

Cassidy K. Buhler (she/her)

✉ cb3452@drexel.edu

in cassie-buhler

🌐 cassiebuhler.github.io/

🐙 cassiebuhler

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 Minor: Computational Data Science <i>Thesis: Advances in Optimization with Applications to Nature Conservation</i> <i>Expected Graduation: June 2024</i>	Drexel University Philadelphia, PA
2019	B.S. Mathematics <i>Statistics Emphasis</i>	University of Utah Salt Lake City, UT

Interests

AI for Conservation; Spatial Conservation Planning; Conservation Decision-Making; Environmental Data Science; Machine Learning; Mixed-Integer Programming; Nonlinear Programming; Operations Research;

Publications

Journal Articles

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](#).

Refereed Conference Proceedings

C. K. Buhler and H. Y. Benson, "Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs," in *Proceedings of the 38th Annual 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.

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](#).

In Progress

C. K. Buhler and H. Y. Benson, "Efficient solution of portfolio optimization problems via dimension reduction and sparsification," *arXiv preprint arXiv:2306.12639*, Working paper. [DOI: 10.48550/arXiv.2306.12639](#).

C. K. Buhler and H. Y. Benson, "Regularized nonlinear conjugate gradient methods for machine learning," Working paper.

Research Experience

- 2019 – **Doctoral Research Fellow** **Drexel University**
Present *Department of Decision Sciences & MIS*
Led research projects in nonlinear and mixed-integer optimization with applications in machine learning and conservation decision-making.
- Project Area #1: Mixed-Integer Optimization + Conservation Decision-Making**
- 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.
- Project Area #2: Nonlinear Optimization + Machine Learning**
- 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.
- 2018 – **Research Assistant** **University of Utah**
2021 *Department of Mathematics*
- Advised by Professor Frederick Adler as an Research Experience for Undergraduates (REU) project.
 - 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.
- 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 and earned a position in the PALACE Acquire program.

Teaching Experience

- 2019 – **Instructor** **Drexel University**
Present *Department of Decision Sciences & MIS*
- Created, organized, and delivered instructional materials for undergraduate and PhD classes/workshops.
 - Earned two awards for teaching performance, along with student course evaluation scores above the college and department average.

Course	Level	Quarter	Skills
BSAN 360: Programming for Data Analytics	U	Winter 2022	R
Ph.D. Programming Bootcamp	PhD	Summer 2021; Summer 2022	Python
MIS 200: Management Information Systems (Recitation Section)	U	Fall 2019; Fall 2020; Winter 2021	MS Access; Excel; HTML

*Undergraduate (U)

Teaching Experience (continued)

2020 – **Teaching Assistant**

Drexel University

Present *Department of Decision Sciences & MIS*

- Served TA for 25+ classes, assisting undergraduate, MS, MBA, Executive MBA, and PhD students.

Course	Level	Quarter	Skills
BSAN 360: Programming for Data Analytics	U	Spring 2021	R
MIS 612: Aligning Information Systems & Business Strategies	EMBA; MBA	Fall 2023	-
MIS 625: Management of Information Technology Operations	MBA	Fall 2023	-
OPM 200: Operations Management	U	Spring 2020; Fall 2021; Spring 2023	-
OPM 341: Supply Chain Management	U	Spring 2021; Spring 2022; Fall 2022	Excel
OPM 344: Revenue Management	U	Fall 2022	Excel
OPR 320: Linear Models for Decision Making	U	Summer 2020; Spring 2021	Excel
STAT 201: Intro to Business Statistics	U	Winter 2020; Spring 2020; Fall 2021; Summer 2022; Spring 2023; Winter 2024	Excel
STAT 202: Business Statistics II	U	Summer 2021; Spring 2023	Excel
STAT 205: Statistical Inference I	U	Spring 2020; Fall 2021	Excel
STAT 206: Statistical Inference II	U	Summer 2021	Excel
STAT 510: Intro to Statistics for Business Analytics	MBA	Summer 2023; Winter 2024	Excel
STAT 642: Data Mining for Business Analytics	MS; PhD	Winter 2023	R

*Undergraduate (U)

2018 – **Computer Lab Assistant & Mathematics Tutor**

University of Utah

2019 *T. Benny Rushing Mathematics Student Center*

- Provided math and programming assistance for undergraduate classes.
- Subjects: Intermediate Algebra, College Algebra, Calculus, Linear Algebra, Applied Statistics.
- Programming: MATLAB, Python, & R.

Software

Derivative-Free Optimization for Land Conservation

A mathematical programming tool for conservationists that allows for linear and nonlinear inputs, continuous and discrete variables, and can be paired with existing ecological software.

📄 <https://github.com/cassiebuhler/conservation-dfo>

🔗 R, Python, RAMAS.

Conmin-CG: Hybrid Cubic Regularization of Conjugate Gradient Methods

An optimization algorithm with memoryless and matrix-free properties that solves large-scale problems more efficiently by improving nonlinear conjugate gradient step quality with hybrid cubic regularization.

📄 <https://github.com/cassiebuhler/ConminCG>

🔗 C, MATLAB, and Python.

