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

Research & Papers

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 Açikmeşe, 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.

January 13, 2023