ALEC KOPPEL

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Artificial Intelligence Research
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RESEARCH INTERESTS

Stochastic optimization for developing learning methods, both for statistical inference and autonomous control. Topics include: centralized and decentralized convex optimization, large-scale and online learning, reinforcement learning and dynamic programming, and Bayesian/nonparametric statistics. Application areas of interest include robotics and autonomy, sourcing and vendor selection, and financial markets.

EMPLOYMENT

JP Morgan Chase & Co. — New York, NY
Vice President/AI Research Lead — June 2022 - present
AI Research - Multi-agent Learning and Simulation team

Amazon — Bellevue, WA
Research Scientist II — Sept. 2021 - June 2022
Supply Chain Optimization Technologies (SCOT)

U.S. Army Research Laboratory — Adelphi, MD
Research Scientist — Sept. 2017 - Sept. 2021
Computational and Information Sciences Directorate

University of Pennsylvania — Philadelphia, PA
Research Assistant — August 2012 - August 2017
Electrical and Systems Engineering

U.S. Army Research Laboratory — Adelphi, MD
SMART Fellow — July 2013 - July 2017
Computational and Information Sciences Directorate

Washington University in St. Louis — St. Louis, MO
Research Assistant — July 2010 - July 2012
Department of Mathematics; Division of Biostatistics

EDUCATION

University of Pennsylvania — Philadelphia, PA
Ph. D., Electrical & Systems Engineering — August 2017
Thesis: "Stochastic Optimization for Multi-Agent Statistical Learning and Control"
GPA: 3.72; *Advisor*: Prof. Alejandro Ribeiro

The Wharton School, University of Pennsylvania — Philadelphia, PA
M. Sc. Statistics — August 2017
Thesis: "Parameter Estimation in High-Dimensions using Doubly Stochastic Approximation"
GPA: 3.72; *Advisor*: Prof. Dylan Small

Washington University — St. Louis, MO
M. Sc. Systems Science & Mathematics — May 2012
GPA: 3.63; *Advisor*: Prof. Hiro Mukai

Washington University — St. Louis, MO
B.A. Mathematics, Magna Cum Laude — May 2011
Thesis: "Stochastic Methods for the Lotka-Volterra Model with Migration"
GPA: 3.66; *Advisor*: Prof. Renato Feres

ACADEMIC HONORS

- Co-author on paper selected for Spotlight at ICML July 2022
- Mentor to ARL Summer Symposium Best Project Awardee August 2021
- IEEE Robotics & Automation Society Honorable Mention, Best Paper Award May 2021
- Co-author on paper selected for Spotlight at NeurIPS Dec. 2020
- ARL Director's Research Award TRC May 2020
- IEEE SPCOM Best Graduation Day Talk Award (co-author) Jul. 2018
- IEEE Asilomar Signals, Systems, & Computers Best Paper Finalist Nov. 2017
- University of Pennsylvania Award for Exceptional Service to ESE Fall 2016
- SMART National Fellowship, sponsored by U.S. Defense Dept. Summer 2013
- University of Pennsylvania Fellowship Award for graduate studies Fall 2012
- George Washington University Fellowship Award for graduate studies Fall 2012
- Latin Honors: Magna Cum Laude, WashU Dept. of Mathematics Spring 2011

PROFESSIONAL AFFILIATIONS AND SERVICES

- Member of: IEEE Signal Processing Society, Mathematical Optimization Society, INFORMS Optimization Society
- Area Chair for: 2023 ICLR, 2023 ICML
- Program Committee for: 2020-2023 Learning for Dynamics and Control (L4DC), 2019-2023 NeurIPS, 2020-2023 ICML, 2018-2022 Technical Program Affiliate for IEEE Signal Processing Society
- Reviewer for the IEEE publications: Trans. Information Theory, Trans. Signal Processing, Trans. Control of Network Systems, Trans. Automatic Control, ICASSP, SPAWC, CDC
- Reviewer for the Springer publications: Journal of Optimization Theory and Applications (JOTA), Set-Valued and Variational Analysis
- Reviewer for the Machine Learning publications: The Journal of Machine Learning Research, NeurIPS (2018-2022), ICML (2019-2022), ICLR (2021-2023), AAAI (2021-2023)
- Reviewer for SIAM Journal on Optimization, Automatica, European Journal on Signal Processing, Elsevier Signal Process.
- Conference sessions chaired: 2023 IEEE CISS, 2020 INFORMS Annual Meeting, 2019 SIAM ICCOPT, 2019 IEEE Asilomar Conf; 2018 INFORMS Annual Meeting; 2018 INFORMS Optimization Soc. Conf.; 2016 INFORMS Optimization Soc. Conf.; 2015 IEEE Asilomar Conf.;
- Mentor to the Office of Secretary of Defense (OSD) Historically Black Colleges and Universities (HBCU) Summer Internship Program, and ARO Technical Advisor Program
- UPenn ESE Phd Student Colloquium Coordinator Fall 2013-Summer 2017
- UPenn Graduate Students Engineering Group (GSEG) Rep. Fall 2015-Summer 2017

