Amirhossein Taghvaei

Contact Info

E-mail: amirtag@uw.edu
Webpage: amirtag.github.io
Address: Department of Aeronautics & Astronautics
University of Washington, Seattle, WA, 98195

Professional experience

Assistant Professor
William Boeing Department of Aeronautics & Astronautics
University of Washington, Seattle — September 2021-now

Adjunct Assistant Professor
Department of Applied Mathematics
University of Washington, Seattle — September 2025-now

Postdoctoral Scholar
Department of Mechanical and Aerospace Engineering
University of California, Irvine — 2019-2021

Education

Ph.D. in Mechanical Engineering
M.S. in Mathematics
University of Illinois at Urbana-Champaign — 2013-2019

B.Sc. in Mechanical Engineering
B.Sc. in Physics (Dual Major)
Sharif University of Technology, Tehran, Iran — 2008-2013

Research grants

NSF AWARD 2318977- Variational Optimal Transport Methods for Nonlinear Filtering (single PI)
National Science Foundation, Energy Power Control Networks (EPCN) program — Sep. 2023

NSF AWARD 2347358- Collaborative Research: Fundamentals of Power Generation from Thermal Anisotropy - A Stochastic Control Framework
National Science Foundation, Energy Power Control Networks (EPCN) program — Sep. 2024

Publications

- 1385 citations (till 11/28/2025).
- 9 articles in top machine learning conferences
- 26 journal publications (IEEE TAC, Automatica, SIAM Uncertainty Quantification, ...)
- 30 articles in peer reviewed control conferences (CDC, ACC, MTNS)

Machine learning conferences

Y. Mei, M. Al-Jarrah, A. Taghvaei, Y. Chen, "Flow matching for stochastic linears ystems". 7th Annual Learning for Dynamics & Control Conference (L4DC), June, 2025

A. A. Joshi, H. S. Chang, A. Taghvaei, P.G. Mehta, S. P. Meyn "Interacting ParticleSystems for Fast Linear Quadratic RL". 7th Annual Learning for Dynamics & ControlConference (L4DC), June, 2025

M. Al-Jarrah, N. Jin, B. Hosseini, A. Taghvaei, "Nonlinear Filtering with Brenier Optimal Transport Maps", International Conference of Machine Learning (ICML), 2024

S. Talebi, A. Taghvaei, M. Mesbahi, "Data-driven Optimal Filtering for Linear Systems with Unknown Noise Covariances", Advances in Neural Information Processing Systems (NeurIPS), 2023.

J. Fan, Q. Zhang, A. Taghvaei, and Y. Chen, "Variational Wasserstein gradient flow", International Conference on Machine Learning (ICML), PMLR 162:6185-6215, 2022.

J. Fan, A. Taghvaei, Y. Chen. Scalable computations of Wasserstein barycenter via input convex neural networks. Proceedings of the 38th International Conference on Machine Learning (ICML), PMLR 139:1571-1581, 2021.

A. Taghvaei, A Makkuva, S. Oh, J. Lee. Optimal transport mapping via input-convex neural networks. Proceedings of the 37th International Conference on Machine Learning (ICML), PMLR 119:6672-6681, 2020.

A. Taghvaei, P. G. Mehta, Accelerated flow for probability distributions. Proceedings of the 36th International Conference on Machine Learning (ICML), PMLR 97:6076-6085, 2019.

A. Taghvaei, J. Kim, P. G. Mehta, How regularization effects the critical points in linear neural networks. Advances in Neural Information Processing Systems (NeurIPS), 30, 2017.

Journal publications

B. Hosseini, A. Hsu, A. Taghvaei, "Conditional Optimal Transport on Function Spaces" SIAM/ASA Journal on Uncertainty Quantification, 13(1), 304-338.

