

Wuchen Li

Department of Mathematics
University of South Carolina
wuchen@mailbox.sc.edu

Current Positions

Assistant Professor, University of South Carolina Aug, 2020 to now

Academic experience

CAM Assistant Adjunct Professor, UCLA July, 2016 to Aug, 2020
Ph.D in mathematics, Georgia Institute of Technology Aug, 2011 to May, 2016
Bachelor in mathematics, Shandong University Sep, 2005 to Jun, 2009

Research interest

- (i) Transport information geometry: Hessian matrices in data science and nonlinear PDEs;
- (ii) Mean field games, Optimal transport, Schrödinger equations, Schrödinger bridge problems and their generalizations;
- (iii) Mean field dynamical modeling in complex systems, optimization, statistics, MCMC algorithms with applications in robotics path planning, communications and pandemics control, etc.

Teaching experience

- Math 528 Mathematical Foundation of Data Science and Machine Learning (Fall 2022)
- Math 524 Optimization (Fall 2021)
- Math 520 Differential equations (Spring 2021, Spring 2022)
- Math 141 Calculus I (Fall 2020*2, Fall 2021, Fall 2022)
- Math 164 Optimization (Fall 2019, Winter 2020, Summer 2020)
- Math 151B Applied numerical method (Spring 2017, Winter 2017, Spring 2018)
- Math 151A Applied numerical method (Winter 2018)
- Math 2605 Calculus 3 for Computer Science (Spring 2015)
- Math 3215 Probability (Summer 2015)

Grants

1. NSF, RTG: Mathematical Foundation of Data Science at University of South Carolina. Co-PI, 08/01/2021 - 07/31/2026, \$1,996,609;
2. Start up funding, U of SC, 2020.

Journal publications: *: corresponding author; ◊: project mentor.

1. Wuchen Li*, Siting Liu, Stanley Osher. *Controlling conservation laws II: compressible Navier-Stokes equations*, accepted in Journal of Computational Physics, 2022.
2. Lisang Ding, Wuchen Li*, Stanley Osher, Wotao Yin. *A Mean-Field Game Inverse Problem*, accepted in Journal of Scientific Computing, 2022.
3. Shu Liu, Wuchen Li*, Hongyuan Zha, Haomin Zhou. *Neural Parametric Fokker-Planck equations*, accepted in SIAM Journal on Numerical Analysis, 2022.
4. Yifei Wang, Wuchen Li*. *Accelerated information gradient flow*, accepted in Journal of Scientific Computing, 2021.
5. Wuchen Li*. *Transport information Bregman divergences*, accepted in Information Geometry, 2021.
6. David Jekel, Wuchen Li◊, and Dimitri Shlyakhtenko. *Tracial smooth functions of non-commuting variables and the free Wasserstein manifold*, accepted in Dissertationes Mathematicae, 2021.
7. Wuchen Li*. *Transport information geometry: Riemannian calculus on probability simplex*, accepted in Information Geometry, 2021.
8. Hao Gao, Wuchen Li◊, Miao Pan, Han Zhu, Vincent Poor. *Modeling COVID-19 with Mean Field Evolutionary Dynamics: Social Distancing and Seasonality*, accepted in Journal of Communications and Networks, 2021.
9. Siting Liu, Matt Jacobs, Wuchen Li◊, Levon Nurbekyan, Stanley Osher. *Computational methods for nonlocal mean field games with applications*, accepted in SIAM journal on Numerical Analysis, 2021.
10. Alex Tong Lin, Samy Wu Fung, Wuchen Li◊, Levon Nurbekyan, Stanley Osher. *ApacNet: An Alternating Population-Agent Control Neural Network for High-Dimensional Stochastic Mean Field Games*, accepted in Proceedings of the National Academy of Sciences of the United States of America (PNAS), 2021.
11. Wonjun Lee, Wuchen Li◊, Bo Lin, and Anthea Monod. *Tropical optimal transport and Wasserstein distance in Phylogenetic Tree Space*, accepted in Information Geometry, 2021.
12. Wuchen Li*. *Hessian metric via transport information geometry*, accepted in Journal of Mathematical Physics, 2021.
13. Yuhan Kang, Siting Liu, Hongliang Li, Wuchen Li◊, Han Zhu, Stanley Osher, Vincent Poor. *Joint Sensing Task Assignment and Collision-Free Trajectory Optimization for Mobile Vehicle Networks using Mean-Field Games*, accepted in IEEE Internet of Things Journal, 2020.
14. Wonjun Lee, Siting Liu, Hamidou Tembine, Wuchen Li*, Stanley Osher. *Controlling Propagation of epidemics via mean-field control*, accepted in SIAM Journal on Applied Mathematics, 2020.
15. Wonjun Lee, Rongjie Lai, Wuchen Li*, Stanley Osher. *Generalized unnormalized optimal transport and its fast algorithm*, accepted in Journal of Computational Physics, 2020.
16. Simon Becker, Wuchen Li◊, *Quantum statistical learning via Quantum Wasserstein natural gradient*, accepted in Journal of Statistical Physics, 2020.
17. Shui-Nee Chow, Wuchen Li*, Chenchen Mou, Haomin Zhou. *Dynamical Schrödinger bridge problems on graphs*, Journal of Dynamics and Differential Equations, 2020.
18. Flavien Leger, Wuchen Li◊. *Hopf-Cole transform via generalized Schrödinger bridge problem*, Journal of Differential Equations, 2020.
19. Jialin Liu, Wotao Yin, Wuchen Li*, Yat Tin Chow. *Multilevel Optimal Transport: a Fast Approximation of Wasserstein-1 distances*, SIAM Journal on Scientific Computing, 2020.
20. Hao Gao, Wuchen Li◊, Reginald A. Banez, Han Zhu, Vincent Poor, Mean Field Evolutionary Dynamics in Dense-user Multi-access Edge Computing Systems, IEEE Transactions on Wireless Communications, 2020.