PUBLICATIONS

Journal Papers: Under Review

1. **A. Koppel**, J. Eappen, S. Bhatt, C. Hawkins, S. Ganesh. "Online MCMC Thinning with Kernelized Stein Discrepancy" SIAM Journal on Mathematics of Data Science (SIMODS) (minor revision submitted Aug. 2023). Available as ArXiv 2201.07130

2. W. A. Suttle, **A. Koppel**, J. Liu, "Occupancy Information Ratio: Infinite-Horizon, Information-Directed, Parameterized Policy Search." arXiv preprint arXiv:2201.08832. SIAM Journal on Control and Optimization (Major Revision April 2023)

3. A. S. Bedi, A. Parayil, J. Zhang, M. Wang, **A. Koppel**, "On the Sample Complexity and Metastability of Heavy-tailed Policy Search in Continuous Control," in *Journal of Machine*

Learning Research (revised), Jan. 2023.

4. V. Aggarwal, , Q. Bai, A. S. Bedi, M. Agarwal, **A. Koppel**"Achieving Zero Constraint Violation for Constrained Reinforcement Learning via Primal-Dual Approach," in *Journal of Machine Learning Research* (under review), Aug. 2022.

5. A. S. Bedi, C. Fan, **A. Koppel**, A. K. Sahu, B. M. Sadler, F. Huang, D. Manocha, (2022). "FedBC: Calibrating Global and Local Models via Federated Learning Beyond Consensus." arXiv preprint arXiv:2206.10815.

6. A. Bedi, D. Peddireddy, V. Aggarwal, and **A. Koppel**, "Sublinear Regret and Belief Complexity in Gaussian Process Bandits via Information Thresholding ," IEEE Transactions on Artificial Intelligence, Aug. 2022. arXiv e-prints, arXiv-2003.

7. A. S. Bedi, **A. Koppel**, K. Rajawat, and B.M. Sadler. "Nonstationary Nonparametric Online Learning: Balancing Dynamic Regret and Model Parsimony," in *IEEE Trans. Signal Process* (submitted), Sept. 2019.

Journal Papers: Refereed

8. H. Kumar, **A. Koppel**, and A. Ribeiro. "On the Sample Complexity of Actor-Critic Method for Reinforcement Learning with Function Approximation" in *Machine Learning*, p. 1-35 Springer. Feb 2023.

9. A. Chakraborty, K. Rajawat and **A. Koppel**, "Sparse Representations of Positive Functions via First- and Second-Order Pseudo-Mirror Descent," in IEEE Transactions on Signal Processing, vol. 70, pp. 3148-3164, 10.1109/TSP.2022.3173146. May 2022

10. E. Noorani, Y. Savas, **A. Koppel**, J. S. Baras, U. Topcu, B. M. Sadler, "Collaborative Beamforming Under Localization Errors: A Discrete Optimization Approach," in *Elsevier Signal Processing*, Volume 200, Nov. 2022, 108647.

11. E. Zobeidi, **A. Koppel**, and N. Atanasov, "Dense Incremental Metric-Semantic Mapping via Sparse Gaussian Process Regression," in IEEE Transactions on Robotics (T-RO), 10.1109/TRO.2022.3168733, May 2022.

12. Z. Gao, **A. Koppel**, and A. Ribeiro, "Balancing Rates and Variance via Adaptive Batch-Size for Stochastic Optimization Problems," *IEEE Trans. Signal Process*, 10.1109/TSP.2022.3186526. (to appear), Jun. 2022.

13. A. S. Bedi, K. Rajawat, V. Aggarwal, **A. Koppel**. "Escaping Saddle Points in Successive Convex Approximation," in *IEEE Trans. Signal Processing* Volume: 70, pp. 307-321 , Issue: 3, May 2022. DOI: 10.1109/TSP.2021.3138242.

14. **A. Koppel**, A. S. Bedi, V. Elvira, and B.M. Sadler. "Nearly Consistent Finite Particle Estimates in Streaming Importance Sampling," in *IEEE Trans. Signal Processing*, 2022. DOI: 10.1109/TSP.2021.3120512, Dec 2021.

15. **A. Koppel**, H. Pradhan, and K. Rajawat. "Consistent Online Gaussian Process Regression Without the Sample Complexity Bottleneck," in *Statistics and Computing*, Springer, Sept. 2021.

16. J. Zhang, A. S. Bedi, M. Wang, and **A. Koppel.** "Cautious Reinforcement Learning via Distributional Risk in the Dual Domain" in *IEEE Journal on Selected Areas in Information Theory*: Special Issue on Sequential, Active, and Reinforcement Learning, May 2021.

17. R. Pradhan, A. S. Bedi, **A. Koppel**, and K. Rajawat. "Adaptive Kernel Learning in Heterogeneous Networks " in *IEEE Trans. Signal and Info. Process. over Networks*, 2021.

