Curriculum Vitae

Personal Information

Dan Calderone, PhD
Postdoctoral Researcher
University of Washington
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Education

08/2010-05/2017 **Ph.D., Electrical & Computer Engineering**
University of California, Berkeley (UCB)
Thesis: Models of Competition for Intelligent Transportation Infrastructure: Parking, Ridesharing, and External Factors in Routing Decisions
Advisor: S. Shankar Sastry

08/2006–05/2010 **B.Sc., Mechanical Engineering**
University of Maryland, College Park (UMD)

Professional Experience

01/2018–12/2020
06/2022–current
University of Washington
Position: Postdoctoral Scholar
Departments: Aerospace/electrical engineering
Supervisor: Lillian J. Ratliff, Behcet Ackimese
Projects: (see below)
Markov decision process congestion games, multi-dimensional continuous-type population games, stability of learning dynamics in games

04/2019–06/2022 **University of Washington**
Position: Lecturer
Departments: Aerospace/electrical engineering
Courses: (see below)
Linear algebra/linear systems, SISO/MIMO/Robust control, estimation, convex optimization, network dynamics, statics

Markov Decision Process Congestion Games	**Overview:** Developed a version of routing games where individual agents solve a Markov decision process as opposed to a shortest path problem. **Applications:** ride-sharing, urban parking, aircraft control management. **Papers:**

1. Calderone, D., and Sastry, S. S. Markov decision process routing games. In *2017 ACM/IEEE 8th International Conference on Cyber-Physical Systems (ICCPS)* (2017), IEEE, pp. 273–280
doi: https://doi.org/10.1145/3055004.3055026
pdf: https://danjcalderone.github.io/papers/mdproutingfin.pdf

2. Calderone, D., and Shankar, S. Infinite-horizon average-cost markov decision process routing games. In *2017 IEEE 20th International Conference on Intelligent Transportation Systems (ITSC)* (2017), IEEE, pp. 1–6
doi: https://doi.org/10.1109/ITSC.2017.8317849
pdf: https://danjcalderone.github.io/papers/mdproutinginf.pdf

3. Li, S. H., Yu, Y., Calderone, D., Ratliff, L., and Açrkmeşe, B. Tolling for constraint satisfaction in markov decision process congestion games. In *2019 American Control Conference (ACC)* (2019), IEEE, pp. 1238–1243
doi: https://doi.org/0.23919/ACC.2019.8814925
pdf: https://danjcalderone.github.io/papers/mdptolling.pdf

4. Li, S. H., Yu, Y., Miguel, N., Calderone, D., Ratliff, L. J., and Acikmese, B. Adaptive constraint satisfaction for markov decision process congestion games: Application to transportation networks. *arXiv preprint arXiv:1907.08912* (2019)
pdf: https://danjcalderone.github.io/papers/mdpconstraints.pdf

5. Li, S. H., Calderone, D., and Acikmese, B. Congestion-aware motion planning game with markov decision process dynamics. *arXiv preprint arXiv:2203.12133* (2022)
doi: https://doi.org/10.48550/arXiv.2203.12133
pdf: https://danjcalderone.github.io/papers/mdpcoordination.pdf

6. Yu, Y., Calderone, D., Li, S. H., Ratliff, L. J., and Açıkmeşe, B. Variable demand and multi-commodity flow in markovian network equilibrium. *Automatica 140* (2022), 110224
doi: https://doi.org/
pdf: https://danjcalderone.github.io/papers/mdpalgorithms.pdf

Continuous-Type Population Games	**Overview:** Developed equilibrium concept and potential function for population games with preferences modeled as multi-dimensional mass distribution. **Applications:** general non-homogeneous population preferences, transportation choice problems. **Papers:**

1. CALDERONE, D., AND RATLIFF, L. J. Multi-dimensional continuous type population potential games. In *2019 IEEE 58th Conference on Decision and Control (CDC)* (2019), IEEE, pp. 5138–5143
doi: https://doi.org/10.1109/CDC40024.2019.9029519
pdf: https://danjcalderone.github.io/papers/continoustypemd.pdf

2. CALDERONE, D., DONG, R., AND SASTRY, S. S. External-cost continuous-type wardrop equilibria in routing games. In *2017 IEEE 20th International Conference on Intelligent Transportation Systems (ITSC)* (2017), IEEE, pp. 1–6
doi: https://doi.org/10.1109/ITSC.2017.8317866
pdf: https://danjcalderone.github.io/papers/continoustype2d.pdf

Braess Paradox: Algebraic Description	**Overview:** Obtained algebraic characterization of Braess paradox in routing games and MDP congestion games. **Papers:**

1. LI, S. H., CALDERONE, D., RATLIFF, L., AND AÇIKMEŞE, B. Sensitivity analysis for markov decision process congestion games. In *2019 IEEE 58th Conference on Decision and Control (CDC)* (2019), IEEE, pp. 1301–1306
doi: https://doi.org/10.1109/CDC40024.2019.9028933
pdf: https://danjcalderone.github.io/papers/mdpsensitivity.pdf

