Cassidy K. Buhler (she/her)

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Education

Expected 2024 **Ph.D. Business Analytics, Computational Data Science Minor** — Drexel University, Philadelphia, PA
Thesis: *Advances in optimization with applications to nature conservation*

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

Employment

2019 – Present **Graduate Research Assistant** — *Drexel University*

Led research projects in nonlinear programming, centered on improving solver efficiency for large-scale optimization, as well as mixed-integer programming projects applied to environmental conservation.

Nonlinear Programming

- 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.

Talks: INFORMS 2020, INFORMS 2021, and SIAM 2021.
Papers:

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

Mixed-Integer Programming

- 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.

Talks: Rising Scholars Conference (MIT Sloan), INFORMS 2023, and SIAM 2023.
Papers:

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

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.
- Subjects: Statistics, Business Analytics, Operations Research, Supply Chain Management, Operations Management, MIS, and 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

Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs
Proceedings of the 38th AAAI Conference on Artificial Intelligence (2024). Forthcoming. (24.2% acceptance rate)
Cassidy K. Buhler & Hande Y. Benson

Optimal land conservation decisions for multiple species
Proceedings of the 52nd Northeast Decision Science Institute Annual Conference (2023). vol. 52, pp. 808–816.
Cassidy K. Buhler & Hande Y. Benson

Do mechanisms matter? Comparing cancer treatment strategies across mathematical models and outcome objectives
Mathematical Biosciences and Engineering (2021). vol. 18, no. 5, pp. 6305–6327
Cassidy K. Buhler, Rebecca S. Terry, Kathryn G. Link, Frederick R. Adler

Under Review

Regularized step directions in nonlinear conjugate gradient methods
Under 2nd round of review at *Mathematical Programming Computation*.
Cassidy K. Buhler, Hande Y. Benson, David F. Shanno