21. Yifan Chen, Wuchen Li[◊], *Optimal transport natural gradient for statistical manifolds with continuous sample space*, Information Geometry, 2020.
22. Wuchen Li, Jiangfeng Lu, Li Wang. *Fisher information regularization schemes for Wasserstein gradient flows*, Journal of Computational Physics, 2020.
23. Lars Ruthottoa, Stanley Osher, Wuchen Li, Levon Nurbekyan, Samy Wu Fung. *A Machine Learning Framework for Solving High-Dimensional Mean Field Game and Mean Field Control Problems*, Proceedings of the National Academy of Sciences of the United States of America (PNAS), 2020.
24. Wuchen Li*, Guido Montufar. *Ricci curvature for parametric statistics via optimal transport*, Information Geometry, 2020.
25. Wuchen Li*, Lexing Ying. *Hessian transport gradient flows*, Research in the Mathematical Sciences, 2019.
26. Alfredo Garbuno-Inigo, Franca Hoffmann, Wuchen Li, Andrew M Stuart. *Interacting Langevin Diffusions: Gradient Structure And Ensemble Kalman sampler*, SIAM Journal on Applied Dynamical Systems, 2019.
27. Shui-Nee Chow, Wuchen Li*, Jun Lu, Haomin Zhou. *Equilibrium selection via Optimal transport*, SIAM Journal on Applied Mathematics, 2019.
28. Wilfrid Gangbo, Wuchen Li*, Stanley Osher, Michael Puthawala. *Unnormalized optimal transport*, Journal of Computational Physics, 2019.
29. Shui-Nee Chow, Wuchen Li*, Haomin Zhou. *Wasserstein Hamiltonian flows*, Journal of Differential Equations, 2019.
30. Yat-Tin Chow, Wuchen Li[◊], Wotao Yin, Stanley Osher. *Algorithm for Hamilton-Jacobi equations in density space via a generalized Hopf formula*, Journal of Scientific Computing, 2019.
31. Matt Jacobs, Flavien Leger, Wuchen Li, Stanley Osher. *Solving Large-Scale Optimization Problems with a Convergence Rate Independent of Grid Size*, SIAM journal on Numerical Analysis, 2019.
32. Shui-Nee Chow, Wuchen Li*, Haomin Zhou. *A discrete Schrödinger equation via optimal transport on graphs*, Journal of Functional Analysis, 2019.
33. Yupeng Li, Wuchen Li*, Guo Cao. *Image Segmentation via L1 Monge-Kantorovich Problem, Inverse problem and Imaging*, 2019.
34. Wuchen Li*, Guido Montufar. *Natural gradient via optimal transport*, Information Geometry, 2018.
35. Shui-Nee Chow, Wuchen Li*, Jun Lu, Haomin Zhou. *Population games and Discrete optimal transport*, Journal of Nonlinear Science, 2018.
36. Wilfrid Gangbo, Wuchen Li, Chenchen Mou. *Geodesic of minimal length in the set of probability measures on graphs*, ESAIM: Control, Optimisation and Calculus of Variations (ESAIM: COCV), 2018.
37. Ernest Ryu, Yongxin Chen, Wuchen Li, Stanley Osher. *Vector and Matrix Optimal Mass Transport: Theory, Algorithm, and Applications*, SIAM Journal on Scientific Computing, 2018.
38. Shui-Nee Chow, Wuchen Li*, Haomin Zhou. *Entropy dissipation on finite graphs*, Discrete and Continuous Dynamical Systems-Series A, 2018.
39. Shui-Nee Chow, Luca Dieci, Wuchen Li*, Haomin Zhou. *Entropy dissipation semi-discretization schemes for Fokker-Planck equations*, Journal of Dynamics and Differential Equations, 2018.
40. Ernest Ryu, Wuchen Li*, Penghang Yin, Stanley Osher. *Unbalanced and Partial L1 Monge-Kantorovich Problem: A Scalable Parallel First-Order Method*, Journal of Scientific Computing, 2017.
41. Wuchen Li*, Penghang Yin, Stanley Osher. *Computation of optimal transport distance with Fisher information regularization*, Journal of Scientific Computing, 2017.
42. Wuchen Li*, Ernest Ryu, Stanley Osher, Wotao Yin, Wilfrid Gangbo. *A parallel method for Earth Mover's distance*, Journal of Scientific Computing, 2017.

