

# Mateo Díaz

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## Research Interests

I am interested in the interplay between continuous optimization and high-dimensional statistics, and its applications to data science.

## Education

### **Cornell University**

*Ph.D. Applied Mathematics* (2016–2021)

Committee: Damek Davis (Advisor), Robert Kleinberg, Adrian Lewis, and James Renegar  
Center for Applied Mathematics;

*M.S. Computer Science* (2016–2018)

Computer Science Department.

### **Universidad de los Andes**

*M.S. Mathematics* (2014–2016)

*B.S. Mathematics* (2010–2013)

Department of Mathematics;

*B.S. Systems and Computing Engineering* (2010–2015)

Systems and Computing Engineering Department.

## Employment history

### **Johns Hopkins University**

*Incoming Assistant Professor* (July 2023–)

### **California Institute of Technology**

*Postdoctoral Scholar* (September 2021–June 2023). Hosts: Venkat Chandrasekaran and Joel Tropp.

### **Google Research**

*Research Intern* (Fall 2020). Hosts: Miles Lubin and David Applegate.

### **Rappi** (Colombia)

*Lead Research Scientist* (Summer 2020). Manager: Alejandro Correa.

### **Google Maps**

*Software Intern* (Summer 2019).

### **wOzy**

*Co-founder and developer* (2010-2015).

I co-founded a video game startup during my undergraduate years.

## Publications

### *Published*

**Optimal Convergence Rates for the Proximal Bundle Method**

(with B. Grimmer)

*SIAM Journal on Optimization*, 2023.

**Escaping strict saddle points of the Moreau envelope in nonsmooth optimization**

(with D. Davis and D. Drusvyatskiy)

*SIAM Journal on Optimization*, 2022.

**Optimization of vaccination for COVID-19 in the midst of a pandemic**

(with Q. Luo, R. Weightman, S. T. McQuade, E. Trélat, W. Barbour, D. Work, S. Samanaranayake, B. Piccoli)

*Networks and Heterogeneous Media*, 2022.

**Low-rank matrix recovery with composite optimization: good conditioning and rapid convergence**

(with V. Charisopoulos, Y. Chen, D. Davis, L. Ding, D. Drusvyatskiy)

*Foundations of Computational Mathematics*, 2021.

**Practical Large-Scale Linear Programming using Primal-Dual Hybrid Gradient**

(with D. Applegate, O. Hinder, H. Lu, M. Lubin, B. O'Donoghue, and W. Schudy),

*NeurIPS*, 2021.

**Composite optimization for robust blind deconvolution**

(with V. Charisopoulos, D. Davis, D. Drusvyatskiy)

*Information and Inference*, 2020.

**Efficient Clustering for Stretched Mixtures: Landscape and Optimality**

(with K. Wang and Y. Yan),

*NeurIPS*, 2020.

**Local angles and dimension estimation from data on manifold**

(with A. Quiroz, M. Velasco)

*Journal of Multivariate Analysis*, 2019.

**The nonsmooth landscape of blind deconvolution**

*NeurIPS Workshop on Optimization for Machine Learning*, 2019.

**Compressed sensing of data with known distribution**

(with M. Junca, F. Rincón, M. Velasco)

*Applied and Computational Harmonic Analysis*, 2018.

**In search of balance: The challenge of generating balanced Latin rectangles**

(with C. Gomes, R. Le Bras)

*CPAIOR*, 2017.

### *Preprints*

**Any-dimensional equivariant neural networks**

(with E. Levin)

*Submitted*, 2023.