18. D. S. Kalhan, A. S. Bedi, **A. Koppel**, K. Rajawat, H. Hassani, A. Gupta, and A. Banerjee. "Dynamic Online Learning via Frank-Wolfe Algorithm" in *IEEE Trans. Signal Process.* 2021.

19. A. S. Bedi, **A. Koppel**, P. Sanyal, and K. Rajawat. "Nonparametric Compositional Stochastic Optimization: Algorithms for Robust Online Learning with Kernels," in *IEEE Trans. Signal Process.* 2021.

20. A. Mokhtari and **A. Koppel**. "High-Dimensional Nonconvex Stochastic Optimization by Doubly Stochastic Successive Convex Approximation" in *IEEE Trans. Signal Process*, Volume 68 (2020): 6287-6302. Oct. 2020.

21. Y. Tian, **A. Koppel**, and A. S. Bedi, and J. How, "Asynchronous and Parallel Distributed Pose Graph Optimization," in *IEEE Robotics and Automation Letters* , Volume 5, no. 4 (2020): 5819-5826, Oct. 2020., **Honorable Mention for Best Paper Award, IEEE Robotics and Automation Society**

22. A. Mokhtari, **A. Koppel**, M. Takáč, and A. Ribeiro, "A Class of Doubly Random Parallel Stochastic Methods for Large Scale Learning," in *Journal of Machine Learning Research*, 21(120):1-51, 2020

23. K. Zhang, **A. Koppel**, H. Zhu, and T. M. Başar. "Global Convergence of Policy Gradient Methods to (Almost) Locally Optimal Policies" in *SIAM Journal on Control and Optimization* DOI 10.1137/19M1288012 , Dec. 2020.

24. **A. Koppel**, G. Warnell, E. Stump, P. Stone, and A. Ribeiro. "Policy Evaluation in Continuous MDPs with Efficient Kernelized Gradient Temporal Difference," in *IEEE Trans. Automatic Control*, DOI 10.1109/TAC.2020.3029315. Volume 66, Issue: 4 Pages: 1856-1863, April 2021.

25. **A. Koppel**, A. S. Bedi, K. Rajawat, and B.M. Sadler. "Optimally Compressed Nonparametric Online Learning: Tradeoffs between memory and consistency," in *IEEE Signal Processing Magazine*, Volume 37 , Issue: 3, May 2020.

26. A. S. Bedi, **A. Koppel**, and K. Rajawat. "Asynchronous Online Learning in Multi-Agent Systems with Proximity Constraints" in *IEEE Transactions on Signal and Information Processing over Networks*, Volume 5, no. 3 (2019): 479-494. 2019

27. **A. Koppel**, K. Zhang, H. Zhu, and T. M. Başar. "Projected Stochastic Primal-Dual Method for Constrained Online Learning with Kernels" in *IEEE Trans. Signal Process.*, Volume 67, no. 10 (2019): 2528-2542, May 2019.

28. A. S. Bedi, **A. Koppel**, and K. Rajawat, "Asynchronous Online Learning in Multi-Agent Systems with Proximity Constraints," *IEEE Transactions on Signal and Information Processing over Networks*, Volume 5, no. 3, pp. 479-494, Sept. 2019

29. **A. Koppel**, S. Paternain, C. Richard, and A. Ribeiro. "Decentralized online learning with kernels." *IEEE Trans. Signal Process*, Volume 66, no. 12 (2018): 3240-3255.

30. **A. Koppel**, G. Warnell, E. Stump, and A. Ribeiro, "Parsimonious Online Learning with Kernels via Sparse Projections in Function Space," in Journal of Machine Learning Research, Jan. 2019

31. **A. Koppel**, B. Sadler, and A. Ribeiro, "Proximity without Consensus in Online Multi-Agent Optimization," in *IEEE Trans. Signal Proc*, Volume 65 No. 12 , Page 3062-3077, June 15, 2017.

32. **A. Koppel**, G. Warnell, E. Stump, and A. Ribeiro, "D4L: Decentralized Dynamic Discriminative Dictionary Learning," *IEEE Trans. Signal Info. Process. over Networks*, Volume 3, no. 4 (2017): 728-743..

33. A. Simonetto, **A. Koppel**, A. Mokhtari, G. Leeus, and A. Ribeiro, "Decentralized Prediction-Correction Methods for Networked Time-Varying Convex Optimization," *IEEE Trans. Automatic Control*, Volume 62, No. 11. Nov, 2017.

34. A. Simonetto, A. Mokhtari, **A. Koppel**, G. Leeus, and A. Ribeiro, "A Class of Prediction-Correction Methods for Time-Varying Convex Optimization," *IEEE Trans. Signal Process*,

Volume 64, no. 17 (2016): 4576-4591.

35. **A. Koppel**, F. Jakubeic, and A. Ribeiro, "A saddle point algorithm for networked online convex optimization," *IEEE Trans. Signal Process.*, Volume 63, no. 19 (2015): 5149-5164.