Stability of Game Learning Dynamics	**Overview:** Stability of gradient play in continuous-action two-player games. **Applications:** learning in neural networks, generative-adversarial networks, multi-agent optimization **Papers:**

1. CHASNOV, B. J., CALDERONE, D., AÇIKMEŞE, B., BURDEN, S. A., AND RATLIFF, L. J. Stability of gradient learning dynamics in continuous games: Scalar action spaces. In *2020 59th IEEE Conference on Decision and Control (CDC)* (2020), IEEE, pp. 3543–3548
doi: https://doi.org/10.1109/CDC42340.2020.9304165
pdf: https://danjcalderone.github.io/papers/stablescalar.pdf

Parking Routing Games	**Overview:** Formulated a version of routing games where agents consider street parking choice as well as travel time. **Applications:** urban street parking **Papers:**

1. CALDERONE, D., MAZUMDAR, E., RATLIFF, L. J., AND SASTRY, S. S. Understanding the impact of parking on urban mobility via routing games on queue-flow networks. In *2016 IEEE 55th Conference on Decision and Control (CDC)* (2016), IEEE, pp. 7605–7610
doi: https://doi.org/10.1109/CDC.2016.7799444
pdf: https://danjcalderone.github.io/papers/parkingrouting.pdf

Other Projects

Papers:

1. CALDERONE, D. J., RATLIFF, L. J., AND SASTRY, S. S. Lane pricing via decision-theoretic lane changing model of driver behavior. In *2015 54th IEEE Conference on Decision and Control (CDC)* (2015), IEEE, pp. 3457–3462
doi: https://doi.org/10.1109/CDC.2015.7402754

2. CALDERONE, D., RATLIFF, L. J., AND SASTRY, S. S. Pricing for coordination in open–loop differential games. *IFAC Proceedings Volumes 47*, 3 (2014), 9001–9006
doi: https://doi.org/10.3182/20140824-6-ZA-1003.02655

3. CALDERONE, D., RATLIFF, L. J., AND SASTRY, S. S. Pricing for coordination in open–loop differential games. *IFAC Proceedings Volumes 47*, 3 (2014), 9001–9006
doi: https://doi.org/10.3182/20140824-6-ZA-1003.02655

4. CALDERONE, D., RATLIFF, L., AND SASTRY, S. Pricing design for robustness in linear-quadratic dynamic games. In *In the Proceedings of the 52rd Annual IEEE Conference on Decision and Control* (2013)
doi: https://doi.org/10.1109/CDC.2013.6760558

5. COOGAN, S., RATLIFF, L. J., CALDERONE, D., TOMLIN, C., AND SASTRY, S. S. Energy management via pricing in lq dynamic games. In *2013 American Control Conference* (2013), IEEE, pp. 443–448
doi: https://doi.org/10.1109/ACC.2013.6579877

6. RATLIFF, L. J., COOGAN, S., CALDERONE, D., AND SASTRY, S. S. Pricing in linear-quadratic dynamic games. In *2012 50th Annual Allerton Conference on Communication, Control, and Computing (Allerton)* (2012), IEEE, pp. 1798–1805
doi: https://doi.org/10.1109/Allerton.2012.6483440

TEACHING

Online Content

Summary: I am developing a collection of interactive visualizations for an online textbook teaching linear algebra, optimization, and other subjects.

WEBSITE: (under construction) https://danjcalderone.github.io/dcmath/

Select Examples—

Hypershapes	https://danjcalderone.github.io/dcmath/linalg/hypershapes
Matrices	https://danjcalderone.github.io/dcmath/linalg/matrices
Inner Products	https://danjcalderone.github.io/dcmath/linalg/innerproducts
Matrix Products	https://danjcalderone.github.io/dcmath/linalg/matrixmultiply
Inverses	https://danjcalderone.github.io/dcmath/linalg/inverses

COURSES

Materials: https://danjcalderone.github.io/teaching.html

Linear Algebra/ Linear Systems
Courses: AA510, AE510
Offerings: Winter 2020, Fall 2020, Winter 2021, Winter 2020
Level: Masters/PhD
Role: Instructor
Select Topics:
Vectors, inner products, linear transforms/ matrices, range/nullspace, rank, Gaussian elimination, matrix inverses, systems of equations, coordinates, similarity, eigen-problem/ diagonalization, spectral mapping, Cayley Hamilton, state-space, LTI/LTV systems, transfer functions, controllability/ observability, canonical forms, pole-placement, observer design, separation principle, Grammians, SVD/ polar

SISO Control
Courses: AA447
Offerings: Spring 2021
Level: Undergraduate
Role: Instructor
Topics:
Time/ frequency domains, Laplace transforms, transfer functions, impulse response, block diagrams, PI/PID control, disturbance rejection, internal model principle, Bode/Nyquist-plots, Nyquist stability, gain/phase/stability margins, loop shaping.