**Robust, randomized preconditioning for kernel ridge regression**

(with E. Epperly, Z. Frangella, J. Tropp, and R. Webber)

*Submitted, 2023.***Stochastic approximation with decision-dependent distributions**

(with J. Cutler and D. Drusvyatskiy)

*Submitted, 2022.***Clustering a Mixture of Gaussians with Unknown Covariance**

(with D. Davis and K. Wang)

*Submitted, 2021.***Infeasibility detection with primal-dual hybrid gradient for large-scale linear programs**(with D. Applegate, H. Lu, and M. Lubin), *Submitted, 2021.*

## Presentations

**INFORMS Annual Meeting**, Phoenix, AZ, October 2023 (Upcoming).*Stochastic approximation with decision-dependent distributions: asymptotic normality and optimality.***International Congress on Industrial and Applied Mathematics**, Tokyo, Japan, August 2023 (Upcoming).**Robust, randomized preconditioning for kernel ridge regression.****Modeling and Optimization: Theory and Applications**, Bethlehem, PA, August 2023 (Upcoming).*Any-dimensional equivariant neural networks.***Modeling and Optimization: Theory and Applications**, Bethlehem, PA, August 2023 (Upcoming).*Stochastic approximation with decision-dependent distributions: asymptotic normality and optimality.***SIAM Conference on Optimization**, Seattle, WA, June 2023.*Infeasibility detection with primal-dual hybrid gradient for large-scale linear programs.***Workshop at University of Washington**, Seattle, WA, June 2023.*Any-dimensional equivariant neural networks.***Statistics Seminar at University of Wisconsin-Madison**, Madison, WI, April 2023.*Clustering a Mixture of Gaussians with Unknown Covariance.***Probability and Statistics Seminar at University of Southern California**, Los Angeles, CA, February 2023.*Clustering a Mixture of Gaussians with Unknown Covariance.***US-Mexico Workshop on Optimization and Applications**, Huatulco, Mexico January 2023.*Clustering a Mixture of Gaussians with Unknown Covariance.***Workshop on Scientific Machine Learning**, Santiago, Chile November 2022.*Clustering a Mixture of Gaussians with Unknown Covariance.***Quantitative Methods seminar at Krannert School of Management (Purdue)**, West Lafayette, IN October 2022.*Clustering a Mixture of Gaussians with Unknown Covariance.***INFORMS Annual Meeting**, Indianapolis, IN October 2022.*Infeasibility detection with primal-dual hybrid gradient for large-scale linear programs.*

**SIAM Conference on Mathematics of Data Science**, San Diego, CA September 2022.  
*Infeasibility detection with primal-dual hybrid gradient for large-scale linear programs.*

**International Conference on Continuous Optimization**, Bethlehem, PA July 2022.  
*Clustering a Mixture of Gaussians with Unknown Covariance.*

**Colombian Congress of Applied and Industrial Mathematics**, Medellin, Colombia June 2022.  
*Escaping strict saddle points in nonsmooth optimization.*

**Workshop on Robustness and Resilience in Stochastic Optimization and Statistical Learning**, Erice, Italy May 2022.  
*Clustering a Mixture of Gaussians with Unknown Covariance.*

**INFORMS Optimization Society Conference**, Greenville, SC March 2022.  
*Clustering a Mixture of Gaussians with Unknown Covariance.*

**Seminario de Estadística, Control y Optimización at Universidad de los Andes**, Bogotá Colombia 2021.  
*Clustering a Mixture of Gaussians with Unknown Covariance.*

**Combinatorics and Probability at UC Irvine**, Irvine, CA November 2021.  
*Clustering a Mixture of Gaussians with Unknown Covariance.*

**CMX Seminar at Caltech**, Pasadena, CA October 2021.  
*Complexity, conditioning, and saddle avoidance in nonsmooth optimization*  
*Clustering a Mixture of Gaussians with Unknown Covariance.*

**SIAM Conference on Optimization**, Virtual July 2021.  
*Infeasibility detection with primal-dual hybrid gradient for large-scale linear programs.*

**PhD Defense at Cornell University**, Ithaca, NY July 2021.  
*Complexity, conditioning, and saddle avoidance in nonsmooth optimization.*

**2021 MINDS Symposium on the Foundations of Data Science**, Baltimore, MD January 2021.  
*Composite optimization for robust low-rank matrix recovery: good conditioning and rapid convergence.*