Technical Skills

Coding

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

Optimization Software

Solver	Proficiency	Applications
GUROBI	★★★★☆	quadratic programming, linear programming
Pyomo	★★★★☆	mixed-integer nonlinear programming
CVX	★★★☆☆	convex programming
CPLEX	★★★☆☆	integer programming
AMPL	★★★☆☆	unconstrained nonlinear programming

Basic: ★★☆☆☆

Intermediate: ★★★☆☆

Advanced: ★★★★☆

Expert: ★★★★★

Awards & Grants

2024	NCEAS Travel Grant	NCEAS
	<ul style="list-style-type: none">Funding to attend the National Center for Ecological Analysis and Synthesis (NCEAS) Environmental Data Science Summit at UC Santa Barbara.	
2023	Rising Scholar	MIT Sloan
	<ul style="list-style-type: none">Selected from a competitive pool of Ph.D. and postdoctoral scholars to present research at the Rising Scholars Conference hosted by the MIT Sloan School of Management.One of the first from Drexel University, out of the 225+ Rising Scholars from 2020-2023 cohorts.	
2023	Graduate Student Travel Subsidy Award	Drexel University
	<ul style="list-style-type: none">Funding to present at the INFORMS Annual Meeting in Phoenix, AZ.	
2023	DEI & Environment and Sustainability Innovation Micro-Grant	Drexel University
	<ul style="list-style-type: none">Awarded to research projects with contributions to DEI or environmental sustainability.Project: "Black-box optimization for reserve design in biodiversity conservation".	
2023	Teck-Kah Lim Graduate Student Travel Subsidy Award	Drexel University
	<ul style="list-style-type: none">Funding to present at the SIAM Conference on Optimization in Seattle, WA.	
2023	SIAM Student Travel Award	SIAM
	<ul style="list-style-type: none">Funding to present at the SIAM Conference on Optimization in Seattle, WA.	
2023	ESIIL Travel Grant	ESIIL
	<ul style="list-style-type: none">Funding to attend the Environmental Data Science Innovation & Inclusion Lab (ESIIL) Innovation Summit at CU Boulder.	
2022	Teaching Assistant Excellence Award	Drexel University
	<ul style="list-style-type: none">Recognizes graduate students who exhibit exemplary commitment to student learning, based on nominations and evaluations from undergraduate students and faculty.	
2021	Teaching Assistant Excellence Award (Highly Commended)	Drexel University
	<ul style="list-style-type: none">Recognizes graduate students who exhibit exemplary commitment to student learning, based on nominations and evaluations from undergraduate students and faculty.Award committee recognized finalists as "highly commended".	

Awards & Grants (continued)

2021	SIAM Student Travel Award • Funding to present at the SIAM Conference on Optimization.	SIAM
2019	Undergraduate Research Scholar Designation • Awarded to undergraduate students who conducted two semesters of research, presented at the Undergraduate Research Symposium, and published in the Undergraduate Research Journal.	University of Utah
2019	Research Experience for Undergraduates (REU) • Grant for undergraduate students conducting research with a faculty member. • Advisor: Professor Frederick Adler. • Project: Mathematical Modeling of Adaptive Therapy in Prostate Cancer.	University of Utah

Presentations

2024	AAAI Conference on Artificial Intelligence (AAAI-24) Poster: Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs.	Vancouver, BC, Canada.
2023	MIT Sloan Rising Scholars Conference Talk: Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs.	Cambridge, MA (Virtual)
2023	INFORMS Annual Meeting Talk: Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs.	Phoenix, AZ.
2023	SIAM Conference on Optimization Talk: Reserve design in biodiversity conservation.	Seattle, WA.
2023	NEDSI Annual Conference Talk: Optimal land conservation decisions for multiple species.	Washington, D.C.
2021	INFORMS Annual Meeting Talk: Regularized step directions in conjugate gradient minimization for machine learning.	Anaheim, CA. (Virtual)
2021	SIAM Conference on Optimization Talk: Conjugate gradient methods for machine learning.	Virtual.
2020	INFORMS Annual Meeting Talk: Efficient solution of portfolio optimization problems via dimension reduction & sparsification.	Virtual.

Service

2023	Session Chair <i>Nonlinear Optimization in Machine Learning Session.</i>	INFORMS Annual Meeting
2023	Session Organizer <i>Nonlinear Optimization and Applications Minisymposium.</i>	SIAM Conference on Optimization
2023	Session Chair <i>Land, Sand, and Plastic Management Session</i>	NEDSI Annual Conference
2022	Panelist <i>Teaching Assistance Orientation Session.</i>	Drexel University

Service (continued)

2019 **Mathematics Tutor - Volunteer**

Utah Prison Education Project

Timpanogos Women's Correctional Facility

- Tutored students who are incarcerated in a Salt Lake Community College math course.

Organizations

AAAI: Association for the Advancement of Artificial Intelligence

AWM: Association for Women in Mathematics

ESA: Ecological Society of America

INFORMS: The Institute for Operations Research and the Management Sciences

SIAM: Society for Industrial and Applied Mathematics

References

Hande Benson, *Ph.D. Research Advisor*
Professor of Decision Sciences and MIS
Drexel University
✉ hvb22 [at] drexel [dot] edu

Frederick Adler, *Undergraduate Research Advisor*
Professor of Biology and Mathematics
Director, School of Biological Sciences
University of Utah
✉ adler [at] math [dot] utah [dot] edu