

George P. Kontoudis

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RESEARCH INTERESTS

My primary research interests lie in the integration of **robotics**, **control theory**, and **machine learning**. What interests me most is the formulation of hybrid theoretical schemes and the development of novel robotic devices to bridge the gap between machine learning and autonomous systems. I am particularly interested in how learning algorithms and control theory can enable multi-agent systems to efficiently collaborate with minimal information exchange for robotic navigation and exploration tasks. Also, I contribute to the OpenBionics initiative on the design and development of robot hands and prosthetic devices.

RESEARCH EXPERIENCE

Postdoctoral Research Associate, University of Maryland

Motion and Teaming Lab (PI: Michael Otte)

Jan 2022–present

Graduate Research Assistant, Virginia Tech

Center for Marine Autonomy & Robotics (PI: Daniel J. Stilwell)

Aug 2018–Dec 2021

Computational Multiphysics Systems Laboratory (PI: Tomonari Furukawa)

Aug 2016–Jul 2018

Undergraduate Research Assistant, National Technical University of Athens

Control Systems Laboratory (PI: Kostas J. Kyriakopoulos)

Apr 2014–Mar 2016

Founder & Research Associate, OpenBionics

Sep 2014–present

EDUCATION

PhD in Electrical Engineering, Virginia Tech

2018–2021

Advisor: Daniel J. Stilwell

Dissertation Title: “Communication-Aware, Scalable Gaussian Processes for Decentralized Exploration”

GPA: 3.94/4.00

MSc in Mechanical Engineering, Virginia Tech

2016–2018

Advisors: Tomonari Furukawa & Kyriakos G. Vamvoudakis

Thesis Title: “Adaptive, Anthropomorphic Robot Hands for Grasping and In-Hand Manipulation”

GPA: 4.00/4.00

Diploma (BSc & MSc) in Mechanical Engineering, National Technical University of Athens

2012–2016

Advisor: Kostas J. Kyriakopoulos

Thesis Title: “Design and Development of an Underactuated, Anthropomorphic Robot Hand”

BSc in Mechanical Engineering, University of West Attica

2005–2010

TEACHING EXPERIENCE

Instructor, ENAE4880/7880 Introduction to Autonomous Multi-Robot Swarms

Department of Aerospace Engineering, University of Maryland

Spring 2023

Graduate Teaching Assistant, ME4005 Mechanical Engineering Lab I

Department of Mechanical Engineering, Virginia Tech

Spring 2017

Graduate Teaching Assistant, ME4006 Mechanical Engineering Lab II

Department of Mechanical Engineering, Virginia Tech

Fall 2016

AWARDS & HONORS

2022 RSS Pioneer (Acceptance Rate: 35%)

2022

2022 MRC Postdoctoral Fellowship (\$60K)

2022

5 × IEEE Student Travel Support for IROS, ACC, and CDC

2015, 2019–2021

2 × Virginia Tech GSA Travel Fund Award for Humanoids and ICORR

2019, 2020

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| NSF Student Travel Grant for WuWNet (\$1K) | 2019 |
| NTUA Thomaideion Award for IROS | 2016 |
| Hackaday Prize, 2 nd place among 900 projects (\$10K) | 2015 |
| Robotdalen Innovation Award, 1 st place (SEK 100K) | 2015 |

INDUSTRY EXPERIENCE

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|---|-------------------|
| Mechanical Engineer, Sychem S.A. | Oct 2010–Aug 2015 |
| Aircraft Maintenance Engineer Trainee, Olympic Aviation | May 2008–Jan 2010 |

PUBLICATIONS

Journal Manuscripts Under Review (J:UR)

- [4] **George P. Kontoudis**, Daniel J. Stilwell, “Fully Decentralized, Scalable Gaussian Process Training for Multi-Agent Learning.”
- [3] **George P. Kontoudis**, Daniel J. Stilwell, “Fully Decentralized, Scalable Gaussian Process Prediction for Multi-Agent Learning.”
- [2] Alkesh K. Srivastava, **George P. Kontoudis**, Michael Otte, “Bayesian Network Approach for Information Gathering using Path-Based Sensors.”
- [1] Zirui Xu, **George P. Kontoudis**, Kyriakos G. Vamvoudakis, “Online and Robust Intermittent Motion Planning in Dynamic and Changing Environments,” *IEEE Transactions on Neural Networks and Learning Systems*. (resubmitted)

Referred Journal Publications (J)