43. Wuchen Li*, Shui-Nee Chow, Magnus Egerstedt, Jun Lu, Haomin Zhou. *Method of evolving junctions: A new approach for the optimal path-planning in a dynamic environment*, The International Journal of Robotics Research, 2017.
44. Shui-Nee Chow, Wuchen Li*, Jun Lu, Haomin Zhou. *Method of evolving junctions: A new approach to optimal control with constraints*, Automatica, 2017.
45. Shui-Nee Chow, Wuchen Li*, Haomin Zhou. *A Newton-like algorithm for the shortest path based on the method of evolving junctions*, Communications in mathematical sciences, 2016.
46. Luca Dieci, Wuchen Li*, Haomin Zhou. *A new model for realistic random perturbations of stochastic oscillators*, Journal of Differential equations, 2016.

Conference publications

1. Wuchen Li*, *Transport information Hessian distances*, Geometric Science of Information (GSI), 2021.
2. Alex Lin, Wuchen Li*, Stanley Osher, Guido Montufar. *Wasserstein proximal of GANs*, Geometric Science of Information (GSI), 2021.
3. Hao Gao, Alex Lin, Reginald A. Banez, Wuchen Li[◊], Zhu Han, Stanley Osher, and H. Vincent Poor. *Opinion Evolution in Social Networks: Connecting Mean Field Games to Generative Adversarial Nets*, IEEE 2021, IEEE International Conference on Communications (ICC): SAC Social Networking Track.
4. Hao Gao, Wuchen Li[◊], Miao Pan, Zhu Han, Vincent Poor. *Analyzing Social Distancing and Seasonality of COVID-19 with Mean Field Evolutionary Dynamics*, IEEE Globecom 2020, December 7 - 11.
5. Yuhan Kang, Siting Liu, Wonjun Lee, Hongliang Zhang, Wuchen Li[◊], and Zhu Han. *Joint Task Assignment and Trajectory Optimization for a Mobile Robot Swarm by Mean-Field Game*, IEEE Globecom 2020, December 7 - 11.
6. Hao Gao, Wonjun Lee, Wuchen Li[◊], Zhu Han, Stanley Osher, and H. Vincent Poor. *Energy-efficient Velocity Control for Massive Rotary-Wing UAVs: A Mean Field Game Approach*, IEEE Globecom 2020, December 7 - 11. *Journal in IEEE Transactions on Vehicular Technology*, 2022.
7. Michael Arbel, Arthur Gretton, Wuchen Li[◊], Guido Montufar. *Kernelized Wasserstein Natural Gradient*, International Conference on Learning Representations (ICLR), Oral, 2020.
8. Alex Lin, Yonatan Dukler, Wuchen Li[◊], Guido Montufar. *Wasserstein Diffusion Tikhonov Regularization*, OTML Workshop NeurIPS, 2019.
9. Hao Gao, Wuchen Li[◊], Reginald A. Banez, Zhu Han, and H. Vincent Poor. *Mean Field Evolutionary Dynamics in Ultra Dense Mobile Edge Computing Systems*, IEEE Global Communications Conference, Puako, HI, December 2019.
10. Flavien Leger, Wuchen Li. *Hopf-Cole transformation and Schrödinger problems*, Geometric Science of Information (GSI), 2019.
11. Wuchen Li[◊], Shu Liu, Hongyuan Zha, Haomin Zhou. *Parametric Fokker-Planck equation*, Geometric Science of Information (GSI), 2019.
12. Wuchen Li[◊], Alex Lin, Guido Montufar. *Affine natural proximal learning*, Geometric Science of Information (GSI), 2019.
13. Yonatan Dukler, Wuchen Li[◊], Alex Lin, Guido Montufar. *Wasserstein of Wasserstein Loss function for learning generative models*, International Conference on Machine Learning (ICML), Long beach, 2019.

