Conference*, pp. 4823-4828, Toronto, Canada, 2024.
8. S. Athalye, **F. Fotiadis**, K. G. Vamvoudakis, J. Hugues, "An Output Feedback Game-Theoretic Approach for Defense against Stealthy GNSS Spoofing Attacks," *Proc. American Control Conference*, pp. 3689-3694, Toronto, Canada, 2024.
9. J. M. Magalhães Júnior, L. Zhai, **F. Fotiadis**, A. Kanellopoulos, K. G. Vamvoudakis, J. Hugues, "Real-Time and Experimental Reactive and Proactive Defense in a Multi-Agent Scenario," *Proc. AIAA SciTech Forum*, Orlando, Florida, 2024.
10. **F. Fotiadis**, K. G. Vamvoudakis, "A Physics-Informed Neural Networks Framework to Solve the Infinite-Horizon Optimal Control Problem," *Proc. IEEE Conference on Decision and Control*, pp. 6008-6013, Marina Bay Sands, Singapore, 2023.
11. **F. Fotiadis**, K. G. Vamvoudakis, "Game-Theoretic Deception Methods for Perfectly and Bounded Rational Stealthy Attackers," *Proc. IEEE Conference on Decision and Control*, pp. 7956-7963, Marina Bay Sands, Singapore, 2023.
12. **F. Fotiadis**, G. A. Rovithakis, "Input-Constrained Prescribed Performance Control for SISO Nonlinear Systems via Reference Relaxation," *Proc. Mediterranean Conference on Control and Automation*, pp. 777-782, Limassol, Cyprus, 2023.
13. K. G. Vamvoudakis, **F. Fotiadis**, J. P. Hespanha, R. Chinchilla, G. Yang, M. Liu, J. S. Shamma, L. Pavel, "Game Theory for Autonomy: From Min-Max Optimization to Equilibrium and Bounded Rationality Learning," *Proc. American Control Conference*, pp. 4363-4380, San Diego, CA, 2023.
14. L. Zhai, **F. Fotiadis**, K. G. Vamvoudakis, J. Hugues, "Timing-Aware Resilience of Data-driven Off-policy Reinforcement Learning for Discrete-Time Systems," *Proc. American Control Conference*, pp. 2782-2787, San Diego, CA, 2023.
15. L. Zhai, A. Kanellopoulos, **F. Fotiadis**, K. G. Vamvoudakis, J. Hugues, "A Modular Approach to Verification of Learning Components in Cyber-Physical Systems," *Proc. AIAA SciTech Forum*, National Harbor, MD, 2023.
16. **F. Fotiadis**, K. G. Vamvoudakis, Z.-P. Jiang, "Data-Based Actuator Selection for Optimal Control Allocation," *Proc. IEEE Conference on Decision and Control*, pp. 4674-4679, Cancun, Mexico, 2022.
17. **F. Fotiadis**, A. Kanellopoulos, K. G. Vamvoudakis, J. Hugues, "Impact of Sensor and Actuator Clock Offsets on Reinforcement Learning," *Proc. American Control Conference*, pp. 2669-2674, Atlanta, GA, 2022.
18. L. Zhai, A. Kanellopoulos, **F. Fotiadis**, K. G. Vamvoudakis, J. Hugues, "Towards Intelligent Security for Unmanned Aerial Vehicles: A Taxonomy of Attacks, Faults, and Detection Mechanisms," *Proc. AIAA SciTech Forum*, 2022.
19. **F. Fotiadis**, K. G. Vamvoudakis, "Learning-based Actuator Placement for Uncertain Systems," *Proc. IEEE Conference on Decision and Control*, pp. 90-95, Austin, TX, 2021.
20. **F. Fotiadis**, C. Verginis, K. G. Vamvoudakis, U. Topcu, "Assured Learning-based Optimal Control subject to Timed Temporal Logic Constraints," *Proc. IEEE Conference on Decision and Control*, pp. 750-756, Austin, TX, 2021.
21. A. Kanellopoulos, **F. Fotiadis**, C. Sun, Z. Xu, K. G. Vamvoudakis, U. Topcu, W. E. Dixon, "Temporal Logic-based Intermittent, Optimal, and Safe Continuous-Time Learning for Trajectory Tracking," *Proc. IEEE Conference on Decision and Control*, pp. 1263-1268, Austin, TX, 2021.

22. **F. Fotiadis**, K. G. Vamvoudakis, "Recursive Reasoning for Bounded Rationality in Multi-Agent Non-Equilibrium Play Learning Systems," *Proc. IEEE Conference on Control Technology and Applications*, pp. 741-746, San Diego, CA, 2021.
23. A. Kanellopoulos, **F. Fotiadis**, K. G. Vamvoudakis, V. Gupta, "A Meta-Learning and Bounded Rationality Framework for Repeated Games in Adversarial Environments," *Proc. IEEE Conference on Decision and Control*, pp. 1640-1645, Jeju Island, Republic of Korea, 2020.
24. **F. Fotiadis**, A. Kanellopoulos, K. G. Vamvoudakis, "Constrained Differential Games for Secure Decision-Making against Stealthy Attacks," *Proc. American Control Conference*, pp. 4658-4663, Denver, CO, 2020.
25. F. Dimeas, **F. Fotiadis**, D. Papageorgiou, A. Sidiropoulos, Z. Doulgeri, "Towards Progressive Automation of Repetitive Tasks Through Physical Human-Robot Interaction," *Human Friendly Robotics: 10th International Workshop*, pp. 151-163, 2018.

Talks & Presentations

University of Texas at Austin: A Data-Driven Perspective for Resilient Cyber-Physical Systems. *[Invited Talk]* 10/2024

CPS Rising Stars Workshop: Data-Driven Sensor and Actuator Selection for Resilient Cyber-Physical Systems. *[Poster Presentation]* 05/2024

Cornell University: Data-Driven Actuator Selection for Cyber-Physical Systems. *[Invited Talk]* 02/2024

CDC Workshop "Combining Learning and Control in Cyber-Physical Systems": On Non-Equilibrium Learning in Stochastic Games. *[Poster Presentation]* 12/2022

N.C. A&T State University: Learning-Based Actuator Placement and Allocation for Resilience against Attacks. *[NASA ULI Seminar Talk]* 10/2022

Service Activities

Reviewer for Journals: Automatica (>40), IEEE Transactions on Automatic Control (>40), IEEE Transactions on Systems, Man and Cybernetics: Systems (>20), IEEE Control Systems Letters (>20), IEEE Transactions on Neural Networks and Learning Systems, IEEE Transactions on Cybernetics, IEEE Transactions on Control of Network Systems, IEEE Transactions on Industrial Electronics, IEEE Transactions on Artificial Intelligence, IEEE Transactions on Control Systems Technology, International Journal of Robust and Nonlinear Control, Systems & Control Letters, European Journal of Control, AIAA Journal of Guidance, Control, and Dynamics Neurocomputing, Journal of Optimization Theory and Applications, Expert Systems with Applications, Optimal Control, Applications and Methods, Applied Mathematics and Computation, The Aeronautical Journal.

Reviewer for Conferences: IEEE Conference on Decision and Control (CDC) (>20), American Control Conference (ACC) (>10), European Control Conference (ECC), IFAC World Congress, Mediterranean Conference on Control and Automation (MED), IEEE Conference on Control Technology and Applications (CCTA), IFAC Conference on Modelling, Identification and Control of Nonlinear Systems.