- [4] **George P. Kontoudis**, Stephen Krauss, Daniel J. Stilwell, “Model-Based Learning of Underwater Acoustic Communication Performance for Marine Robots,” *Robotics and Autonomous Systems*, 2021.
- [3] Geng Gao, Mojtaba Shahmohammadi, Lucas Gerez, **George P. Kontoudis**, Minas Liarokapis, “On Differential Mechanisms for Underactuated, Lightweight, Adaptive Prosthetic Hands,” *Frontiers in Neurorobotics*, 2021.
- [2] **George P. Kontoudis**, Kyriakos G. Vamvoudakis, “Kinodynamic Motion Planning with Continuous-Time Q-Learning: An Online, Model-Free, and Safe Navigation Framework,” *IEEE Trans. on Neural Networks and Learning Systems*, 2019.
- [1] **George P. Kontoudis**, Minas Liarokapis, Kyriakos G. Vamvoudakis, Tomonari Furukawa, “An Adaptive Actuation Mechanism for Anthropomorphic Robot Hands,” *Frontiers in Robotics and AI*, 2019.

Chapters in Edited Volumes (BC)

- [1] **George P. Kontoudis**, Kyriakos G. Vamvoudakis, Zirui Xu, “RRT-QX: Real-Time Kinodynamic Motion Planning in Dynamic Environments with Continuous-Time Reinforcement Learning,” in *Brain and Cognitive Intelligence: Control in Robotics*, B. Wei (Ed.), Taylor & Francis Group, CRC Press, 2022.

Conference Papers Under Review (C:UR)

- [1] **George P. Kontoudis**, Michael Otte, “Exploration-Exploitation Active Learning of Gaussian Process Surrogates for Adaptive Sampling.”

Referred Conference Publications (C)

- [15] **George P. Kontoudis**, Michael Otte, “Closed-Form Active Learning of Expected Variance Reduction using Gaussian Process Surrogates for Adaptive Sampling,” *American Control Conference (ACC)*, San Diego, USA, 2023.
- [14] Alkesh K. Srivastava, **George P. Kontoudis**, Donald Sofge, Michael Otte, “Distributed Multi-Robot Information Gathering using Path-Based Sensors in Entropy-Weighted Voronoi Regions,” *International Symposium on Distributed Autonomous Robotic Systems (DARS)*, Montbéliard, France, 2022.
- [13] Christos N. Mavridis, **George P. Kontoudis**, John S. Baras, “Sparse Gaussian Process Regression using Progressively Growing Learning Representations,” *IEEE Conference on Decision and Control (CDC)*, Cancun, Mexico, 2022.

- [12] Josh Netter, **George P. Kontoudis**, Kyriakos G. Vamvoudakis, “Bounded Rational RRT-QX: Multi-Agent Motion Planning in Dynamic Human-Like Environments Using Cognitive Hierarchy and Q-Learning,” *IEEE Conference on Decision and Control (CDC)*, Austin, USA, 2021.
- [11] **George P. Kontoudis**, Daniel J. Stilwell, “Decentralized Nested Gaussian Processes for Multi-Robot Systems,” *IEEE International Conference on Robotics and Automation (ICRA)*, Xi’an, China, 2021.
- [10] Minas Liarokapis, **George P. Kontoudis**, “Teaching Robotic and Biomechatronic Concepts with a Gripper Design Project and a Grasping and Manipulation Competition,” *IEEE International Conference on Robotics and Automation (ICRA)*, Xi’an, China, 2021.
- [9] **George P. Kontoudis**, Daniel J. Stilwell, “Prediction of Acoustic Communication Performance in Marine Robots Using Model-Based Kriging,” *American Control Conference (ACC)*, New Orleans, USA, 2021.
- [8] Gal Gorjup, **George P. Kontoudis**, Anany Dwivedi, Geng Gao, Saori Matsunaga, Toshisada Mariyama, Bruce MacDonald, and Minas Liarokapis “Combining Programming by Demonstration with Path Optimization and Local Replanning to Facilitate the Execution of Assembly Tasks,” *IEEE International Conference on Systems, Man and Cybernetics (SMC)*, Toronto, Canada, 2020.
- [7] **George P. Kontoudis**, Zirui Xu, Kyriakos G. Vamvoudakis, “Online, Model-Free Motion Planning in Dynamic Environments: An Intermittent, Finite Horizon Approach with Continuous-Time Q-Learning,” *American Control Conference (ACC)*, Denver, USA, 2020.
- [6] **George P. Kontoudis**, Daniel J. Stilwell, “A Comparison of Kriging and Cokriging for Estimation of Underwater Acoustic Communication Performance,” *ACM Int. Conf. on Underwater Networks and Systems (WUWNet)*, Atlanta, USA, 2019.
- [5] **George P. Kontoudis**, Minas Liarokapis, Kyriakos G. Vamvoudakis, “An Adaptive, Humanlike Robot Hand with Selective Interdigitation: Towards Robust Grasping and Dexterous, In-Hand Manipulation,” *IEEE-RAS International Conference on Humanoid Robots (Humanoids)*, Toronto, Canada, 2019.
- [4] **George P. Kontoudis**, Minas Liarokapis, Kyriakos G. Vamvoudakis, “A Compliant, Underactuated Finger for Anthropomorphic Hands,” *IEEE/RAS-EMBS Inter. Conference on Rehabilitation Robotics (ICORR)*, Toronto, Canada, 2019.
- [3] **George P. Kontoudis**, Kyriakos G. Vamvoudakis, “Robust Kinodynamic Motion Planning using Model-Free Game-Theoretic Learning,” *American Control Conference (ACC)*, Philadelphia, USA, 2019.
- [2] Kyriakos D. Tsoukalas, **George P. Kontoudis**, Kyriakos G. Vamvoudakis, “Active-Bayesian Learning for Cooperation Connectivity in Dynamic Cyber-Physical-Human Systems,” *IEEE Symposium on Adaptive Dynamic Programming and Reinforcement Learning (ADPRL)*, Honolulu, USA, 2017.
- [1] **George P. Kontoudis**, Minas Liarokapis, Agisilaos G. Zisimatos, Christoforos I. Mavrogiannis, Kostas J. Kyriakopoulos, “Open-Source, Anthropomorphic, Underactuated Robot Hands with a Selectively Lockable Differential Mechanism: Towards Affordable Prostheses,” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Hamburg, Germany, 2015.

