Damek Davis

Contact

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Google Scholar

Interests

I am broadly interested in the mathematics of data science, particularly the interplay of optimization, signal processing, statistics, and machine learning.

Positions

2022–	**Associate Professor (with tenure)** *Operations Research and Information Engineering*	Cornell University
2016–2022	**Assistant Professor** *Operations Research and Information Engineering*	Cornell University
Sept-Dec 2022	**Senior Fellow** *Program on Computational Microscopy*	Institute for Pure and Applied Mathematics
Aug-Oct 2017	**Visiting Research Scientist** *Program on Bridging Continuous and Discrete Optimization*	Simons Institute for the Theory of Computing
2015–2016	**NSF Mathematics Postdoctoral Fellow**	University of California, Los Angeles

Education

2010-2015	**Ph.D. in Mathematics** Thesis: *On the Design and Analysis of Operator-Splitting Schemes* Committee: Wotao Yin (chair), Stefano Soatto (co-chair), Stan Osher, Lieven Vandenberghe	University of California, Los Angeles
2006-2010	**B.S. summa cum laude** Majoring in Mathematics	University of California, Irvine

Honors and Awards

2023	**SIAM Activity Group on Optimization Best Paper Prize** SIAM
2020	**NSF CAREER Award** Budget: $454,000
2020	**Sloan Research Fellowship in Mathematics** Budget: $75,000
2019	**Young Researchers Prize** INFORMS Optimization Society
2019	**Finalist: Best Paper Prize for Young Researchers in Continuous Optimization (One of Four)** ICCOPT
2018	**A. W. Tucker Dissertation Prize Finalist (One of Two)** Mathematical Optimization Society

2015 **NSF Mathematics Postdoctoral Fellowship**
Budget: $150,000

2015 **Dissertation Prize**
Pacific Journal of Mathematics

2014 **Student Paper Prize**
INFORMS Optimization Society

2010 **NSF Graduate Research Fellowship**
Title: *Generalized Washnitzer and Dagger Algebras and a More General p-Adic Cohomology Theory in Rigid Analysis*

2009 **Elected to Phi Beta Kappa (Junior Year)**

Funding

2020 **NSF CAREER Award**
Budget: $454,000

2020 **Sloan Research Fellowship in Mathematics**
Budget: $75,000

2015 **NSF Mathematics Postdoctoral Fellowship**
Budget: $150,000

Publications

Invited Talks

June 2023 **A nearly linearly convergent first-order method for nonsmooth functions with quadratic growth** Paris, France
Continuous Optimization Workshop, Foundations of Computational Mathematics 2023

Spring 2023 **Leveraging ``partial'' smoothness for faster convergence in nonsmooth optimization** Pasadena, California
CMX Lunch Seminar, Caltech

Fall 2022 **Leveraging ``partial'' smoothness for faster convergence in nonsmooth optimization** Los Angeles, California
Level Set Seminar, UCLA

Fall 2022 **Leveraging ``partial'' smoothness for faster convergence in nonsmooth optimization** Los Angeles, California
Seminar, IPAM workshop on computational microscopy

Fall 2022 **Leveraging ``partial'' smoothness for faster convergence in nonsmooth optimization** Los Angeles
Seminar, UCLA Department of Computer Science

Fall 2022 **Leveraging "partial" smoothness for faster convergence in nonsmooth optimization** Palo Alto, California
ISL seminar, Stanford

Fall 2022 **Leveraging ``partial'' smoothness for faster convergence in nonsmooth optimization** Evanston, Illinois
Seminar, Northwestern University Department of Statistics and Data Science

Nov 2022	**A nearly linearly convergent first-order method for nonsmooth functions with quadratic growth** OPTML++ seminar, MIT	Virtual
July 2022	**A nearly linearly convergent first-order method for nonsmooth functions with quadratic growth** International Conference on Continuous Optimization	Lehigh, Pennsylvannia
May 2022	**Avoiding saddle points in nonsmooth optimization** Workshop on Robustness and Resilience in Stochastic Optimization and Statistical Learning: Mathematical Foundations Ettore Majorana Foundation And Centre For Scientific Culture	Erice, Italy
February 2022	**Avoiding saddle points in nonsmooth optimization** Theoretical Computer Science Seminar, University at Illinois, Chicago	Virtual
Dec 2021	**Plenary Talk: Avoiding saddle points in nonsmooth optimization** OPT2021 NeurIPS Workshop	Virtual
Nov 2021	**Avoiding saddle points in nonsmooth optimization** One World Optimization Seminar	Virtual
July 2021	**Avoiding saddle points in nonsmooth optimization** SIAM Optimization Conference	Virtual
Nov 2020	**Nonconvex Optimization for Estimation and Learning: Dynamics, Conditioning, and Nonsmoothness** CRM Applied Math Seminar, McGill University	Montreal, Quebec, Canada
June 2020	**Proximal methods avoid active strict saddles of weakly convex functions** Foundations of Computational Mathematics (Cancelled due to COVID)	Vancouver, Canda
May 2020	**Stochastic Algorithms with Geometric Step Decay Converge Linearly on Sharp Functions** SIAM Mathematics of Data Science (sessions cancelled due to COVID)	Cincinnati, Ohio
Nov 2019	**Stochastic model-based minimization of weakly convex functions** INFORMS Optimization Society Young Researchers Award Presentation	Seattle, Washington
Nov 2019	**Low-rank matrix recovery with composite optimization: good conditioning and rapid convergence** INFORMS Annual Meeting	Seattle, Washington
Nov 2019	**Stochastic subgradient method converges on tame functions** INFORMS Annual Meeting	Seattle, Washington
August 2019	**Stochastic subgradient method converges on tame functions** ICCOPT Best Paper Prize for Young Researchers in Continuous Optimization Finalist	Berlin, Germany
April 2019	**Nonsmooth and nonconvex optimization under statistical assumptions** Operations Research and Financial Engineering Optimization Seminar, Princeton University	Princeton, New Jersey
Sept 2018	**Stochastic Methods for Non-smooth Non-convex Optimization** Annual Allerton Conference on Communication, Control, and Computing	Urbana-Champaign, Illinois
Aug 2018	**Algorithmic Foundations of Huge-Scale Nonsmooth, NonConvex Optimization with Applications in Data Science** AFOSR Optimization and Discrete Math Program Review	Arlington, Virginia

