Cassidy K. Buhler (she/her)

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About

I'm a Ph.D. candidate on the job market for a research position (e.g. post-doc, applied scientist, research scientist) and am particularly interested in roles which address environmental challenges using AI and ML.

Education

2024 **Ph.D. Business Analytics** ***Drexel University***
Minor: Computational Data Science Philadelphia, PA
Thesis: Advances in Optimization with Applications to Nature Conservation
Expected Graduation: June 2024

2019 **B.S. Mathematics** ***University of Utah***
Salt Lake City, UT

Employment

2019 – Present **Graduate Research Assistant** ***Drexel University***
Led research projects in nonlinear and mixed-integer optimization.

1. Mixed-Integer Optimization

- Developed a mixed-integer nonlinear programming (MINLP) framework for spatial conservation planning as a computational tool for conservationists.
- Utilized population viability analysis to gain insight into a species' extinction risk and merged with MINLP framework to find the cheapest collection of parcels that best protect a vulnerable species.
- Framework promotes interdisciplinary work, as it allows for more complex decision inputs and can be paired with existing ecological software.

Presentations:
- *AAAI 2024, Rising Scholars Conference 2023 (MIT Sloan), INFORMS 2023, SIAM 2023, & NEDSI 2023.*

Papers:
- *Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs.*
- *Optimal land conservation decisions for multiple species.*

2. Nonlinear Optimization

- Advanced unconstrained optimization methods for nonlinear programming, with special emphasis on large-scale machine learning problems.
- Formulated a quasi-Newton algorithm by applying hybrid cubic regularization to nonlinear conjugate gradient methods (CGM).
- Solver exhibits reduced iteration count, faster CPU runtime, and improved theoretical guarantees compared to non-regularized CGM.

Presentations: *SIAM 2021, INFORMS 2021, & INFORMS 2020.*

Papers:
- *Regularized step directions in nonlinear conjugate gradient methods.* Under review.
- *Nonlinear conjugate gradient methods for machine learning.* In progress.

2019 – Present **Instructor & Teaching Assistant** ***Drexel University***
Department of Decision Sciences & MIS

- Served as an instructor for 4 classes and 2 workshops, and as a TA for 25+ classes.
- Created and delivered instructional materials for BS, MS, MBA, Executive MBA, and PhD students.
- Earned two awards for teaching performance, along with student course evaluation scores above the college and department average.

Awards: *TA Excellence Award 2022 & TA Excellence Award (Highly Commended) 2021*

Subjects: *Statistics, Operations Research, Supply Chain Management, Operations Management, MIS, Business Analytics, & Data Mining.*

Employment (continued)

2018 – 2021 **Research Assistant** ***University of Utah***
Department of Mathematics

- Developed mathematical models to understand the response of castration-resistant prostate cancer under various treatment regimens.
- Simulated the dynamics of biological systems as differential equations, formulating the models with differing mechanism complexity.
- Evaluated modern treatment regimens under this scheme and disseminated findings to academic and medical audiences.

Paper: *Do mechanisms matter? Comparing cancer treatment strategies across mathematical models.*

2018 **Computer Scientist Intern** ***United States Air Force***
Hill Air Force Base

- Conducted research related to improving software for USAF aircraft in the Software Engineering Group.
- Hired under the Premier College Intern Program (PCIP) and earned a position in the PALACE Acquire (PAQ) program.

Technical Skills

Coding

Language	*Libraries/Packages/Toolboxes*
Python	PyTorch, TensorFlow, Pandas, BeautifulSoup, scikit-learn, Keras, Seaborn, rasterio.
R	tidyverse, ggplot, rgdal, raster, rgeos, SDMTools, deSolve.
MATLAB	Deep Learning, Statistics & Machine Learning, Optimization, Financial, Computer Vision.

Optimization Software

Solver	*Applications*
GUROBI	Quadratic programming, Linear programming
Pyomo	Mixed-integer nonlinear programming
CVX	Convex programming
CPLEX	Integer programming
AMPL	Unconstrained nonlinear programming

Publications

C. K. Buhler and H. Y. Benson, "Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs," in *Proceedings of the AAAI Conference on Artificial Intelligence.*, Acceptance rate 24.2%, 2024. DOI: 10.48550/arXiv.2308.11549, forthcoming.

C. K. Buhler and H. Y. Benson, "Optimal land conservation decisions for multiple species," in *Proceedings of the 52nd Northeast Decision Science Institute Annual Conference*, vol. 52, Washington, D.C., 2023, pp. 808–816.

C. K. Buhler, R. S. Terry, K. G. Link, and F. R. Adler, "Do mechanisms matter? Comparing cancer treatment strategies across mathematical models and outcome objectives," *Mathematical Biosciences and Engineering*, vol. 18, no. 5, pp. 6305–6327, 2021, ISSN: 1551-0018. DOI: 10.3934/mbe.2021315.

Under Review

C. K. Buhler, H. Y. Benson, and D. F. Shanno, "Regularized step directions in nonlinear conjugate gradient methods," *arXiv preprint arXiv:2110.06308*, 2021, Under 2nd round of review at Mathematical Programming Computation. DOI: 10.48550/arXiv.2110.06308.