Preprints (P)

- [1] **George P. Kontoudis**, Daniel J. Stilwell, “Fully Decentralized, Scalable Gaussian Processes for Multi-Agent Federated Learning,” *arXiv preprint, arXiv:2203.02865*, 2022.

Referred Workshop Publications (W)

- [2] Alkesh K. Srivastava, **George P. Kontoudis**, Donald Sofge, Michael Otte, “Path-Based Sensors: Will the Knowledge of Correlation in Random Variables Accelerate Information Gathering?” *IEEE International Conference on Robotics and Automation (ICRA), Workshop on Communication Challenges in Multi-Robot Systems: Perception, Coordination, and Learning*, London, UK, June 2023.
- [1] **George P. Kontoudis**, “Scalable Multi-Robot Active Exploration,” *Robotics: Science and Systems (RSS), Pioneers Workshop*, New York City, USA, June 2022.

Theses (T)

- [3] **George P. Kontoudis**, “Communication-Aware, Scalable Gaussian Processes for Decentralized Exploration,” *Doctoral Dissertation, Virginia Tech*, USA, December 2021.

- [2] **George P. Kontoudis**, “Adaptive, Anthropomorphic Robot Hands for Grasping and In-Hand Manipulation,” *Master Thesis, Virginia Tech*, USA, December 2018.
- [1] **George P. Kontoudis**, “Design and Development of an Underactuated, Anthropomorphic Robot Hand,” *Diploma Thesis, National Technical University of Athens*, March 2016. (in Greek)

Technical Reports (TR)

- [2] **George P. Kontoudis**, Minas Liarokapis, Agisilaos G. Zisimatos, Christoforos I. Mavrogiannis, Kostas J. Kyriakopoulos, “How to Create Affordable, Anthropomorphic, Light-Weight Prosthetic Hands,” *Control Systems Lab, National Technical University of Athens*, Athens, Greece, October 2015.
- [1] Agisilaos G. Zisimatos, Minas Liarokapis, Christoforos I. Mavrogiannis, **George P. Kontoudis**, Kostas J. Kyriakopoulos, “How to Create Affordable, Modular, Light-Weight, Underactuated, Compliant Robot Hand,” *Control Systems Lab, National Technical University of Athens*, Athens, Greece, January 2015.