M. Al-Jarrah, B. Hosseini, A. Taghvaei, "Fast filtering of non-Gaussian models using Amortized Optimal Transport Maps", IEEE Control Systems Letters, vol. 9, pp. 1670-1675, 2025

A. Taghvaei, P. G. Mehta, "How to implement Bayes' law in the age of ML?",Encyclopedia of Systems and Control Engine

O. Movilla Miangolarra, A. Taghvaei, and T. T. Georgiou, "Minimal entropy production in the presence of anisotropic fluctuations", Transactions of Automatic Control (TAC), vol. 70, no. 2, pp.845-860, Feb. 2025

R. Fu, O. Movilla Miangolarra, A. Taghvaei, Y. Chen, T. T. Georgiou, "Stochastic thermodynamic engines under time-varying temperature profile", Automatica, 2024 Jan1;159:111361.

D. Grange, M Al-Jarrah, R. Baptista, A. Taghvaei, T. T. Georgiou, S. Phillips, A.Tannenbaum, "Computational optimal transport and filtering on Riemannian manifolds", IEEE Control Systems Letters, 2023

O. Movilla Miangolarra, A. Taghvaei, and T. T. Georgiou, "A matching principle for power transfer in stochastic thermodynamics", IEEE Control Systems Letters, 2023

A. Taghvaei, P. G. Mehta, "A Survey of Feedback Particle Filter and related Controlled Interacting Particle Systems (CIPS), Annual Reviews in Control (2023).

Q. Zhang, A. Taghvaei, Y. Chen, "An optimal control approach to particle filtering",Automatica, Volume 151, 2023,110894,

J. V. Siches, O. Movilla Miangolarra, A. Taghvaei, Y. Chen, T. Georgiou, "Inertialess Gyrating Engines", PNAS Nexus, Volume 1, Issue 5, November 2022,

A. A. Joshi, A. Taghvaei, P. G. Mehta, S. P. Meyn, "Controlled interacting particle algorithms for simulation-based reinforcement learning", System & Control Letters, Volume 170,105392, 2022,

O. Movilla Miangolarra, A. Taghvaei, Y. Chen, and T. T. Georgiou, "Thernodynamic engine powered by anisotropic fluctuations", Phys. Rev. Research, 4, 023218, Jun 2022

O. Movilla Miangolarra, A. Taghvaei, Y. Chen, and T. T. Georgiou, "Geometry of finite time thermodynamic cycles with anisotropic thermal fluctuations", IEEE Control Systems Letters,vol. 6, pp. 3409-3414, 2022

O. Movilla Miangolarra, A. Taghvaei, R. Fu, Y. Chen, and T. T. Georgiou. "Energy harvesting from anisotropic fluctuations," Phys. Rev. E 104, 044101, Oct 20

A. Taghvaei and P. G. Mehta, "Optimal Transportation Methods in Nonlinear Filtering,"in IEEE Control Systems Magazine, vol. 41, no. 4, pp. 34-49, Aug. 2021

A. Taghvaei and P. G. Mehta, "On the Lyapunov Foster criterion and Poincare inequality for Reversible Markov Chains," in IEEE Transactions on Automatic Control,

O. Movilla Miangolarra, A. Taghvaei, R. Fu, Y. Chen, and T. T. Georgiou,"Underdamped stochastic

thermodynamic engines in contact with a heat bath with arbitrary temperature profile,"Phys. Rev. E 103, 062103, Jun 2021

A. Taghvaei, O. Movilla Miangolarra, R. Fu, Y. Chen and T. T. Georgiou, "On the Relation Between Information and Power in Stochastic Thermodynamic Engines," in IEEE Control Systems Letters, vol. 6, pp. 434-439, 2022,

J. Kim, A. Taghvaei, Y. Chen, P. G. Mehta, "Feedback particle filter for collective inference," Foundations of Data Science, 3(3), 543:561, 2021

R. Fu, A. Taghvaei, Y. Chen, T. T. Georgiou, "Maximal power output of a stochastic thermodynamic engine," Automatica, 123, 109366, 2021

A. Taghvaei and P. G. Mehta, "An Optimal Transport Formulation of the Ensemble Kalman Filter," in IEEE Transactions on Automatic Control, vol. 66, no. 7, pp. 3052-3067, July 2021,

