

CHRISTOS N. MAVRIDIS

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2239 A.V. Williams Building, University of Maryland, College Park, MD 20742, USA

Research Interests:

Theoretical: Control Theory, Optimization, Machine Learning.

Applied: Robotics, Multi-Agent Systems, Intelligent Transportation Systems, Communication Networks, Healthcare.

EDUCATION

University of Maryland, College Park

2021

Ph.D., Electrical and Computer Engineering

Advisor: Prof. John S. Baras

- Ph.D. Thesis: “Learning Latent Representations and Intrinsic Laws of Complex Systems”.

University of Maryland, College Park

2021

M.S., Electrical and Computer Engineering

National Technical University of Athens, Greece

2017

Diploma (5 years) in Electrical and Computer Engineering

Advisor: Prof. Kostas J. Kyriakopoulos

- Diploma Thesis: “EEG and EMG Signals in Neuro-Robotic Systems”.

RESEARCH EXPERIENCE

Institute for Systems Research & ARC Lab, UMD

August 2017 - December 2021

Graduate Research Assistant

University of Maryland, College Park, MD

- Research Focus: Machine Learning Theory, Optimization, Systems and Control Theory, Multi-Agent Systems, Robotics.
- Research Advisor: John S. Baras, Distinguished University Professor and Chair in Systems Engineering.

System Sciences Lab, Palo Alto Research Center (PARC)

May 2019 - August 2019

Research Intern

Palo Alto, CA

- Research Focus: Control of Networked Systems, Mean-field Game Theory.
- Supervisors: Ion Matei and Johan de Kleer.

Math & Algorithms Research Group, Nokia Bell Labs

June 2018 - August 2018

Research Intern

Murray Hill, NJ

- Research Focus: Information Theory for Feature Extraction and Machine Learning Applications.
- Supervisor: Iraj Saniee, Head, Math & Algorithms Research Group.

Control Systems Lab

August 2015 - June 2017

Undergraduate Research Assistant

Mechanical Eng. Dept., NTUA, Athens, Greece

- Research Focus: System Identification, Machine Learning, Adaptive Control, Human-Robot Collaboration, EEG & EMG Signal Processing, Brain-Robot Interfaces, Robot Control.
- Advisor: Kostas J. Kyriakopoulos, Professor of Robotics, Mechatronics and Control.

TEACHING EXPERIENCE

Graduate Teaching Assistant

Fall 2020, Spring 2021

Dept. of Electrical and Computer Engineering

University of Maryland, College Park, MD

- Spring 2021: ENEE 436 (Foundations of Machine Learning), Prof. Behtash Babadi.
- Fall 2020: ENEE 660 (Systems Theory), Prof. John S. Baras.

Guest Lecturer

Spring 2018 - Spring 2021

Dept. of Electrical and Computer Engineering

University of Maryland, College Park, MD

- ENEE436 (Foundations of Machine Learning), ENEE660 (Systems Theory), ENSE622 (System Trade-off Analysis, Modeling, and Simulation).

PUBLICATIONS

Journal Papers

- Christos N. Mavridis, John S. Baras, *Online Deterministic Annealing for Classification and Clustering*, *IEEE Transactions on Neural Networks and Learning Systems (TNNLS)* [to appear, arXiv:2102.05836].
- Christos N. Mavridis, Amoolya Tirumalai, John S. Baras, *Learning Swarm Interaction Dynamics from Density Evolution*, *IEEE Transactions on Control of Network Systems (TCNS)* [to appear, arXiv:2112.02675].
- Christos N. Mavridis, John S. Baras, *Annealing Optimization for Progressive Learning with Stochastic Approximation*, *Transactions on Automatic Control (TAC)* [under review].
- Amoolya Tirumalai, Christos N. Mavridis, John S. Baras, *Weak Solutions to an Euler Alignment System with Singular Interactions in a Bounded Domain*, *SIAM Journal on Mathematical Analysis (SIMA)* [under review, arXiv:2111.05361].
- Christos N. Mavridis, John S. Baras, *Towards the One Learning Algorithm Hypothesis: A System-theoretic Approach*, *SIAM Journal on Mathematics of Data Science (SIMODS)* [under review, arXiv:2112.02256].
- Christos N. Mavridis, John S. Baras, *Universal Machine Learning Architectures Inspired by the One Learning Algorithm Hypothesis*, *Proceedings of the National Academy of Sciences (PNAS)* [under review].