Preprint

1. Wuchen Li*. *Diffusion hypercontractivity via generalized density manifold*.
2. Wuchen Li*, Jiayi Zhao. *Wasserstein information matrix*.
3. Yifei Wang, Wuchen Li*. *Information Newton's flow: second-order optimization method in probability space*.
4. Karthik Elamvazhuthi, Siting Liu, Wuchen Li[◊], Stanley Osher. *Optimal Transport of Nonlinear Control-Affine Systems*.
5. Qi Feng, Wuchen Li[◊]. *Entropy dissipation for degenerate stochastic differential equations via sub-Riemannian density manifold (I)*. (90 pages).
6. Qi Feng, Wuchen Li*. *Entropy dissipation via information Gamma calculus: Non-reversible stochastic differential equations*.
7. Qi Feng, Wuchen Li[◊]. *Hypoelliptic entropy dissipation for stochastic differential equations (II)*.
8. Yifei Wang, Peng Chen, Wuchen Li[◊]. *Projected Wasserstein gradient descent for high-dimensional Bayesian inference*.
9. Jiajia Yu, Rongjie Lai, Wuchen Li, Stanley Osher. *A Fast Proximal Gradient Method and Convergence Analysis For Dynamic Mean Field Planning*.
10. Wonjun Lee, Siting Liu, Wuchen Li*, Stanley Osher. *Mean field control problems for Vaccine distribution*.
11. Wuchen Li*, Wonjun Lee, Stanley Osher. *Computational Mean-field information dynamics associated with Reaction-diffusion equations*.
12. Wuchen Li*, Siting Liu, Stanley Osher. *Controlling conservation laws I: entropy-entropy flux*.
13. Yifei Wang, Peng Chen, Mert Pilanci, Wuchen Li[◊]. *Optimal Neural Network Approximations of Wasserstein Gradient Direction via Convex Optimization*.
14. Wuchen Li, Javier Rubio Alvarez. *On a prior based on the Wasserstein information matrix*.
15. Wuchen Li[◊], Hansol Park. *Mean field Kuramoto models on graphs*.
16. Wuchen Li*, Linyuan Lu. *Mean field information matrices on graphs*.
17. Erhan Bayraktar, Qi Feng, Wuchen Li[◊]. *Exponential Entropy dissipation for weakly self-consistent Vlasov-Fokker-Planck equations*.
18. Jiajia Yu, Rongjie Lai, Wuchen Li[◊], Stanley Osher. *Mean-field Games on Manifolds and their fast Algorithms*.

Upcoming presentations

- Invited talk, “Wasserstein Gradient Flows in Math and Machine Learning”, BIRS, planned in 2023.
- Invited talk, “Applied and Computational Differential Geometry and Geometric PDEs”, BIRS, planned in 2023.
- Organization talk, “Transport information geometric sampling in inverse problems”, SQuaRE, AIM, San Jose, planned in Fall 2022 or later.
- Invited talk, “Kinetic theory: Novel statistical, stochastic and analytical methods”, MSRI, UC Berkeley, planned in Fall 2022.
- Invited talk, “Transport optimization methods in Bayesian sampling problems”, Exploiting low-dimensional structure in PDE-constrained Bayesian inverse problems, SIAM MDS, UC San Diego, CA, Sep 26 to Sep 30, 2022.
- Invited talk, “Information Geometry in Data Science”, Hamburg University of Technology, Germany, Sep 19 to Sep 23, 2022.

