Cassidy K. Buhler (she/her)

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Education

2024 **Ph.D. Operations & 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

2019 – Present **Doctoral Research Fellow** — ***Drexel University***
Department of Decision Sciences & MIS
Applied optimization methods and models to address challenges in machine learning and land conservation.

Research Area #1: Mixed-Integer Nonlinear Optimization + Conservation Decision-Making

- Developed an open-source decision-making tool for spatial conservation planning using a novel optimization framework that minimizes a species' predicted extinction risk.
- Framework allows for more complex decision inputs compared to existing spatial planning models, and can be paired with existing ecological software.

Research Area #2: Nonlinear Optimization + Machine Learning

- Advanced unconstrained optimization methods for nonlinear programming by improving the step direction calculation in nonlinear conjugate gradient methods.
- Algorithm exhibited reduced iteration count when solving large instances of machine learning problems.

Research (continued)

2018 – 2021 **Research Assistant** ***University of Utah***
Department of Mathematics
- Developed math models to study the response of castration-resistant prostate cancer under various treatment regimens.
- Simulated biological dynamics as differential equations, formulating 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

2019 – Present **Instructor** ***Drexel University***
Department of Decision Sciences & MIS
- Created, organized, and delivered instructional materials for undergraduate and PhD classes/workshops.
- Earned two student-nominated awards for teaching performance, along with 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)

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)*

Teaching (continued)

2018 – 2019 **Computer Lab & Mathematics Assistant** ***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 Languages: MATLAB, Python, & R.

Software

Derivative-Free Optimization for Land Conservation
`https://github.com/cassiebuhler/conservation-dfo`
</> R, Python, RAMAS.

Conmin-CG: Hybrid Cubic Regularization of Conjugate Gradient Methods
`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 *Environmental Data Science Summit* hosted by the *National Center for Ecological Analysis and Synthesis* (NCEAS) 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*.
- 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*
- Funding to present at the *2023 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 *2023 SIAM Conference on Optimization* in Seattle, WA.

Awards & Grants (continued)

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

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

2022 **Teaching Assistant Excellence Award** *Drexel University*
- Graduate students who exhibit an exemplary commitment to student learning, based on nominations and evaluations from undergraduate students and faculty.

2021 **Teaching Assistant Excellence Award (Highly Commended)** *Drexel University*
- Graduate students who exhibit an exemplary commitment to student learning, based on nominations and evaluations from undergraduate students and faculty. Finalists are recognized as "highly commended".

2021 **SIAM Student Travel Award** *SIAM*
- Funding to present at the *2021 SIAM Conference on Optimization*.

2019 **Undergraduate Research Scholar** *University of Utah*
- Awarded to students who conducted 2 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.

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

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Drexel University
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Frederick Adler, *Undergraduate Research Advisor*
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