Peer-Reviewed Conference Papers

- Faizan M. Tariq, Nilesh Suriyarachchi, Christos N. Mavridis, John S. Baras, *Autonomous Vehicle Overtaking in a Bidirectional Mixed-Traffic Setting*, *2022 American Control Conference (ACC)* [under review].
- Christos N. Mavridis, Nilesh Suriyarachchi, John S. Baras, *Maximum-Entropy Progressive State Aggregation for Reinforcement Learning*, *IEEE Conference on Decision and Control (CDC)*, 2021.
- Christos N. Mavridis, John S. Baras, *Progressive Graph Partitioning Based on Information Diffusion*, *IEEE Conference on Decision and Control (CDC)*, 2021.
- Nilesh Suriyarachchi, Faizan M. Tariq, Christos N. Mavridis, John S. Baras, *Real-Time Priority-Based Cooperative Highway Merging for Heterogeneous Autonomous Traffic*, *IEEE International Conference on Intelligent Transportation Systems (ITSC)*, 2021. (Best Student Paper Award)
- Christos N. Mavridis, John S. Baras, *Vector Quantization for Adaptive State Aggregation in Reinforcement Learning*, *American Control Conference (ACC)*, 2021.
- Christos N. Mavridis, Nilesh Suriyarachchi, John S. Baras, *Detection of Dynamically Changing Leaders in Complex Swarms from Observed Dynamic Data*, *Conference on Decision and Game Theory for Security (GameSec)*, 2020.
- Christos N. Mavridis, Amoolya Tirumalai, John S. Baras, *Learning Interaction Dynamics from Particle Trajectories and Density Evolution*, *IEEE Conference on Decision and Control (CDC)*, 2020.
- Christos N. Mavridis, Amoolya Tirumalai, John S. Baras, Ion Matei, *Semi-linear Poisson-mediated Flocking in a Cucker-Smale Model*, *International Symposium on Mathematical Theory of Networks and Systems (MTNS)*, 2020.
- Christos N. Mavridis, John S. Baras, Kostas Kyriakopoulos, *A Human-Robot Interface based on Surface Electroencephalographic Sensors*, *International Conference on Intelligent Robots and Systems (IROS)*, 2020.
- Christos N. Mavridis, John S. Baras, *Convergence of Stochastic Vector Quantization and Learning Vector Quantization with Bregman Divergences*, *IFAC World Congress*, 2020.
- Christos N. Mavridis, Constantinos Vrohidis, John S. Baras, Kostas J. Kyriakopoulos, *Robot Navigation Under MITL Constraints Using Time-Dependent Vector Field Based Control*, *IEEE Conference on Decision and Control (CDC)*, 2019.
- Ion Matei, Christos N. Mavridis, John S. Baras, Maksym Zhenirowsky, *Inferring Particle Interaction Physical Models and Their Dynamical Properties*, *IEEE Conference on Decision and Control (CDC)*, 2019.
- Christos N. Mavridis, Konstantinos Alevizos, Charalampos P. Bechlioulis, Kostas J. Kyriakopoulos, *Human-robot collaboration based on robust motion intention estimation with prescribed performance*, *European Control Conference (ECC)*, 2018.

OPEN-SOURCE SOFTWARE

Online Deterministic Annealing (ODA)

<https://github.com/MavridisChristos/OnlineDeterministicAnnealing>

- “A progressively-growing competitive-learning neural network architecture with inherent interpretability, robustness, and regularization properties. ODA is based on the principles of vector quantization and annealing optimization, and is trained with a gradient-free stochastic approximation algorithm. Applications include online unsupervised and supervised learning, adaptive graph partitioning, swarm leader detection, and reinforcement learning”.

PATENTS

Invention NC314849, US

- Iraj Saniee, Christos Mavridis, “Method and network node for internet-of-things (IOT) feature selection for storage and computation” (pending).

RESEARCH PROJECTS

Northrop Grumman Corporation Grant

“Neuromorphic Signal Processing: From Analytics for Deep Learning to Cortex-on-a-Chip” Spring 2020 - Spring 2021

- Lead research, developed theory and algorithms, performed computations, prepared reports and presentations.

DARPA Artificial Intelligence Research Associate Program (AIRA)

Agreement No. HR00111990027

“Learning Intrinsically Composable Laws of Complex Autonomous Collectives”

Spring 2018 - Spring 2019

- Lead research and communication, developed theory and algorithms, performed computations, prepared bi-monthly reports and presentations, contributed to conceptualization and writing of project extension proposal.

ONR Science of Autonomy Program

Grant N00014-17-1-2622

“Intelligent and Learning Autonomous Systems: Composability and Correctness”

Fall 2017 - Spring 2022

- Lead research, developed theory and algorithms, performed computations, prepared reports and presentations.

HONORS & AWARDS

- Best Student Paper Award (1st place), IEEE ITSC (2021).
- ISR Outstanding Systems Engineering Graduate Student Award, UMD (2021).
- Ann G. Wylie Dissertation Fellowship [\$15,000], UMD (2021).
- Future Faculty Program Fellowship, A. James Clark School of Engineering, UMD (2021).
- Graduate School’s Outstanding Research Assistant Award, A. James Clark School of Engineering, UMD (2020-21).
- Gerontelis Foundation Scholarship [\$5,000], MA (2018).
- Qualcomm Innovation Fellowship US Finalist, San Diego, CA (2018).
- A. James Clark School of Engineering Distinguished Graduate Fellowship [\$15,000], UMD (2017).
- “Great Moment for Education” student excellence award [€1,000], EFG Eurobank, Greece (2010).

INVITED TALKS

- “Learning Latent Representations and Intrinsic Laws of Complex Systems”, Maryland Robotics Center, UMD, October 2021.

PROFESSIONAL & VOLUNTARY SERVICE

- Scholarly peer reviewer: CDC, ACC, ITSC, ICRA, IROS, DCDS-B, ECC, ABB.
- Member, ECE Graduate Student Association Board, UMD.
- Member, Management Committee, 24th IEEE MED Conference, Athens, Greece.

SOFTWARE SKILLS

Languages

Python, C++, C, Bash (Unix Shell), HTML/CSS, Matlab.

Tools

PyTorch, ROS/Gazebo, Wolfram Mathematica, Gurobi Optimizer, Latex, Git.

Christos Mavridis
Last updated: 12/2021