- Invited talk, *Computational transport information geometry with applications*, “Probability Workshop on Information geometry and applications”, Annual Meeting of the Statistical Society of Canada, June 5, 2022.

Presentations

1. Invited talk, *Controlling conservation laws via entropy-entropy flux pairs*, “International Conference on New Trends in Scientific Computing”, April 20-22, IPAM, UCLA, LA, 2022.
2. Invited talk, *Transport information Newton’s flows*, “Sampling via Variational Methods”, SIAM Conference on Uncertainty Quantification, April 12-14, Atlanta, Georgia, 2022.
3. Invited participation, “Socio-Math Workshop”, April 11-12, Basic Research Innovation Collaboration Center (BRICC), Arlington, VA, 2022.
4. Organization talk, *Transport information flows for Bayesian sampling problems*, U of SC RTG seminar, March 4, 2022.
5. Invited talk, *Wasserstein information matrix and its estimation properties*, Imperial College Statistics Seminar, March 4, 2022.
6. Invited talk, *Computational Mean-field information dynamics associated with Reaction-diffusion equations*, High Dimensional Hamilton-Jacobi PDEs Reunion, Jan 13, IPAM, UCLA, LA, 2022.
7. Invited talk, *Transport information flows for Bayesian sampling problems*, Applied math seminar, Illinois institute of Technology, Dec 17, 2021.
8. Organization talk, *Controlling conservation laws via entropy-entropy flux pairs*, Optimal transport and Mean field game seminar, U of SC/UCLA, Dec 15, 2021.
9. Invited talk, *Controlling propagation of pandemics via mean-field games*, Applications of Mean Field Games: from Models to Practice, IMSI, University of Chicago, Nov 19, 2021.
10. Invited talk, *Neural computational mean field games*, Mathematical finance seminar, UC Berkeley, Nov 5, 2021.
11. Invited talk, *Transport information dynamics for sampling problems*, Mathematical data science seminar, Purdue University, Nov 1, 2021.
12. Invited talk, *Computational mean field games, Accelerated Information flows, Transport information Newton’s flows*, 2021 SIAM Southeastern Atlantic Section Conference, Auburn University, September 18-19, 2021.
13. Invited talk, *Entropy dissipation via information Gamma calculus*, Wasserstein gradient flows and their applications, the 13th International Conference on Monte Carlo Methods and Applications, University of Mannheim, August 18, 2021.
14. Organization talk, *Transport information Hessian distances*, Transport information geometry/Divergence statistics, Geometric Science of Information, July 21 to July 23, 2021.
15. Invited talk, *Transport information Bregman divergences*, Analysis of nonlinear wave models, SIAM Conference on Applications of Dynamical Systems (DS21), May 23 to 27, 2021.
16. Invited talk, *Transport information Bregman divergences*, One World Seminar Series on the Mathematics of Machine Learning, May 12, 2021.
17. Invited talk, *Entropy dissipation via Information Gamma calculus*, Analysis Seminar at the Center of Mathematics, University of Coimbra, Portugal, April 9, 2021.
18. Invited talk, *Free Wasserstein manifold*, Probabilistic operator algebra seminar, UC Berkeley, Feb 22, 2021.
19. Invited talk, *Learning via transport information geometry*, Applied math seminar, Auburn university, Feb 19, 2021.
20. Home talk, *Transport information dynamics with applications*, Applied math seminar, University of South Carolina, Jan 22, 2021.
21. Invited talk, *Mean field games with applications*, Gatsby Seminar, University College London, January, 13, 2021.