Conference Papers

1. A. Mishler, Mohsen Ghassemi, **A. Koppel**, S. Ganesh, "Model Robustness and Active Learning with Missing-Not-At-Random Outcomes," in 2023 UAI Workshop on Epistemic Uncertainty in Artificial Intelligence

2. S. Chakraborty, A.S. Bedi, P. Tokekar, **A. Koppel**, M. Wang, F. Huang "Principal-Driven Reward Design and Agent Policy Alignment via Bilevel-RL" in ILHF Workshop at ICML 2023

3. H. He, **A. Koppel**, A. S. Bedi, D. Stilwell, M. Farhood, B. Biggs, "Bi-Level Nonstationary Kernels for Online Gaussian Process Regression" in *2023 IEEE 19th International Conference on Automation Science and Engineering* (CASE), Aug 26 - 30, 2023.

4. W. A. Suttle, A.S. Bedi, B. Patel, B. M. Sadler, **A. Koppel**, D. Manocha,"Beyond Exponentially Fast Mixing in Average-Reward Reinforcement Learning via Multi-Level Monte Carlo Actor-Critic" in 2023 International Conference on Machine Learning (ICML)

5. S. Chakraborty, A.S. Bedi, P. Tokekar, **A. Koppel**, M. Wang, F. Huang, D. Manocha,"STEERING: Stein Information Directed Sampling for Efficient Exploration in Model-Based Reinforcement Learning" in 2023 International Conference on Machine Learning (ICML)

6. M. A. Zaman, M. Lauriére, **A. Koppel**, T. Başar, "Receding Horizon Policy Gradient for Zero-Sum Mean-Field Type Games," in 2023 57th Annual Conference on Information Sciences and Systems (CISS)

7. W. Suttle, **A. Koppel**, J. Liu, "Information-Directed Policy Search in Sparse-Reward Settings via the Occupancy Information Ratio," in 2023 57th Annual Conference on Information Sciences and Systems (CISS)

8. A. S. Bedi, C. Fan, **A. Koppel**, A. K. Sahu, F. Huang, D. Manocha, "Federated Learning Beyond Consensus," in 2023 57th Annual Conference on Information Sciences and Systems (CISS)

9. D. Ying, Y. Ding., **A. Koppel**, J. Lavaei, "Scalable Multi-Agent Reinforcement Learning with General Utilities" in 2023 IEEE *American Control Conference* (ACC).

10. S. Chakraborty, A.S. Bedi, P. Tokekar, **A. Koppel**, B.M. Sadler, F. Huang, D. Manocha, "Posterior Coreset Construction with Kernelized Stein Discrepancy for Model-Based Reinforcement Learning" in 2023 Conference on Artificial Intelligence (AAAI). arXiv preprint arXiv:2206.01162.

11. W. A. Suttle, **A. Koppel**, J. Liu, "Occupancy Information Ratio: Infinite-Horizon, Information-Directed, Parameterized Policy Search," Workshop paper at 2023 AAAI Symposium on Machine Learning for Dynamical Systems.

12. S. Chakraborty, A.S. Bedi, P. Tokekar, **A. Koppel**, B.M. Sadler, F. Huang, D. Manocha,"Stein Information Directed Sampling for Efficient Exploration in Model-Based Reinforcement Learning" Workshop paper at 2023 AAAI Workshop on Reinforcement Learning Ready for Production.

13. M. A. Zaman, **A. Koppel**, S. Bhatt, and T. Başar. "Oracle-free Reinforcement Learning in Mean-Field Games along a Single Sample Path" in 2023 Artificial Intelligence and Statistics (AISTATS) arXiv preprint arXiv:2208.11639.

14. S. Chakraborty, A.S. Bedi, K. Mudiyanselage, P. Poddar, **A. Koppel**, P. Tokekar, D. Manocha, "Dealing with Sparse Rewards in Continuous Control Robotics via Heavy-Tailed Policy Optimization" in *International Conference on Robotics and Automation* (ICRA), May 29 - June 2, 2023.

15. H. He, **A. Koppel**, A. S. Bedi, D. Stilwell, M. Farhood, B. Biggs, "Decentralized Multi-agent Exploration with Limited Inter-agent Communications" in *International Conference on Robotics and Automation* (ICRA), May 29 - June 2, 2023.

16. Y. Tian, A. S. Bedi, **A. Koppel**, M. Calvo-Fullana, D. M. Rosen, J. P. How, "Distributed Riemannian Optimization with Lazy Communication for Collaborative Geometric Estimation ," in 2022 *IEEE Conference on Intelligent Robotics and Systems* (IROS). Available as arXiv:2203.00851.

17. **A. Koppel**, A. S. Bedi, B. Ganguly, V. Aggarwal, "Convergence Rates of Average-Reward Multi-agent Reinforcement Learning via Randomized Linear Programming ," in 2022 *IEEE Conference on Decision and Control* (CDC).

