Curriculum Vitae—Katy Craig

Contact Information

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Appointments

Assistant Professor, University of California, Santa Barbara, 2016-present
UC President's Postdoctoral Fellow, University of California, Santa Barbara, 2015-2016
NSF Postdoctoral Fellow, University of California, Los Angeles, 2014-2015

Education

Rutgers University, New Brunswick, Ph.D. in mathematics, 2010-2014
Stanford University, B.S. in mathematics with distinction, 2004-2008

Research Interests

optimal transport, nonlinear PDE, machine learning

Awards and Honors

National Science Foundation CAREER Grant, DMS-2145900	UCSB, 2022
Hellman Faculty Fellowship	UCSB, 2020
UC Regent's Junior Faculty Fellowship	UCSB, 2019
National Science Foundation Grant, DMS-1811012	UCSB, 2018-2022
UC Faculty Research Grant	UCSB, 2017
UC Faculty Enrichment Award	UCSB, 2016
UC President's Postdoctoral Fellowship	UCSB, 2015-2016
NSF Mathematical Sciences Postdoctoral Research Fellowship	UCLA, 2014-2015, 2016-2018
Rutgers Presidential Fellowship	Rutgers University, 2010-2012

Publications and Preprints

1. K. Craig, K. Elamvazhuthi, M. Haberland, and O. Turanova, A blob method for inhomogeneous diffusion with applications to multi-agent control and sampling, arXiv: 2202.12927, submitted.

2. T. Cai, J. Cheng, K. Craig, and N. Craig, Which metric on the space of collider events?, *Physical Review D*, 105 (7). link

3. K. Craig, N. García Trillos, and D. Slepčev, Clustering dynamics on graphs: from spectral clustering to mean shift through Fokker-Planck interpolation, in *Active Particles, Volume III*. Birkhäuser, Cham. (2022) 105-151. link

4. T. Cai, J. Cheng, K. Craig, and N. Craig, Linearized optimal transport for collider events, *Physical Review D.*, 102 (2020). link

5. K. Craig, J.-G. Liu, J. Lu, J. L. Marzuola, and L. Wang, A proximal-gradient algorithm for crystal surface evolution, accepted to *Numerische Mathematik*, link.

6. J.A. Carrillo, K. Craig, L. Wang, and C. Wei, Primal dual methods for Wasserstein gradient flows, *Foundations of Computational Mathematics*, (2021), 1-55. link

7. J.A. Carrillo, K. Craig, and Y. Yao, Aggregation-diffusion equations: dynamics, asymptotics, and singular limits, *Active Particle Methods, Volume II,* Birkhäuser, Cham (2019), 65-108. link

8. K. Craig and I. Topaloglu, Aggregation-diffusion to constrained aggregation: minimizers and gradient flows in the slow diffusion limit, *Annales de l'Institut Henri Poincare, Analyse non lineaire,* 37.2 (2020), 239-279. link

9. J.A. Carrillo, K. Craig, and F.S. Patacchini, A blob method for diffusion, *Calculus of Variations and Partial Differential Equations*, 58.2 (2019), 1-53. link

10. K. Craig, I. Kim, and Y. Yao, Congested aggregation via Newtonian interaction, *Archive for Rational Mechanics and Analysis*, 227.1 (2018), 1-67. link

11. K. Craig, Nonconvex gradient flow in the Wasserstein metric and applications to constrained nonlocal interactions, *Proceedings of the London Mathematical Society* 114 (2017), 60-102. link

12. K. Craig and I. Topaloglu, Convergence of regularized nonlocal interaction energies, *SIAM Journal on Mathematical Analysis* 48 (2016), 34-60. link

13. A. Bertozzi and K. Craig, A blob method for the aggregation equation, *Mathematics of Computation* 85 (2016), 1681-1717. link

14. K. Craig, The exponential formula for the Wasserstein metric, *ESAIM Control, Optimisation, and Calculus of Variations* 48 (2016), 169-187. link

15. E. Carlen and K. Craig, Contraction of the proximal map and generalized convexity of the Moreau-Yosida regularization in the 2-Wasserstein metric, *Mathematics and Mechanics of Complex Systems* 1 (2013), 33-65. link

Selected Recent Presentations

(* denotes cancellation due to COVID-19 or severe weather)

Graph clustering dynamics: from spectral to mean shift via Fokker Planck
SIAM PDE minisymposium, "The Geometry of PDEs on Graphs," 3/15/22.
Data Science Seminar, Johns Hopkins University, 3/2/22.
Data Science Seminar, Institute for Math & Applications, Univ. of Minnesota, 2/15/22.