22. Invited talk, *High order MCMC methods via transport information geometry*, “New Frontiers in Computational Mathematics” in the Joint Mathematics Meeting (JMM), Washington DC, January 8, 2021.
23. Invited talk, *Transport information flows for Bayesian sampling problems*, “Mathematics in Imaging, Data and Optimization”, Rensselaer Polytechnic Institute, Dec 9th, 2020.
24. Invited talk, *Transport information flows for Bayesian sampling problems*, Applied Math/PDE seminar, Nov 13rd, UC Santa Barbara, 2020.
25. Invited talk, *Mean field games with applications*, UC SOUTHERN HUB: Frontiers in Machine Learning for the Physical Sciences, UC Irvine, October 26, 2020.
26. Invited talk, *Controlling Propagation of epidemics via mean-field games*, Math and deep learning collective, Sep 11, 2020, Iowa State University.
27. Invited talk, *Transport information geometric learning*, workshop on computation and applications of PDEs based on machine learning, July 14, 2020.
28. Invited talk, *Wasserstein information matrix*, Optimal Transport: Regularization and Applications, July 7-8, 2020, Columbia university.
29. Organization talk, *Controlling propagation of pandemics via mean-field games*, Optimal control in data space minisymposium, June 17, 2020, SIAM Conference on Mathematics of Data Science.
30. Invited talk, *Transport information Newton’s flow*, Optimal Transport minisymposium, May 29, 2020, SIAM Conference on Mathematics of Data Science.
31. Invited talk, *Transport information geometric computation: Mean field games*, Math and deep learning (MDL) collective, May 8, 2020, Iowa State University.
32. Invited talk, *Transport information geometric computation: Neural Fokker-Planck equations*, Data science seminar, May 4, 2020, Shanghai Jiao Tong university.
33. Invited talk, *Accelerated information gradient flow*, Workshop II: PDE and Inverse Problem Methods in Machine Learning, April 23, 2020, IPAM, LA.
34. Invited talk, *Transport information Newton’s flow*, Computational and Applied Mathematics Seminar, April 14, 2020, Carnegie Mellon University, Pittsburgh.
35. Invited talk, *Transport information Newton’s flow*, probability and statistics seminar, April 10, 2020, University of Southern California, LA.
36. Invited talk, *Transport information geometry: current and future*, March 26 and April 6, 2020, IPAM, UCLA.
37. Joint Stochastic and Applied Math Seminar talk: *Accelerated information gradient flow*, Jan 22, 2020, The University of Utah, Salt Lake City.
38. Colloquia talk: *Transport information geometric learning*, Jan 21, 2020, The University of Utah, Salt Lake City.
39. Invited talk: *Accelerated information gradient flow*, Applied Math Youth Forum, Dec 22, 2019, Peking university.
40. Lecture series: *Transport information geometry with applications in data science, statistics and data-driven scientific computing*, Dec 19, 20, 23, 2019, Tsinghua university.
41. Invited talk: *Wasserstein information matrix*, SIAM Conference on Analysis of Partial Differential Equations, session: PDEs in machine learning, Dec 14, 2019, La Quinta.
42. Invited talk: *Accelerated information gradient flow*, SIAM Conference on Analysis of Partial Differential Equations, session: Gradient Flows and Beyond: New Directions in Geometric Flows and Partial Differential Equations, Dec 11, 2019, La Quinta.
43. Colloquia talk: *Transport information geometric learning*, Dec 6, 2019, University of South Carolina, Columbia.
44. Invited talk: *Transport information geometric learning*, Applied and Computational Mathematics, Nov 4, 2019, UCI, Irvine.