A. Taghvaei, T. T. Georgiou, L. Norton, and A. Tannenbaum, "Fractional SIR epidemiological models", Scientific reports 10, 1, 1-15, 2020

A. Taghvaei, P. G. Mehta, and S. P. Meyn, "Diffusion Map-based Algorithm for Gain Function Approximation in the Feedback Particle Filter", SIAM/ASA Journal on Uncertainty Quantification, 8(3), 1090-1117, 2020

C. Zhang, A. Taghvaei and P. G. Mehta, "A Mean-Field Optimal Control Formulation for Global Optimization," in IEEE Transactions on Automatic Control, vol. 64, no. 1, pp. 282-289,Jan. 2019

C. Zhang, A. Taghvaei and P. G. Mehta, "Feedback Particle Filter on Riemannian Manifolds and Matrix Lie Groups," in IEEE Transactions on Automatic Control, vol. 63, no. 8, pp.2465-2480, Aug. 2018

A. Taghvaei, J. de Wiljes, P. G. Mehta, and S. Reich, "Kalman Filter and Its Modern Extensions for the Continuous-Time Nonlinear Filtering Problem." ASME. J. Dyn. Sys., Meas.,Control. March 2018; 140(3): 030904

Conference proceedings

Y. Mei, A. Taghvaei, A. Pakniyat. "A Time-Reversal Control Synthesis for Steering the State of Stochastic Systems" IEEE Conference on Decision and Control (CDC), Rio, Brazil, 2025

Y. Mei, A. Taghvaei. "Time-reversal solution of BSDEs in stochastic optimal control: a linear quadratic study". IEEE American Control Conference (ACC), 2025

A. Taghvaei, "Time-reversal of stochastic maximum principle", IEEE Conference on Decision and Control (CDC), Milan, 2024

M. Al-Jarrah, B. Hosseini, A. Taghvaei, "Data-Driven Approximation of Stationary Nonlinear Filters with Optimal Transport Maps",IEEE Conference on Decision and Control (CDC), Milan, 2024

D. Grange, R. Baptista, A. Taghvaei, A. Tannenbaum, S. Phillips, "Distributed Nonlinear Filtering using Triangular Transport Maps", IEEE American Control Conference (ACC), 2024

D. Grange, M Al-Jarrah, R. Baptista, A. Taghvaei, T. T. Georgiou, S. Phillips, A.Tannenbaum, "Computational optimal transport and filtering on Riemannian manifolds", IEEE American Control Conference (ACC), 2024

O. Movilla Miangolarra, A. Taghvaei, and T. T. Georgiou, "A matching principle for power transfer in Stochastic Thermodynamics", IEEE Conference on Decision and Control (CDC),Singapore, 2023

M. Al-Jarrah, B. Hosseini, A. Taghvaei, "Optimal transport particle filters", IEEE Conference on Decision and Control (CDC), Singapore, 2023

S. Talebi, A. Taghvaei, and M. Mesbahi, "Duality-Based Stochastic Policy Optimization for Estimation with Unknown Noise Covariances", American Control Conference (ACC), 2023

O. Movilla Miangolarra, A. Taghvaei, and T. T. Georgiou, "Minimal entropy production in anisotropic temperature fields", American Control Conference (ACC), 2023

O. Movilla Miangolarra, A. Taghvaei, Y. Chen, and T. T. Georgiou, "Geometry of finite time thermodynamic cycles with anisotropic thermal fluctuations", IEEE Conference on Decision and Control (CDC), Cancun, Mexico, 2022

A. Taghvaei and B. Hosseini, "An Optimal Transport Formulation of Bayes' Law for Nonlinear Filtering Algorithms", IEEE Conference on Decision and Control (CDC), Cancun,Mexico, 2022

Taghvaei, P. G. Mehta, T. T. Georgiou, "Optimality vs Stability Trade-off in Ensemble Kalman Filters", International Symposium on Mathematical Theory of Networks and Systems (MTNS), Bayreuth, Germany, 2022