**Google Research**, New York, NY January 2021.  
*Composite optimization for robust low-rank matrix recovery: good conditioning and rapid convergence.*

**SIAM Conference on Optimization**, Hong Kong, China May 2020. **(Cancelled)**

**SIAM Conference on Mathematics of Data Science**, Cincinnati, OH May 2020. **(Cancelled)**

**INFORMS Optimization Society Conference**, Greenville, SC. March 2020. **(Postponed)**

**RPI Applied Math days**, Troy NY, April 2019.  
*Composite optimization for robust blind deconvolution.*

**Young Researchers Workshop (ORIE Cornell)**, Ithaca NY October 2017. Poster presenter.  
*A Randomized Algorithm for Quadratic inclusions.*

**Foundations of Computational Mathematics conference**, Barcelona Spain June 2017. Poster Presenter.  
*Angles and Intrinsic Dimension.*

**Octava Escuela de Física Matemática**, Bogotá Colombia May 2016. *A geometrical introduction to origami.*

**The 22nd International Symposium on Mathematical Programming**, Pittsburgh PA June 2015. Contributed Sessions.

*Compressed Sensing with an a priori distribution.*

**Foundations of Computational Mathematics conference**, Montevideo Uruguay December 2014. Poster Presenter.

*Compressed Sensing with an a priori distribution.*

## Grants and Awards

**Universidad de los Andes: Proyecto Semilla** 1-semester Grant, “*Adquisición compresiva (compressive sensing) de datos con distribución conocida*”, Fall 2015.

**Universidad de los Andes: Full-tuition fellowship for Master’s Degree**, 2014-2016.

**Ecopetrol: “Bachilleres por Colombia” Scholarship**, 2010-2014. Full-tuition scholarship for undergraduate studies, given to the best ICFES score (equivalent to SAT in Colombia) in each State.

## Service

**Thesis committee member:** Diego Arevalo Ovalle (Masters Uniandes 2022) and Diego Fernando Fonseca (PhD Uniandes 2023).

**Panelist:** NSF review panel 2023.

**Reviewer:** Mathematical Programming, SIAM Journal on Optimization, INFORMS Journal on Optimization, INFORMS Journal on Computing, Journal of Machine Learning Research, NeurIPS, Symposium on Theory of Computing (STOC), IEEE International Symposium on Information Theory, IEEE Transactions on Signal Processing, IEEE Transactions on Information Theory, and Optimization and Engineering.

**Minisymposium organizer:** INFORMS 2023, MOPTA 2023, SIAM Conference on Optimization 2023, INFORMS 2022, ICCOPT 2022, INFORMS Conference on Optimization 2020 (Cancelled).

**Seminars organized:** CMI Student/Postdoc seminar at Caltech 2021-2023 and Optimization seminar at Cornell 2018-2020.

## Teaching Experience

**At Cornell:**

ORIE 6340 Mathematics of Data Science, Spring 2021 (TA),

ORIE 5270 Big Data Technologies, Spring 2020 (Instructor),

ORIE 6125 Computational Methods in Operations Research, Spring 2020 (Instructor),

ORIE 3300 Optimization I, Summer 2017 (TA).

**At Universidad de los Andes:**

MATE-1201 Precalculus, Spring 2015 (TA),

MATE-2604 Numerical Analysis, Spring 2015 (TA),

MATE-1105 Linear Algebra, Fall 2012, Spring 2013, Fall 2014 (TA),

MATE-3410 Differential Geometry Fall 2013 (TA),

MATE-1214 Integral Calculus Fall 2013 (TA),

ISIS-1206 Data Structures Spring 2012 (TA).

## Programming Skills

C++, Python, Julia, Objective-C, Matlab,  $\text{\LaTeX}$ .

## Languages

Fluent: English, Portuguese, and Spanish (native).

Last updated: June 14, 2023