Cassidy K. Buhler (she/her)

cb3452@drexel.edu 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** — ***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***
Statistics Emphasis — 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 – Present **Doctoral Research Fellow** ***Drexel University***
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 – 2021 **Research Assistant** ***University of Utah***
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 – Present **Instructor** ***Drexel University***
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 – Present **Teaching Assistant** ***Drexel University***
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 – 2019 **Computer Lab Assistant & Mathematics Tutor** ***University of Utah***
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, SDMTools, 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*
- 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*
- 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.
- Out of the 225+ Rising Scholars from 2020-2023 cohorts, only 3 are from Drexel University.

2023 **Graduate Student Travel Subsidy Award** *Drexel University*
- Funding to present at the INFORMS Annual Meeting in Phoenix, AZ.

2023 **DEI & Environment and Sustainability Innovation Micro-Grant** *Drexel University*
- 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*
- Funding to present at the SIAM Conference on Optimization in Seattle, WA.

2023 **SIAM Student Travel Award** *SIAM*
- Funding to present at the SIAM Conference on Optimization in Seattle, WA.

2023 **ESIIL Travel Grant** *ESIIL*
- Funding to attend the Environmental Data Science Innovation & Inclusion Lab (ESIIL) Innovation Summit at CU Boulder.

2022 **Teaching Assistant Excellence Award** *Drexel University*
- 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*
- 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** *SIAM*

- Funding to present at the SIAM Conference on Optimization.

2019 **Undergraduate Research Scholar Designation** *University of Utah*

- Awarded to undergraduate students who conducted two semesters of research, presented at the Undergraduate Research Symposium, and published in the Undergraduate Research Journal.

2019 **Research Experience for Undergraduates (REU)** *University of Utah*

- Grant for undergraduate students conducting research with a faculty member.
- Advisor: Professor Frederick Adler.
- Project: Mathematical Modeling of Adaptive Therapy in Prostate Cancer.

Presentations

2024 **AAAI Conference on Artificial Intelligence (AAAI-24)** *Vancouver, BC, Canada.*

Poster: Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs.

2023 **MIT Sloan Rising Scholars Conference** *Cambridge, MA (Virtual)*

Talk: Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs.

2023 **INFORMS Annual Meeting** *Phoenix, AZ.*

Talk: Decision-making for land conservation: A derivative-free optimization framework with nonlinear inputs.

2023 **SIAM Conference on Optimization** *Seattle, WA.*

Talk: Reserve design in biodiversity conservation.

2023 **NEDSI Annual Conference** *Washington, D.C.*

Talk: Optimal land conservation decisions for multiple species.

2021 **INFORMS Annual Meeting** *Anaheim, CA. (Virtual)*

Talk: Regularized step directions in conjugate gradient minimization for machine learning.

2021 **SIAM Conference on Optimization** *Virtual.*

Talk: Conjugate gradient methods for machine learning.

2020 **INFORMS Annual Meeting** *Virtual.*

Talk: Efficient solution of portfolio optimization problems via dimension reduction & sparsification.

Service

2023 **Session Chair** *INFORMS Annual Meeting*

Nonlinear Optimization in Machine Learning Session.

2023 **Session Organizer** *SIAM Conference on Optimization*

Nonlinear Optimization and Applications Minisymposium.

2023 **Session Chair** *NEDSI Annual Conference*

Land, Sand, and Plastic Management Session

2022 **Panelist** *Drexel University*

Teaching Assistance Orientation Session.

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