A. Taghvaei, O. Movilla Miangolarra, R. Fu, Y. Chen, T. T. Georgiou, "On the relation between information and power in stochastic thermodynamic engines", IEEE Conference on Decision and Control (CDC), Austin, December 2021

A. Dong, A. Taghvaei, T. T. Georgiou, "Lasso formulation of the shortest path problem",IEEE Conference on Decision and Control (CDC), 402-407, Jeju Island, Republic of Korea,December 2020

R. Fu, O. Movilla, A. Taghvaei, Y. Chen, T. T. Georgiou, "Harvesting energy from aperiodic heat bath", IEEE Conference on Decision and Control (CDC), 3034-3039, Jeju Island,Republic of Korea, December 2020

S. Y. Olmez, A. Taghvaei, P. G. Mehta, "Deep FPF: Gain function approximation in high dimensions", IEEE Conference on Decision and Control (CDC), 4790-4795, Jeju Island,Republic of Korea, December 2020.

T. Wang, A. Taghvaei, P. G. Mehta, "Bio-inspired Learning of Sensorimotor Control for Locomotion", IEEE American Control Conference (ACC), 2188–2193, Denver, July 2020.

A. Taghvaei, P. G. Mehta, T. T. Georgiou, "Optimality vs Stability Trade-off in Ensemble Kalman Filters", 24th International Symposium on Mathematical Theory of Networks and Systems (MTNS), 2020

T. Wang, A. Taghvaei, P. G. Mehta, "Q-learning for POMDP: An application to learning locomotion gaits", IEEE Conference on Decision and Control (CDC), 2758–2763, Nice, France,December 2019.

J. W. Kim, A. Taghvaei, P. G. Mehta, S. P. Meyn, "An approach to duality in nonlinear filtering", IEEE American Control Conference (ACC), 5360–5365, Philadelphia, July 2019.

A. Taghvaei, P. G. Mehta, "Error analysis of the stochastic linear feedback particle filter",IEEE Conference on Decision and Control (CDC), 7194–7199, Miami, December 2018.

J. Kim, A. Taghvaei, P. G. Mehta, "Derivation and Extensions of the Linear Feedback Particle Filter based on Duality Formalisms", IEEE Conference on Decision and Control (CDC),7188–7193, Miami, December 2018.

A. Taghvaei, P. G. Mehta, "Error analysis of the linear feedback article filter", IEEE American Control Conference (ACC), 4261–4266, Milwaukee, June 2018.

A. Taghvaei, P. G. Mehta. S. P. Meyn, "Error Estimates for the Kernel Gain Function Approximation in the Feedback Particle Filter", IEEE American Control Conference (ACC),4576–4582, Seattle, May 2017.

C. Zhang, A. Taghvaei, P. G. Mehta, "Attitude Estimation of a Wearable Motion Sensor",IEEE American Control Conference (ACC), 4570–4575, Seattle, May 2017.

A. Taghvaei, P. G. Mehta, "Gain Function Approximation in the Feedback Particle Filter".IEEE Conference on Decision and Control (CDC), 5446–5452 Las Vegas, December 2016.

C. Zhang, A. Taghvaei, P. G. Mehta. "Attitude Estimation with Feedback Particle Filter".IEEE Conference on Decision and Control (CDC), 5440–5445, Las Vegas, December 2016.

A. Taghvaei, P. G. Mehta. "An Optimal Transport Formulation of Linear Feedback Particle Filter". IEEE American Control Conference (ACC), 3614–3619, Boston, June 2016.

C. Zhang, A. Taghvaei, P. G. Mehta. "Feedback Particle Filter on Matrix Lie group", IEEE American Control Conference (ACC), 2723–2728, Boston, June 2016.

A. Taghvaei, S. A. Hutchinson, and P. G. Mehta. "A Coupled Oscillator-based Control Architecture for Locomotory Gaits". IEEE Conference on Decision and Control (CDC), 3487–3492, Los Angeles, December 2014.