18. Q Jin, **A Koppel**, K Rajawat, A Mokhtari "Sharpened Quasi-Newton Methods: Faster Superlinear Rate and Larger Local Convergence Neighborhood" **Spotlight** in *International Conference on Machine Learning* (ICML), July 19-21, 2022.

19. A. S. Bedi, S. Chakraborty, A. Parayil, B. M. Sadler, P. Tokekar, **A. Koppel**, "On the Hidden Biases of Policy Mirror Ascent in Continuous Action Spaces," **Spotlight** in *International Conference on Machine Learning (ICML), July 19-21, 2022*

20. H. Pradhan, **A. Koppel**, K. Rajawat, " On Submodular Set Cover Problems For Near-Optimal Online Kernel Basis Selection ," in *2022 IEEE International Conference on Acoustics, Speech, & Signal Processing* (ICASSP), May 2022.

21. J. Di, E. Zobeidi, A. Koppel, N. Atanasov, " Distributed Gaussian Process Mapping for Robot Teams with Time-varying Communication ," in *2022 IEEE American Control Conference* (ACC), June 2022.

22. W. Suttle, **A. Koppel**, and J. Liu, "Policy gradient for ratio optimization: a case study ," in 2022 *IEEE Conference on Information Science and Systems* (CISS).

23. Q Bai, A. S. Bedi, M. Agarwal, **A. Koppel**, V. Aggarwal, "Achieving Zero Constraint Violation for Constrained Reinforcement Learning via Primal-Dual Approach" in 2022 Thirty-Sixth AAAI Conference on Artificial Intelligence (AAAI-22).

24. J. Zhang, A. S. Bedi, M. Wang, **A. Koppel**, "Multi-Agent Reinforcement Learning with General Utilities via Decentralized Shadow Reward Actor-Critic" in 2022 Thirty-Sixth AAAI Conference on Artificial Intelligence (AAAI-22).

25. **A. Koppel**, J. Zhang, A. S. Bedi, M. Wang, "Intermittent Communications in Decentralized Shadow Reward Actor-Critic," in *IEEE Conference on Decision and Control* (CDC), Austin, TX, Dec. 13-15 2021

26. S. Bhatt, W. Mao, **A. Koppel**, T. Başar, "Semiparametric Information State Embedding for Policy Search under Imperfect Information," in *IEEE Conference on Decision and Control* (CDC), Austin, TX, Dec. 13-15 2021

27. A. Chakraborty, K. Rajawat, and **A. Koppel**, "Projected Pseudo-Mirror Descent in Reproducing Kernel Hilbert Space" in *Asilomar Conference on Signals, Systems, and Computers*, Oct. 31 - Nov 3rd, 2021.

28. E. Noorani, Y. Savas, **A. Koppel**, J. S. Baras, U. Topcu, B. M. Sadler, "Collaborative Beamforming for Agents with Localization Errors," in *Asilomar Conference on Signals, Systems, and Computers*, Oct. 31 - Nov 3rd, 2021.

29. **A. Koppel**, A. S. Bedi, B. Ganguly, and V. Aggarwal, "Randomized Linear Programming for Tabular Average-Cost Multi-agent Reinforcement Learning" in *Asilomar Conference on Signals, Systems, and Computers*, Oct. 31 - Nov 3rd, 2021.

30. M. Kepler, **A. Koppel**, A. S. Bedi, D. Stillwell "Wasserstein-Splitting Gaussian Process Regression for Heterogeneous Online Bayesian Inference," in *IEEE International Conference on Intelligent Robotics and Systems*(IROS), Sept. 27-Oct. 1, 2021.

31. **A. Koppel**, A. S. Bedi, and V. Krishnamurthy, "A Dynamical Systems Perspective on Online Bayesian Nonparametric Estimators with Adaptive Hyperparameters," in *Int. Conf. Acoustics Speech Signal Process* (ICASSP), 6-11 June 2021.

32. A. Parayil, A. S. Bedi, and **A. Koppel**, "Joint Position and Beamforming Control via Alternating Nonlinear Least-Squares with a Hierarchical Gamma Prior," in *IEEE American Control Conf.* (ACC), May 26-28, 2021

33. J. Zhang, A. S. Bedi, M. Wang, and **A. Koppel**, "Beyond Cumulative Returns via Reinforcement Learning over State-Action Occupancy Measures," in *IEEE American Control Conf.*, May 26-28, 2021

34. Z. Gao, **A. Koppel**, and A. Ribeiro, "Incremental Greedy BFGS: An Incremental Quasi-Newton Method with Explicit Superlinear Rate," in *Neural Information Processing Systems* (NeurIPS), Workshop on Optimization for Machine Learning, **Spotlight**, 11-12 Dec. 2020

35. J. Zhang, **A. Koppel**, A. S. Bedi, C. Szepesvári, M. Wang, "Variational Policy Gradient Method for Reinforcement Learning with General Utilities," in *Neural Information Processing Systems* (NeurIPS), **Spotlight**, 6-12 Dec. 2020

36. H. Pradhan, A. Bedi, **A. Koppel**, K. Rajawat, "Conservative Multi-agent Online Kernel Learning in Heterogeneous Networks," in *IEEE Proc. Asilomar Conf. Signals, Systems, Computers*, Pacific Grove, CA, Nov. 8-11, 2020.