Optimal transport and the geometry of collider data
ML and Science Forum, Berkeley Institute for Data Science, UC Berkeley, 12/7/21

Wasserstein gradient flows and partial differential equations
Bootcamp, Simons Center for Theory of Computing, UC Berkeley, 9/2/21

A blob method for degenerate diffusion and applications to sampling and two layer neural networks
UC Santa Cruz, Baskin School of Engineering Applied Mathematics, 4/25/22
UC San Diego, Center for Computational Mathematics Seminar, 4/19/22
University of Bonn SFB-Seminar, Analysis and Differential Equations, 1/11/22
Columbia University Applied Math Colloquium, 11/9/21
Geometry & Learning from Data, Centro Matematica Oaxaca, 10/27/21
Sampling Algorithms and Geometry, Simons Center for Theory of Computing, 9/29/21
BIRS New Trends in Nonlinear Diffusion, Centro Matematica Oaxaca, 9/9/21
Monte Carlo Methods 2021, University of Mannheim, 8/18/21
Entropic and Optimal Transport, Banff International Research Station, 6/25/21
PDE and Applied Math Seminar, UC Riverside, 1/13/21

Minimizers and gradient flows in the slow diffusion limit
Gradient Flows in PDEs webinar, Institut Camille Jordan (ICJ), Lyon, 10/14/20

A Proximal-Gradient Algorithm for Crystal Surface Evolution
Nonlinear PDE Seminar, University of California, Irvine, 10/16/20
Applied Mathematics and Comp Seminar, University of Massachusetts, Amherst, 9/29/20
Variational Methods for Evolution, Oberwolfach, 9/17/20

Gradient flows in the W_2 metric: from discrete to continuum via regularization
Plenary lecture, Southern California Applied Mathematics Symposium, 5/21/22
Operations Research seminar, Stanford University, 11/5/20
Optimal Transport & Machine Learning, Math Bio Institute, Ohio State, 7/8/20
Optimal Transport, Regularization, & Appl., Statistics Dept, Columbia University, 7/7/20

Mesh vs. mesh free: from Eulerian to Lagrangian via optimal transport
Plenary lecture, OTAA conference, Massachusetts Institute of Technology, 5/18/20*

Minimizers and gradient flows in the slow diffusion limit
Applied Mathematics Seminar, University of Utah, 2/3/20*
PDE/Applied Math Seminar, Drexel University, 1/24/19
Nonlinear Analysis Seminar, Rutgers University, 1/22/19
Computational Applied Mathematics and PDE Seminar, University of Chicago, 5/2/18
Analysis Seminar, University of Texas, 2/7/18

Gradient flow in the Wasserstein metric
NIPS, Optimal Transport and Machine Learning, Long Beach, CA, 12/9/17

A blob method for degenerate diffusion
Casa Matemática Oaxaca, Optimal transport meets machine learning, 5/2/17

From slow diffusion to a hard height constraint
Analysis and Applied Math Seminar, Duke University, 2/22/17

Selected Service

Organizer, Nonlinear diffusion and nonlocal interaction: entropies, complexity, and multi-scale structures, BIRS-IMAG, Granada, Spain, May 2023
Lead organizer, Conference on Dynamics & Discretization, Simons Institute for Theory of Computing, UC Berkeley, October 2021
Organizer, Geometric Methods in Optimization and Sampling, Simons Institute for Theory of Computing, UC Berkeley, Fall 2021
Lead organizer, MSRI Conference on Optimal Transport and Machine Learning, May 2020
Organizer, SIAM Conference on Partial Differential Equations, December 2019
NSF panelist, Division of Mathematical Sciences, March 2020, 2021, and 2022
Organizer, Southern California Applied Mathematics Symposium (SOCAMS), 2018

Referee for Inventiones Mathematicae, Transactions of the AMS, Journal of Differential Equations, Journal of Machine Learning Research, SIAM Journal of Mathematical Analysis, SIAM Journal of Numerical Analysis, Mathematics of Computation, European Journal of Applied Mathematics, and others.

Undergraduate/Graduate Mentoring

Doctoral advisor of Micah Pedrick (graduation est. June 2023) and Đorđe Nikolic (graduation est. June 2024)

Undergraduate research advisor of McNair scholar Emily Lopez (graduated June 2022, now pursuing PhD in applied mathematics at Cornell University) and Haoqing Yu (graduation est. June 2024).

Selected Recent Teaching

Math 201a: measure theory, fall 2021
Math 290J: optimal transport, spring 2020 and winter 2022
Math 119a: dynamical systems, fall 2018
Math 117: real analysis, 2016-2022
Math 6B: vector calculus II, 2021