Teaching Experience

Undergraduate courses

Control Systems in Aerospace (AA 447), University of Washington, Seattle, Spring, '22, '24
Student evaluation score (4.6/5 & 4.3/5)

Graduate courses

Linear Systems Theory (AA 547), University of Washington, Seattle, Winter, '24, '25
Student evaluation score (4.6/5, 4.8/5)

Nonlinear Systems and Control (AA 583), University of Washington, Seattle, Fall, '21, '22, '23
Student evaluation score (4.4/5 & 4.3/5 & 4.8/5)

Estimation and System Identification (AA 549), University of Washington, Seattle, Spring, '23, '25
Student evaluation score (4.4/5, 4.3/5)

Estimation Theory (AE 514), University of Washington, Seattle, Fall, '24
Student evaluation score (4.3/5)

Honours and Awards

CSE Fellow[1], Computational Science and Engineering, UIUC, 2016-2017,

Ranked 9th in **National University Entrance Exam**, Iran, 2008

Invited talks

(semi-planary lecture) Towards data-driven nonlinear filtering algorithms, the 26th International Symposium on Mathematical Theory of Networks and Systems (MTNS), Cambridge, UK, August 2024

From diffusion models to stochastic control: a time-reversal methodology for feedback control design, Seminar in Applied Mathematics, University of Washington, Seattle, Oct, 2025

Towards Data-Driven Nonlinear Filtering Algorithms, Presented at the 1st MMS Workshopfor Young Researchers Department of Mathematics, Kyoto University, Kyoto, Japan, Nov,2024

Variatioanal Optimal Transport Methods in Nonlinear Filtering, Presented at 7th Workshopon Cognition and Control Univ. of Florida, Gainsville, Jan. 2024

The role of optimal transportation and geometry on stochastic thermodynamics, PIMS-IFDS- NSF Summer School on Optimal Transport, University of Washington , Seattle, June, 2022

Variational Wassserstein Gradient flow, Kantorovich Initiative Retreat, Univesity of Washington, Seattle, Mar, 2022

Optimal Transportation Methods in Nonlinear filtering, Nonlinear Dynamics and Controls Lab (NDCL), Univesity of Washington, Seattle, Feb, 2022

Controlled Interacting Particle Systems for Estimation and Sampling, University of Washington, Feb, 2021

Feedback Particle Filter: Design, Estimation, and Error Analysis. University of California Los Angeles, Nov, 2019

[1] Annual award to outstanding graduate students with interdisciplinary and computationally oriented research.

Feedback Particle Filter: Design, Estimation, Analysis. University of California Irvine, June, 2019

Poisson equation, its approximation, and error analysis. Mathematical Analysis Seminar Series. University of Illinois at Urbana-Champaign, Feb, 2019

Accelerated Gradient Flow for Probability Distributions, CSL Student Conference, University of Illinois at Urbana-Champaign, Feb, 2019

Efficient Implementation of the Feedback Particle Filter Algorithm in High Dimensions, CSE Annual Meeting: 2017 Fellows Symposium, University of Illinois at Urbana-Champaign, April, 2017.

Bias-Variance Tradeoff in solution to the Poisson Equation, 5th Workshop on Cognition and Control, University of Florida, Gainesville, Jan, 2017

Gain Function Approximation in the Feedback Particle Filter, 5th Workshop on Control and Game Theory, Purdue University, Purdue, April, 2016

Poisson Equation in Learning and Classification, 4th Workshop on Cognition and Control, University of Florida, Gainesville, Jan, 2016

Conference presentations

"A time-reversal methodology for steering the state of control-affine stochastic systems", Presented at the 61th Annual Allerton Conference on Communication, Control, and Computing, Urbana, Illinois, Sep, 2025

"Data-Driven Nonlinear Filtering Algorithms with Optimal Transport Maps" Presented at the SIAM Conference on Computational Science and Engineering (CSE25), Feb, 2025

Variational Optimal Transport Methods for Nonlinear Filtering, Presented at the 2025 Joint Mathematics Meeting (JMM), Seattle, WA, Jan, 2025

Nonlinear Filtering with Brenier Optimal Transport Maps, Presented at the 60th AnnualAllerton Conference on Communication, Control, and Computing, Urbana, Illinois, Sep,2024