37. E. Zobeidi, **A. Koppel**, and N. Atanasov, "Dense Incremental Metric-Semantic Mapping via Sparse Gaussian Process Regression," in *IEEE Proc. Int. Conf. Intelligent Robotics and Systems* (IROS), Las Vegas, NV, Oct. 25-9, 2020.

38. A.S. Bedi, **A. Koppel**, K. Rajawat, B.M. Sadler, "Trading Dynamic Regret for Model Complexity in Nonstationary Nonparametric Optimization," in *IEEE American Control Conference*, Denver, Colorado, Jul. 1-3, 2020.

39. A. S. Bedi, D. Peddireddy, V. Aggarwal, **A. Koppel**, "Efficient Large-Scale Gaussian Process Bandits by Believing only Informative Actions," in 2nd Annual Conference on Learning for Dynamics and Control (L4DC), Berkeley, CA, Jun. 6-9, 2020.

40. D. S. Kalhan, A. S. Bedi, **A. Koppel**, K. Rajawat, A. Gupta, and A. Banerjee, "Projection Free Dynamic Online Learning," in *IEEE Proc. Int. Conf. Acoustics Speech Signal Process (ICASSP)*, Barcelona, Spain, May. 4-8, 2020.

41. Z. Gao, **A. Koppel**, and A. Ribeiro, "Balancing Rates and Variance via Adaptive Batch-Sizes in First-Order Stochastic Optimization," in *IEEE Proc. Int. Conf. Acoustics Speech Signal Process (ICASSP)*, Barcelona, Spain, May. 4-8, 2020.

42. **A. Koppel**, A.S. Bedi, V. Elvira, B.M. Sadler, "A Projection Operator to Balance Consistency and Complexity in Importance Sampling," in *Neural Information Processing Systems, Symposium on Advances in Approximate Bayesian Inference*,Vancouver, Canada, Dec. 8, 2019.

43. H. Kumar, **A. Koppel**, Alejandro Ribeiro, "On the Sample Complexity of Actor-Critic for Reinforcement Learning," in *Neural Information Processing Systems, Workshop on Optimization Foundations of Reinforcement Learning*, Vancouver, Canada, Dec. 14, 2019.

44. S. Bhatt, **A. Koppel**, V. Krishnamurthy, "Policy Gradient using Weak Derivatives for Reinforcement Learning," in *IEEE Conference on Decision and Control* (CDC), Nice, France, Dec. 11-13, 2019.

45. K. Zhang, **A. Koppel**, H. Zhu, T. Başar, "Convergence and Iteration Complexity of Policy Gradient Methods for Infinite-horizon Reinforcement Learning," in *IEEE Conference on Decision and Control* (CDC), Nice, France, Dec. 11-13, 2019.

46. S. Bhatt, **A. Koppel**, V. Krishnamurthy, "Policy Search using Jordan Decomposition for Reinforcement Learning," in *IEEE Conference on Information Sciences and Systems* (CISS),

Baltimore, MD, Mar. 20-22, 2019.

47. K. Zhang, **A. Koppel**, H. Zhu, T. Başar, "Policy Search in Infinite-Horizon Discounted Reinforcement Learning: Advances through Connections to Non-Convex Optimization," in *IEEE Conference on Information Sciences and Systems* (CISS), Baltimore, MD, Mar. 20-22, 2019.

48. **A. Koppel**, A. S. Bedi, K. Rajawat, "Controlling the the Bias-Variance Tradeoff via Coherent Risk for Robust Learning with Kernels," in *American Control Conference*, Philadelphia, PA, July 10-12, 2019.

49. **A. Koppel**, "Consistent Online Gaussian Process Regression Without the Sample Complexity Bottleneck," in *American Control Conference*, Philadelphia, PA, July 10-12, 2019.

50. H. Pradhan, A. S. Bedi, **A. Koppel**, and K. Rajawat, "Exact Decentralized Online Nonparametric Optimization," in *IEEE Global Conf. on Signal and Info. Processing* (GlobalSIP), Anaheim, CA, Nov. 26-28, 2018.

51. **A. Koppel**, S. Paternain, C. Richard, and A. Ribeiro,"Decentralized Online Nonparametric Learning", in Proc. Asilomar Conf. Signals, Systems, Computers, Pacific Grove, CA, Oct. 28-31, 2018.

52. A. S. Bedi, **A. Koppel**, and K. Rajawat, "Asynchronous Saddle Point Method: Interference Management Through Pricing," in *IEEE Conf. on Decision and Control* (CDC), Miami Beach, FL, Dec. 17-19, 2018.