Aug 2018 **Stochastic Methods for Non-smooth Non-convex Optimization** Lehigh, Pennsylvania
TRIPODS/MOPTA Conference

July 2018 **Convergence rates of stochastic methods for nonsmooth nonconvex problems** Bordeaux, France
International Symposium on Mathematical Programming (ISMP) (cancelled due to Illness)

June 2018 **Stochastic Methods for Non-smooth Non-convex Optimization** Seattle, Washington
DIMACS Workshop on ADMM and Proximal Splitting Methods in Optimization (cancelled due to Illness)

May 2018 **Stochastic Methods for Non-smooth Non-convex Optimization** Seattle, Washington
West Coast Optimization Meeting

April 2018 **Recent progress on nonsmooth nonconvex optimization under statistical assumptions** Cambridge, Massachusetts
Operations Research Center Seminar, MIT

Nov 2017 **Proximally Guided Stochastic Subgradient Method for Nonsmooth, Nonconvex Problems** Houston, Texas
INFORMS Annual Meeting

July 2017 **Trimmed Statistical Estimation via Variance Reduction** Montreal, Quebec, Canada
EUROPT continuous optimization working group of EURO (The Association of European Operational Research Societies)

July 2017 **A SMART Stochastic Algorithm for Nonconvex Optimization with Applications to Robust Machine Learning** New York, New York
Google Brain Seminar

May 2017 **A SMART Stochastic Algorithm for Nonconvex Optimization with Applications to Robust Machine Learning** Los Angeles, California
Applied Mathematics Colloquium, UCLA

May 2017 **A SMART Stochastic Algorithm for Nonconvex Optimization with Applications to Robust Machine Learning** Vancouver, Canada
SIAM Optimization Conference

July 2016 **Fast Algorithms for Robust Machine Learning** New York, New York
Google Internal Seminar

June 2016 **SMART: The Stochastic Monotone Aggregated Root-Finding Algorithm** Waikoloa, Hawaii
INFORMS International Meeting

May 2016 **A Three-Operator Splitting Scheme and its Optimization Applications** Albuquerque, New Mexico
SIAM Conference on Imaging Science

Feb 2016 **SMART: The Stochastic Monotone Aggregated Root-Finding Algorithm** Madison, Wisconsin
Systems, Information, Learning and Optimization (SILO) Seminar, University of Wisconsin, Madison

Oct 2015 **A Three-Operator Splitting Scheme and its Optimization Applications** Seattle, Washington
TOPS Optimization Seminar, University of Washington

July 2015 **A Three-Operator Splitting Scheme and its Optimization Applications** Pittsburg, Pennsylvania
International Symposium on Mathematical Programming (ISMP)

June 2015 **Decentralized Optimization via Operator Splitting** Murray Hill, New Jersey
Bell Labs Prize Innovathon @ Alcatel-Lucent

May 2015 **A Three-Operator Splitting Scheme and its Optimization Applications** Stanford, California
Linear Algebra and Optimization Seminar, Stanford University

Feb 2015 **The Design and Analysis of Large-scale Operator-splitting Schemes** Madison, Wisconsin
Wisconsin Institute for Discovery Colloquium, University of Wisconsin, Madison

Jan 2015 **The Design and Analysis of Large-scale Operator-splitting Schemes** Waterloo, Ontario, Canada
Combinatorics and Optimization Seminar, University of Waterloo

Service

Editorial

2022- **Associate Editor**
Mathematical Programming

Conference/Workshop/Seminar organization

2022- **Stream co-chair for Nonsmooth Optimization** Lehigh University
International Conference on Continuous Optimization

2020- **Cluster co-chair for Continuous Optimization** Beijing, China
International Symposium on Mathematical Programing

2019-2020 **Track co-chair for Optimization in Data Science** Clemson University
INFORMS Optimization Society 2020 Meeting

2016 **OPT2016 Program Committee Member** Barcelona, Spain
Neural Information Processing Systems