"Variatioanal Optimal Transport Methods inNonlinear Filtering", SIAM Conference on Uncertainty Quantification, Trieste, Italy, Feb.2024

"Variational Wasserstein Gradient Flow", SIAM Conference on Optimization,Seattle, May, 2023

"An Optimal Transport Formulation of Bayes' Law for Nonlinear Filtering Algorithms", IEEE Conference on Decision and Control (CDC), Cancun, Mexico, 2022

"Optimality vs Stability Trade-off in Ensemble Kalman Filters", International Symposium on Mathematical Theory of Networks and Systems (MTNS), Bayreuth, Germany, 2022

"Ensemble Kalman filter for reinforcement learning", SIAM Conference on Uncertainty Quantification, Hybrid, April, 2022

"On the relation between information and power in stochastic thermodynamic engines", IEEE Conference on Decision and Control (CDC), December 2021(virtual)

"Optimal transport mapping via input-convex neural networks". International Conference on Machine Learning (ICML), Jun, 2020 (virtual).

"Accelerated flow for probability distributions". International Conference on Machine Learning (ICML), Long Beach, June, 2019.

"Error analysis of the stochastic linear feedback particle filter", IEEE Conference on Decision and Control (CDC), Miami, December 2018.

"Error analysis of the linear feedback article filter", IEEE American Control Conference (ACC), Milwaukee, June 2018.

"Numerical Methods to Solve the Weighted Poisson Equation", SIAM Conference on Uncertainty Quantification, Garden Grove, California, April, 2018

"How regularization effects the critical points in linear neural networks", Advances in Neural In-

formation Processing Systems (NurIPS), Long Beach, December, 2017

"Error Estimates for the Kernel Gain Function Approximation in the Feedback Particle Filter", IEEE American Control Conference (ACC), Seattle, May 2017.

"Gain Function Approximation in the Feedback Particle Filter". IEEE Conference on Decision and Control (CDC), Las Vegas, December 2016.

"An Optimal Transport Formulation of Linear Feedback Particle Filter". IEEE American Control Conference (ACC), Boston, June 2016.

"A Coupled Oscillator-based Control Architecture for Locomotory Gaits". IEEE Conference on Decision and Control (CDC), Los Angeles, December 2014.

Services

Professional society memberships

Institute of Electrical and Electronics Engineers (IEEE)- Member

Society of Industrial and Applied Mathematics (SIAM)- Early Career membership

Student Exam Committees

Served in the qualification exam committee of 10 PhD students

Served in the general exam committee of 9 PhD students

Served in the final dissertation exams committee of 5 PhD students

Reviewing

CDC best student award committee,

Swiss National Science Foundation external reviewer, Summer, 2023

Served in NSF panel review, 2022

Reviewer for Transaction for Automatic Control (TAC) (41 total)

Reviewer for IEEE American Control Conference

Reviewer for IEEE Conference on Decision and Control (CDC)

Reviewer for IFAC journal, Automatica

Reviewer for International Conference on Learning Representation (ICLR)

Reviewer for International Conference on Machine Learning (ICML)

Reviewer for Advances in Neural Information Processing Systems (NurIPS)

Reviewer for IEEE Control Systems letters

Reviewer for SIAM Journal of Uncertainty Quantification (JUQ)

Reviewer for Journal of Machine learning research (JMLR)

Others

Advising the Washington Aerial Robotics registered student organization (RSO), University of Washington, Seattle

Mentoring and financial support of one URM undergraduate student through the Louis Stokes Alliance for Minority Participation (LSAMP) initiative supported by National Science Foundation, Summer 2023

Co-organizing the control-x seminars, University of Washington, Seattle

Organizer of the of the Coordinated Science Laboratory Student Conference, 2015-2018

Organizer of the Coordinated Science Laboratory (CSL) Social Hour, 2015-2017

Participation in Engineering Volunteering In Stem Education (ENVISION), University ofIllinois at Urbana-Champaign, Spring and Fall 2017