53. K. Zhang, H. Zhu, T. Başar, and **A. Koppel** , "Projected Stochastic Primal-Dual Method for Constrained Online Learning with Kernels,"in *IEEE Conf. on Decision and Control* (CDC), Miami Beach, FL, Dec. 17-19, 2018.

54. E. Tolstaya, E. Stump, **A. Koppel**, and A. Ribeiro, "Composable Learning with Sparse Kernel Representations," in *International Conference on Intelligent Robots and Systems* (IROS), Madrid, Spain, Oct 1-5, 2018.

55. E. Tolstaya, **A. Koppel**, E. Stump, and A. Ribeiro, "Nonparametric Stochastic Compositional Gradient Descent for Q-Learning in Continuous Markov Decision Problems," in *American Control Conference*, Milwaukee, WI, June 27-29, 2018.

56. **A. Koppel**, A. Mokhtari, and A. Ribeiro, "Parallel Stochastic Successive Convex Approximation Method for Large-Scale Dictionary Learning," in *Proc. Int. Conf. Acoustics Speech Signal Process*, Calgary, Canada, Apr. 15-20, 2018.

57. **A. Koppel**, S. Paternain, C. Richard, and A. Ribeiro, "Decentralized Efficient Nonparametric Stochastic Optimization", in *IEEE Global Conference on Signal and Information Processing*, Montreal, Canada, Nov. 14-16, 2017.

58. A. S. Bedi, **A. Koppel**, and K. Rejawat, "Beyond Consensus and Synchrony in Decentralized Online Optimization using Saddle Point Method" in *Proc. Asilomar Conf. on Signals Systems Computers*, Pacific Grove, CA, Oct. 29-Nov. 1, 2017. **Best Paper Finalist, IEEE Signal Processing Society**

59. M. Fazylab, **A. Koppel**, V. Preciado, and A. Ribeiro, "A Variational Approach to Dual Methods for Constrained Convex Optimization," in *American Control Conference*, Seattle, WA, May 24-26, 2017.

60. A. Mokhtari, **A. Koppel**, and G. Scutari, A. Ribeiro, "Large-Scale Non-Convex Stochastic Optimization by Doubly Stochastic Successive Convex Approximation," in *Proc. Int. Conf. Acoustics Speech Signal Processing*, New Orleans, LA, USA Mar. 5-9 2017.

61. **A. Koppel**, G. Warnell, E. Stump, and A. Ribeiro, "Parsimonious Online Learning with Kernels via Sparse Projections in Function Space," in *Proc. Int. Conf. Acoustics Speech Signal Process*, New Orleans, LA, USA Mar. 5-9 2017.

62. **A. Koppel**, B. M. Sadler, and A. Ribeiro, "Decentralized Online Optimization with Heterogeneous Data Sources", *IEEE Global Conference on Signal and Information Processing* (to appear), Washington, DC, Dec. 7-9, 2016.

63. **A. Koppel**, A. Mokhtari, and A. Ribeiro "Doubly Random Parallel Stochastic Methods for Large Scale Optimization." in *Proc. Asilomar Conf. on Signals Systems Computers*, Pacific Grove, CA, November 6-9 2016.

64. **A. Koppel**, J. Fink, G. Warnell, E. Stump, and A. Ribeiro, "Online Learning for Characterizing Unknown Environments in Ground Robotic Vehicle Models," in *Proc. Int. Conf. Intelligent Robotics and Systems*, South Korea, Oct. 2016

65. A. Simonetto, **A. Koppel**, A. Mokhtari, G. Leus, and A. Ribeiro, "A Quasi-Newton Prediction-Correction Method for Decentralized Dynamic Convex Optimization", *European Control Conference*, Aalborg, Denmark, June 29 - July 1, 2016.

66. A. Mokhtari, **A. Koppel**, and A. Ribeiro, "Doubly Random Parallel Stochastic Methods for Large Scale Learning," in *American Control Conference*, Boston, MA, July 6-8 2016.

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71. **A. Koppel**, G. Warnell, E. Stump, and A. Ribeiro "Task-Driven Dictionary Learning in Distributed Online Settings." in *Proc. Asilomar Conf. on Signals Systems Computers*, Pacific Grove, CA, November 8-11 2015.

72. **A. Koppel**, G. Warnell, E. Stump, and A. Ribeiro, "D4L: Decentralized Dynamic Discrminative Dictionary Learning," in *Proc. Int. Conf. Intelligent Robotics and Systems*, Hamburg, Germany, Sep 28-Oct2 2015.

73. **A. Koppel**, F. Jakubeic and A. Ribeiro, "Regret Bounds of a distributed saddle point algorithm," in *Proc. Int. Conf. Acoustics Speech Signal Process.*, Brisbane Australia, Apr 19-24 2015.

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Technical Reports and Theses

1. **A. Koppel**, "Stochastic Optimization For Multi-Agent Statistical Learning And Control." Phd Dissertation, Dept. of Electrical and Systems Engineering, University of Pennsylvania, June 2017.