MIMO Control
Courses: AE513
Offerings: Fall 2019, Fall 2021
Level: Masters
Role: Instructor
Topics:
Dynamical systems, linearization, open-loop and feedback control, PD matrices, Lyapunov theory/equations, Grammians, dynamic programming/ Bellman equation, LQR (DT / CT, fin / inf horizon), Riccati ODE/ ARE Hamiltonian systems,adjoint method for optimal control, intro to Kalman filter, LQG control.

Robust Control
Courses: AA594
Offerings: Winter 2022
Level: PhD

	Role: Instructor Topics:
Estimation	Courses: AA549,AE514 Offerings: Spring 2019, Fall 2020, Spring 2021 Level: Masters/PhD Role: Instructor Topics:
	Positive definite matrices, basic probability, multivariate Gaussians, covariance matrices, basis functions, weighted least squares, nonlinear least squares, maximum likelihood estimation (MLE), maximum a-posteriori estimation (MAP), Kalman filter (CT / DT), extended Kalman filter, unscented Kalman filter, particle filters
Convex Optimization	Courses: AA578 Offerings: Winter 2021 Level: Masters/PhD Role: Instructor Topics:
	Linear transformations of sets, affine sets - range and nullspace representations, inequality constraints, polytopes, slack variables, linear programs (LP), quadratic programs (QP) Lagrange multipliers, vector space duality, Lagrangian duality - game interpretation LP / QP duality, primal and dual visual interpretations, KKT conditions, complementary slackness, simplex algorithm, gradient descent, Newton's method, barrier methods, interior point methods.
Network Dynamics	Courses: AA597 Offerings: Spring 2022 Level: Masters/PhD Role: Instructor Topics:
	Undirected/ directed graphs, matrices (incidence/ adjacency/ Laplacian), matrix decompositions, Laplacian spectra, agreement protocol (undirected/ directed, CT/DT), distributed estimation, distributed optimization, formation control, input/output controllability/ observability.
Statics	Courses: AA210 Offerings: Spring 2022 Level: Undergraduate Role: Instructor Topics:
	Free body diagrams, forces/moments/couples, distributed loads, rigid body equilibrium, static determinancy, truss methods (joints/sections), zero-force members, space-trusses, frames/machines, cables/arches,retaining walls, friction, centers of mass/ centroids, moments of inertia, Mohr's circle, shear/ bending moment diagrams.

Robotic Manipulators	Courses: EE125 (UCB) Offerings: Fall 2013 Level: Undergraduate Role: Teaching Assistant Responsibilities: Lectured in discussion section, designed homeworks, designed & implemented labs Topics: Coordinate transformations, rotations, skew-symmetric matrix exponential, homogeneous transformations, inverting coordinate transforms, Lie groups and lie algebras, $SO(3)/so(3)$, $SE(3)/se(3)$, joint transformations, product of exponentials, forward kinematics, inverse kinematics via Paden-Kahn subproblems, Lagrangian dynamics formulation
EE Intro Survey Course	Courses: EE16A (UCB) Offerings: Fall 2015 Level: Undergraduate Role: Teaching Assistant Responsibilities: Lead content team (of 15 TAs) designing homeworks

Industry/Work Experience

eBay Advertising	Role: Internship Dates: May-Dec 2014 Description: Developed regression models for predicting the impact of advertising on eBay sales
Army Research Lab	Role: Internship Dates: May-Aug 2009 Description: Investigated biological systems for low power communications in small robotic platforms.
Johns Hopkins Applied Physics Lab	Role: Internship Dates: May-Aug 2008 Description: Finite element modeling of human torso for studying blast trauma.
Alfred Gessow Rotorcraft Center (UMD)	Role: Internship Dates: May-Aug 2007 Description: Assisted with fabrication of experimental helicopter rotors for hover-stand test.

Outreach Experience

EE-Graduate Outreach Program (UCB)	Dates: May 2013-Fall 2016 Description: Develop and presented engineering interest talks at elementary, middle, and high schools.

EEGSA (UCB) Co-President	Dates: Sept 2013-Spring 2014 Description: Organized social and outreach events for UCB graduate student organization.
EEGSA (UCB) Visit-Day Coordinator	Dates: March 2013 Description: Lead team of ten students in assigning mentors, organizing accommodations, and planning social events for new students during recruitment weekend.
Resident Assistant (UMD)	Dates: Aug 2008–Spring 2010 Description: Developed community, planned educational events, maintained security, enforced policies, and provided personal support for 70 freshman on a residence hall floor. Voted RA of the Year for 2009-2010 by the fifteen other RA's in the residence hall.
Student Honor Council (UMD)	Dates: Aug 2007–Spring 2008 Description: Promoted the academic integrity of the university by educating students and adjudicating cases of academic dishonesty.

February 27, 2023