45. Invited talk: *Accelerated Information Gradient flow*, Applied Math seminar, Oct 23, 2019, Stanford university, San Jose.
46. Invited talk: *Wasserstein information geometric learning*, CAM seminar, Sep 16, 2019, Iowa state university, Iowa, Ames.
47. Plenary talk: *Learning via Wasserstein information geometry*, Peter G. Hall Conference: Statistics and Machine Learning, May 10, 2019, UC Davis.
48. Invited talk: *Wasserstein information geometric learning*, SOCAMS, April 27, 2019, Caltech, Pasadena.
49. Invited talk: *Wasserstein information geometric learning*, Applied Math seminar, April 17, 2019, Stanford University, San Jose.
50. Invited talk: *Wasserstein information geometric learning*, Special seminar on optimal transport and information geometry, April 10, 2019, UCLA.
51. Invited talk: *Wasserstein information geometric learning*, Deep learning kickoff conference, March 29, 2019, Max-Planck institute, Leipzig, Germany.
52. Invited talk: *Wasserstein information geometric learning*, Applied Math seminar, March 4, 2019, University of California, Santa Cruz.
53. Invited talk: *Wasserstein information geometric learning*, Special seminar, Feb 21, 2019, Courant Institute of Mathematical Sciences , New York.
54. Invited talk: *Wasserstein information geometric learning*, Special seminar, Feb 20, 2019, New Jersey Institute of Technology, New Jersey.
55. Invited talk: *Wasserstein information geometric learning*, Optimal transport seminar, Jan 2019, Caltech, Pasadena.
56. Invited talk: *Learning via Wasserstein information geometry*, Applied mathematics and Statistics Youth Forum, Dec 2018, Peking university.
57. Organization talk: *Mean field games and Optimal transport*, Mean field games kickoff conference, Dec 2018, UCLA.
58. Invited talk: *Optimal transport on graph with applications*, Special event, Nov 2018, University of Minnesota.
59. Invited talk: *Wasserstein statistical manifold*, AIM conference on Restricted Boltzmann machine, Sep 2018, San Jose.
60. Plenary talk: *Machine learning via Wasserstein statistical manifold*, A first conference in Machine learning and optimal control, July 2018, Shenzhen.
61. Plenary talk: *Dynamics in Wasserstein statistical manifold*, International conference on infinite dimensional dynamical systems, Sichuan University, July 2018, Chengdu.
62. Lecture series: *Mean field games via probability manifold I, II*, IPAM lectures, June 2018, UCLA, Los Angeles.
63. Invited talk: *Wasserstein Natural gradient*, Level set seminar, June 2018, UCLA, Los Angeles.
64. Invited talk: *Wasserstein statistical manifold*, Level set seminar, April 2018, UCLA, Los Angeles.
65. Invited talk: *Optimal transport on graphs with applications*, Applied Math/PDE seminar, Feb 2018, UCSB, Santa Barbara.
66. *Optimal transport on graphs with applications*, Level set seminar, Feb 2018, UCLA, Los Angeles.
67. Plenary talk: *Schrödinger equation on graphs via optimal transport*, ICMC Differential equations, Feb 2018, USP, Sao Carlos, Brazil.
68. Invited talk: *Entropy dissipation on finite graphs*, 10 to 60 conference, Dec 2017, Georgia Tech, Atlanta.
69. Invited talk: *Discrete Schrödinger equation via optimal transport*, Nov 2017, AIMS, UC river-side.

70. Invited talk: *Fokker-Planck equations on finite graphs*, Probability and Statistics seminar, Sep 1st, 2017, USC.
71. Home talk: *Optimal control problems in density space*, Level set seminar, August 29, 2017, UCLA.
72. Invited talk: *Dynamical system in density manifold for finite graphs*, Workshop in dynamical system, August 10, 2017, Georgia Tech, Atlanta.
73. Invited talk: *Optimal transport with applications*, Topology seminar, June 20, 2017, Southwest Jiaotong University, Chengdu.
74. Invited talk: *Population games via optimal transport*, International Conference on Topological Nonlinear Analysis, June 15, 2017, Guangzhou.
75. Invited talk: *Optimal transport with Fisher information regularization*, SOCAMS, June 6, 2017, UC Irvine.
76. Invited talk: *Discrete Schrödinger equation via optimal transport*, Working Group for Problems in Transport and Related Topics in Graphs, May 6, 2017, Georgia Tech, Atlanta.
77. Home talk: *Optimal transport on finite graphs with applications*, Applied math colloquium, March 2017, UCLA.
78. Invited talk: *Optimal transport on finite graphs with applications*, Applied math seminar, February 2017, Claremont Colleges.
79. Home talk: *Fast algorithms for Earth Mover's distance*, Level set seminar, January 2017, UCLA.
80. Home talk: *Optimal transport and Entropy dissipation on finite graphs*, Level set seminar, August 29, 2016, UCLA.
81. Invited talk: *A new model for realistic random perturbations of stochastic oscillators*, AIMS Orlando conference, July 3, 2016, Orlando, Florida.
82. Invited talk: *A new approach to optimal control with constraints*, AIMS Orlando conference, July 1, 2016, Orlando, Florida.
83. Home talk: *A study of stochastic differential equations and Fokker-Planck equations with applications*, Applied and computational math seminars, April 4, 2016, Georgia Tech, Atlanta.
84. Invited talk: *Method of evolving junctions*, 2016, University of Georgia, Athens, Georgia.
85. Invited talk: *Method of evolving junctions: A new approach to optimal control with constraints*, SIAM student conference, April 11, 2015, Georgia Tech, Atlanta.
86. Poster section: *Newton-like algorithm for the shortest path based on the method of evolving junctions*, February 28, 2015, Georgia Scientific Computing Symposium, Georgia Tech, Atlanta.