Departmental Service

2021 **ORIE Director Reappointment Committee** Cornell University
Operations Research and Information Engineering

2018-2019 **COR-OPT Optimization Seminar** Cornell University
Operations Research and Information Engineering

2018-2020, 2022 **Graduate Admissions Committee** Cornell University
Operations Research and Information Engineering

2016, 2021, 2022 **Masters of Engineering Admissions Committee** Cornell University
Operations Research and Information Engineering

2017-2018 **Colloquium Co-organizer** Cornell University
Center for Applied Math

2016, 2020 **Colloquium Co-organizer** Cornell University
Operations Research and Information Engineering

Reviews

2020, 2021 **Proposal Reviewer**
NSF Division of Mathematical Sciences

2014- **Article Reviewer**
Mathematical Programming Series A/B,
SIAM Journal on Optimization,
Foundations of Computational Mathematics,
Mathematics of Operations Research,
Transactions of the American Mathematical Society,
Set-Valued and Variational Analysis,
Journal of Optimization Theory and Applications,
IEEE Transactions on Automatic Control,
IEEE Signal Processing Magazine

Teaching

Courses

Spring 2022 **ORIE 4740 Statistical Data Mining** Cornell University
Dept: Operations Research and Information Engineering

Fall 2021 **ORIE 7391 Selected Topics in Mathematical Programming** Cornell University
Dept: Operations Research and Information Engineering

Spring 2021 **ORIE 6340 Mathematics of Data Science** Cornell University
Dept: Operations Research and Information Engineering
Course materials available at the following link:
`https://www.dropbox.com/sh/bvxav1pc2nr5n6x/AABn7gEfuYY7qD_ZxUQzJwpma?dl=0`

Fall 2020 **ORIE 3300 Optimization I** Cornell University
Dept: Operations Research and Information Engineering

Fall 2020 **Engineering 1050** Cornell University
Dept: Operations Research and Information Engineering

Spring 2020 **ORIE 4740 Statistical Data Mining** Cornell University
Dept: Operations Research and Information Engineering

Fall 2019 **ORIE 6300 Mathematical Programming I** Cornell University
Dept: Operations Research and Information Engineering
Lecture notes available at the following link:
`https://people.orie.cornell.edu/dsd95/ORIE6300Fall2019notes.pdf`

Fall 2018 **ORIE 3300 Optimization I** Cornell University
Dept: Operations Research and Information Engineering

Spring 2018 **Math 2940 Linear Algebra for Engineers** Cornell University
Dept: Mathematics

Spring 2017 **ORIE 4350 Introduction to Game Theory** Cornell University
Dept: Operations Research and Information Engineering

Fall 2016 **ORIE 6300 Mathematical Programming I** Cornell University
Dept: Operations Research and Information Engineering

Advising

Current PhD Students

2021– **Tao Jiang** Cornell University
Operations Research and Information Engineering
Status: Q Exam Passed

2020– **Liwei Jiang** Cornell University
Operations Research and Information Engineering
Status: Q Exam Passed

2018– **Vasileios Charisopoulos** Cornell University
Operations Research and Information Engineering
Status: A Exam Passed

Former PhD Students

2016–2021 **Mateo Diaz** Cornell University
Computational and Applied Mathematics
Status: Degree Obtained
Thesis: *Complexity, conditioning, and saddle avoidance in nonsmooth optimization*
Next Positions: Postdoc (w/ V. Chandrasekaran and J. Tropp)
Asst. Prof. at Johns Hopkins (Applied Math)

2017–2021 **Benjamin Grimmer** Cornell University
Operations Research and Information Engineering
(Co-adviser: J. Renegar (primary))
Status: Degree Obtained
Thesis: *Some Extensions On The Reach Of First-Order Optimization Theory*
Next Position: Asst. Prof. at Johns Hopkins (Applied Math)

Doctoral Supervising Committee Member:

Si Yi (Cathy) Meng (ORIE), Song (Sam) Zhou (ORIE) , Qinru Shi (CAM), Calvin Wylie (ORIE), Miaolan Xie (ORIE), Tonghua Tian (ORIE)

Former MEng Students (ORIE Capstone Project)

2016–2017 **Kendrick Cancio, Karen Cronk, Alexis Rouge Carrassat** Cornell University
Co-adviser: D. Shmoys
Industry Sponsor: MITRE

Fall 2017 **Henry Zhou, Juan Duran-Vara, Elijah Huang** Cornell University
Putnam Investments
Co-adviser: J. Renegar

2017-2018 **Anne Ng, Antong Su, Charlotte Wang, Umut Yildiz** Cornell University
Industry Sponsor: Equifax

2018-2019 **Chenxin Guo, Dajun Luo, Liyang Du, Zuolin Shen** Cornell University
Industry Sponsor: Equifax

2019-2020 **Percy Zhao, Iris Zhao, Foster Zhen, Betsy Fu** Cornell University
Industry Sponsor: Equifax

2020-2021 **Yixiao He, Xiaoxiang Ma, Yuke Wu, Jiaqi Zhang** Cornell University
Industry Sponsor: Pitney Bowes