2. **A. Koppel**, "Parameter Estimation in High-Dimensions using Doubly Stochastic Approximation." MS Thesis, Dept. of Statistics, The Wharton School, University of Pennsylvania, May 2017.

3. V. Ganesan, **A. Koppel**, S. Han, J. Conroy, A. Wickenden, R. Murray, and W. Nothwang.

"Implementation and Validation of Bioplausible Visual Servoing Control." ARL-TR- 6387; U.S. Army Research Laboratory: Adelphi, MD, March 2013.

4. **A. Koppel**, E. Stump, W. Nothwang, and B. Sadler. "An Adaptive Stochastic Differential System for Multi-Agent Coordination." Army Research Laboratory Technical Report. Aug. 2012.

5. **A. Koppel**, V. Ganesan, A. Wickenden, W. Nothwang. "Slow Computing Simulation of Bio-Plausible Control." ARL-TR-5959; U.S. Army Research Laboratory: Adelphi, MD, March 2012

6. **A. Koppel** and R. Feres. "Stochastic Methods for the Lotka-Volterra Model with Migration." Bachelors Honors Thesis. Washington University in St. Louis, Mar. 2011.

SKILLS

- *Programming Languages*: MATLAB & SIMULINK, Python, R, SAS
- *Applications*: LATEX, Microsoft Office, CVX
- *Operating Systems*: Microsoft Windows 7/XP/2000, Linux, Ubuntu, Mac OSX
- *Languages*: English (native), Spanish (proficient)

TEACHING EXPERIENCE

Teaching Certification, **UPenn's Center for Teaching** & **Learning** Fall 2015

Teaching assistant, **University of Pennsylvania**

- "Signal and Information Processing" (Instructor: Prof. Ribeiro) Spring 2015
- "Modern Convex Optimization" (Instructor: Prof. Ribeiro) Spring 2014
- "Engineering Probability", (Instructor: Prof. Sarkar) Fall 2013

Teaching assistant & ***Peer Academic Mentor***, **WashU**

- "Calculus of Several Variables" (Instructor: Prof. Thornton) Spring 2011
- "Matrix Algebra" (Instructor: Prof. Freiwald) Fall 2010
- "Calculus III", (Instructor: Prof. Blank) Fall 2010
- "Calculus II", (Instructor: Prof. Feres) Spring 2009

MENTORING EXPERIENCE

ARL Research Associates: **Undergraduates**

- Andi Johnson, "Pseudo-input search in Online Gaussian Processes" Summer 2020
  Affiliation: BA student, Math, Eastern New Mexico University
- Gisselle Contreras, "Adapting Hyper-parameters in Kernel Regression" Summer 2020
  Affiliation: BA student, ECE, UT San Antonio
- Dylan Scott, "Adaptive Gradient Methods for Non-stationary Learning" Summer 2020
  Affiliation: BA student, CS, Hampton University

ARL Research Associates: **Graduate Fellows**

- Bingjia Wang, "Compressed GPs for Policy Search" Summer 2020 - present
  Affiliation: MS student, ECE, Cornell University
- James Berneburg, "RL for Event-Triggered Control" Summer 2020 - present
  Affiliation: Phd student, ECE, George Mason University
- Kaiqing Zhang, "Non-convex optimization approaches to policy search" Summer 2018
  Affiliation: Phd student, ECE University of Illinois Urbana-Champaign
- Hrusikesha Pradhan, "Compressions of Gaussian Processes" Fall 2018 - present
  Affiliation: Phd student, EE, India Institute of Technology, Kanpur
- Sujay Bhatt, "Variance-reduced policy gradients via weak-derivatives" Fall 2018
  Affiliation: Phd student, ECE, Cornell University

ARL Research Associates: **Postdoctoral Fellows**

- Amrit Singh Bedi, "Risk in Bayesian & Reinforcement Learning" Winter 2019 - present
- Anjaly Parayil, "Control Design for Decentralized Beamforming" Winter 2020 - present

Other Mentorship Experience: **Graduate Fellows**

- Yagiz Savas, "Beamforming with Localization Errors" Summer 2019 - present
  Affiliation: Phd student, University of Texas at Austin
- Erfaun Noorani, "Beamforming with Localization Errors" Summer 2019 - present
  Affiliation: Phd student, University of Maryland, College Park
- Ehsan Zobeidi, "Gaussian Processes for Occupancy Mapping" Spring 2019 - present
  Affiliation: Phd student, University of California, San Diego
- Zhan Gao, "Covarying Step and Batch-sizes in Learning" Spring 2019 - present
  Affiliation: Phd student, ESE, UPenn
- Harshat Kumar, "Sample Complexity of Actor-Critic in RL" Summer 2018 - Fall 2019
  Affiliation: Phd student, ESE, UPenn
- Mathew Rittonia, " Defenses to Black Box Data Poisoning " Spring - Summer 2019
  Affiliation: MS student, AMS, Johns Hopkins University
- Ekaterina Tolstaya, "Compressed Kernel Q Learning" Fall 2016 - Spring 2018
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