Reviewers

Journals

- Journal of Scientific Computing;
- Journal of Computational Physics;
- Research in the Mathematical Sciences;
- Journal of Physics A: Mathematical and Theoretical;
- Journal of Differential Equations;
- Annals of Statistics;
- SIAM Journal on Applied Mathematics;
- SIAM Journal of Scientific Computing;
- SIAM/ASA Journal on Uncertainty Quantification;
- SIAM Journal on Control and Optimization;

- SIAM Journal of Mathematical Analysis;
- SIAM on Numerical Analysis;
- SIAM Journal on Applied Dynamical Systems;
- Probability and related fields;
- Information geometry;
- Journal of Machine Learning Research;
- Differential Geometry and its Applications;
- Inverse problems;
- Entropy;
- Information and Inference: A journal of the IMA;
- Science report;
- Dynamical Games and Applications;
- IEEE Signal Processing Letters;
- Mathematical Programming;
- Archive for Rational Mechanics and Analysis;
- Journal of Optimization Theory and Applications;
- Communications on Pure and Applied Analysis;
- Mathematical methods in applied sciences;
- Symmetry;
- Journal of Applied Mathematics and Computing;
- Qualitative Theory of Dynamical Systems;
- Journal of Finance and Data Science;
- Communications in Mathematical Sciences;
- Taiwanese Journal of Mathematics;

Conferences

- GSI (Geometric Science of Information) 2019, 2021;
- ICLR (International Conference on Learning Representations) 2019, 2020, 2021, 2022;
- NeurIPS (Conference on Neural Information Processing Systems) 2020;
- ICML (International Conference on Machine Learning) 2021, 2022;
- IEEE Global Communications Conference 2020;
- MTNS (International Symposium on Mathematical Theory of Networks and Systems) 2020;
- Mathematical and Scientific Machine Learning 2021, 2022.

Seminar

- Organizer: Optimal transport and Mean field games seminar, 2019 summer, 2020 spring, fall, 2021 spring, summer, fall, 2022 spring, summer, fall.
- Organizer: Mathematical aspects of data science and deep learning, 2020 fall, 2021 spring, summer, fall, DASIV center.

Conference

- Co-organizer: Ricci Curvatures of Graphs and Applications to Data Science, AMS Mathematics Research Communities, summer 2023.
- Co-organizer: Transport information geometric sampling in inverse problems, SQuaRE, AIM, San Jose, planned in Fall 2022 or later.
- Co-organizer: Optimal transport: theory, computation, and biology. UC Irvine, June 3-4, 2022.
- Chair: Transport information geometry, Geometry science of information (GSI), 2019, 2021, France.
- Co-organizer: DASIV Spring School Series, 2021, Columbia, SC.
- Co-organizer: Deep learning via optimal control in data space, SIAM Conference on Mathematics of Data Science, June 17-18, 2020, Ohio.
- Co-organizer: Optimal transport for nonlinear problems in ICIAM 2019, Spain.
- Co-organizer: Mean field games MURI kickoff meeting, 2018, UCLA.

Service

1. Faculty Hiring Committee, U of SC, 2021-2022.
2. Mathematics Colloquium, U of SC, 2021-2022.

Academic activities

- Lectures in Transport information geometry: current and future, April, IPAM, 2020.
- Lectures in Transport information geometry, Dec, Tsinghua university, 2019.
- Lectures in Mean field games, June, Los Angeles, 2017, 2018.
- AIMS Orlando conference, July 1-July 5, Orlando, Florida, 2016.
- Evolutionary Game Theory, April 27-May 1, MBI, Ohio State University, 2014.
- Georgia Scientific Computing Symposium, 2012-2015.
- MSRI Summer school, July 07-July 18, MSRI, University of California, Berkeley, 2014.
- Houston Summer School, May 20-May 28, University of Houston, 2014.
- Research assistant, Georgia Institute of Technology, Fall 2014, Fall 2015.

Supervision of graduate students

Yupei Li, U of SC, 2021-.

Supervision of visiting postdocs and graduate students

Hansol Park, Seoul national university, 2021-2022.