TALKS & PRESENTATIONS

- “Multi-Robot Adaptive Sampling using Decentralized Gaussian Processes,” *International Symposium on Distributed Autonomous Robotic Systems (DARS)*, Monbeliard, France, November 2022. [**Poster Presentation**]
- “Scalable Multi-Robot Active Exploration,” *Robotics: Science and Systems (RSS), Pioneers Workshop*, New York City, USA, June 2022. [**Spotlight Presentation**]
- “Communication-Aware, Scalable Gaussian Processes for Decentralized Exploration” *Bradley Department of Electrical and Computer Engineering, Virginia Tech*, Blacksburg, USA, December 2021. [**PhD Defense**]
- “Decentralized Nested Gaussian Processes for Multi-Robot Systems,” *IEEE International Conference on Robotics and Automation (ICRA)*, Xi’an, China, 2021. [**Virtual Presentation**]
- “Online, Model-Free Motion Planning in Dynamic Environments: An Intermittent, Finite Horizon Approach with Continuous-Time Q-Learning,” *American Control Conference (ACC)*, Denver, USA, 2020. [**Rapid-Interactive Presentation**]
- “A Comparison of Kriging and Cokriging for Estimation of Underwater Acoustic Communication Performance,” *ACM International Conference on Underwater Networks and Systems (WuWNet)*, Atlanta, USA, 2019. [**Oral Presentation**]
- “An Adaptive, Humanlike Robot Hand with Selective Interdigitation: Towards Robust Grasping and Dexterous, In-Hand Manipulation,” *Workshop on New Challenges in Humanoid Grasping and Manipulation in IEEE-RAS International Conference on Humanoid Robots (Humanoids)*, Toronto, Canada, 2019. [**Oral Presentation - Invited Talk**]
- “An Adaptive, Humanlike Robot Hand with Selective Interdigitation: Towards Robust Grasping and Dexterous, In-Hand Manipulation,” *IEEE-RAS International Conference on Humanoid Robots (Humanoids)*, Toronto, Canada, 2019. [**Poster Presentation**]
- “Robust Kinodynamic Motion Planning using Model-Free Game-Theoretic Learning,” *American Control Conference (ACC)*, Philadelphia, USA, 2019. [**Oral Presentation**]
- “A Compliant, Underactuated Finger for Anthropomorphic Hands,” *IEEE/RAS-EMBS International Conference on Rehabilitation Robotics (ICORR)*, Toronto, Canada, 2019. [**Poster Presentation**]
- “Adaptive, Anthropomorphic Robot Hands for Grasping and In-Hand Manipulation,” *Department of Mechanical Engineering, Virginia Tech*, Blacksburg, USA, December 2018. [**Master’s Defense**]
- “Evaluation Strategies of Adaptive, Anthropomorphic Robot Hands for Dexterous In-Hand Manipulation: Early Results,” *National Institute of Standards and Technology (NIST)*, USA, 2018. [**Invited Talk**]
- “Open-Source, Anthropomorphic, Underactuated Robot Hands with a Selectively Lockable Differential Mechanism: Towards Affordable Prostheses,” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, Hamburg, Germany, 2015. [**Oral Presentation**]

SERVICE ACTIVITIES

Conference Committees

- General Chair, Robotics: Science and Systems (RSS), Pioneers Workshop 2023
- Program Committee Member, Conference on Artificial Intelligence (AAAI), Student Abstract and Poster 2023
- Online Platform Chair, Conference on Robot Learning (CoRL) 2022

Reviewer, Journals

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| · IEEE Transactions on Neural Networks and Learning Systems | 2019–2022 |
| · IEEE Transactions on Robotics | 2020, 2023 |
| · IEEE Transactions on Automation Science and Engineering | 2020–2023 |
| · IEEE Transactions on Cybernetics | 2020 |
| · IEEE Transactions on Systems, Man and Cybernetics: Systems | 2021 |
| · IEEE Computational Intelligence Magazine | 2020 |
| · IEEE Control Systems Letters | 2019, 2020 |
| · IEEE Robotics and Automation Letters | 2019, 2022, 2023 |
| · IEEE Robotics & Automation Magazine | 2022 |
| · Autonomous Robots | 2022 |
| · Frontiers in Artificial Intelligence | 2021 |
| · Frontiers in Robotics and AI | 2022 |
| · Journal of Optimization Theory and Applications | 2021 |
| · International Journal of Advanced Robotic Systems | 2015, 2016 |

Reviewer, Conferences

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| · IEEE International Conference on Robotics and Automation (ICRA) | 2018–2023 |
| · IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) | 2018–2023 |
| · American Control Conference (ACC) | 2018–2021 |
| · IEEE Conference on Decision and Control (CDC) | 2019, 2020, 2023 |
| · IEEE International Conference on Automation Science and Engineering (CASE) | 2019 |
| · IEEE-RAS International Conference on Humanoid Robots (Humanoids) | 2019 |
| · IEEE International Conference on Biomedical Robotics and Biomechatronics (BioRob) | 2018, 2020, 2021 |
| · European Control Conference (ECC) | 2022 |
| · Mediterranean Conference on Control and Automation (MED) | 2018 |

MENTORING

PhD Students

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| · Joshua Netter, Georgia Institute of Technology Advisor: Kyriakos G. Vamvoudakis | 2021–present |
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Master's Students

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| · Alkesh K. Srivastava , University of Maryland Advisor: Michael Otte Publications: C-[14], W-[2], J:UR-[2] | 2022–present |
| · Joshua Netter, Georgia Institute of Technology Advisor: Kyriakos G. Vamvoudakis Publications: C-[12] | 2020–2021 |
| · Zirui Xu , Georgia Institute of Technology, Advisor: Kyriakos G. Vamvoudakis Publications: C-[7], BC-[1], J:UR-[1] Currently: PhD Candidate, University of Michigan | 2018–2020 |