Yulia Alexandr

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Research interests

algebraic statistics, applied algebra, mathematical machine learning

Employment

University of California, Los Angeles Jan 2024–Jun 2026
Hedrick Assistant Adjunct Professor
Mentor: Guido Montúfar

Harvard University Jun–Sep 2025
Postdoctoral Fellow
Mentor: Anna Seigal

Education

University of California, Berkeley 2019–2023
PhD in Mathematics
Advisors: Bernd Sturmfels and Serkan Hoşten
Thesis: *From Voronoi Cells to Algebraic Statistics*

Wesleyan University Class of 2019
BA in Mathematics with High Honors; class rank: 1
Advisor: Karen Collins
Thesis: *Combinatorial Nullstellensatz: Various Proofs, Extensions & Applications*

Awards and fellowships

DARPA AIQ grant (PI: Guido Montúfar) 2025
key personnel, contributed to proposal writing and project development
AMS-Simons travel grant ($5000) 2025
AWM travel grant ($2300) 2024
UC Berkeley conference travel grant ($900) 2022
NSF Graduate Research Fellowship 2020-2023
Chancellor's Graduate Fellowship (UC Berkeley) 2019-2020
Phi Beta Kappa (Connecticut Gamma Chapter) 2019
Rice Prize (Wesleyan University) 2019
awarded to a senior for excellence in mathematics
Rae Shortt Prize (Wesleyan University) 2018
awarded to a junior for excellence in mathematics
Twin Cities REU at the University of Minnesota 2018
DIMACS REU at Rutgers University and Charles University (Prague) 2017
Treespace REU at Lehman College 2016

Papers

Constraining the outputs of ReLU neural networks
with Guido Montúfar.
Submitted, available on *arXiv*, 2025.

Decomposing conditional independence ideals with hidden variables
with Kristen Dawson, Hannah Friedman, Fatemeh Mohammadi, Pardis Semnani, and Teresa Yu.
Submitted, available on *arXiv*, 2025.

New directions in algebraic statistics: three challenges from 2023
with M. Bakenhus, M. Curiel, S. K. Deshpande, E. Gross, Y. Gu, M. Hill, J. Johnson, B. Kagy, V. Karwa, J. Li, H. Lyu, S. Petrović, and J. I. Rodriguez.
Published in *Algebraic Statistics*, **15** (2024), no. 2, 357–382.

Mixtures of discrete decomposable graphical models
with Jane Ivy Coons and Nils Sturma.
Published in *Algebraic Statistics*, **15** (2024), no. 2, 269–293.

Maximum information divergence from linear and toric models
with Serkan Hoşten.
Published in *Information Geometry*, **8** (2025), 159–197.

Moment varieties for mixtures of products
with Joe Kileel and Bernd Sturmfels.
Published in Proceedings of the *International Symposium on Symbolic and Algebraic Computation (ISSAC 2023)*, ACM, New York, 2023, 53–60.

Decomposable context-specific models
with Eliana Duarte and Julian Vill.
Published in *SIAM Journal on Applied Algebra and Geometry* **8** (2024), no. 2, 363-393.

Logarithmic Voronoi cells for Gaussian models
with Serkan Hoşten.
Published in *Journal of Symbolic Computation* **122** (2024) paper no. 102256.

Logarithmic Voronoi polytopes for discrete linear models
Published in *Algebraic Statistics* **15** (2024) no. 1, 1–13.

Logarithmic Voronoi cells
with Alexander Heaton.
Published in *Algebraic Statistics* **12** (2021), no. 1, 75-95.

Computing a logarithmic Voronoi cell
with Alexander Heaton and Sascha Timme.
Published online at *HomotopyContinuation.jl*, 2019.

Recovering conductances of resistor networks in a punctured disk
with Brian Burks, Sunita Chepuri, and Patricia Commins.
Preprint. Available on *arXiv*, 2019.

Deformations of the Weyl character formula for $SO(2n+1,\mathbb{C})$ via ice models
with P. Commins, A. Embry, S. Frank, Y. Li, and A. Vetter.
Preprint. Available on *arXiv*, 2018.

Growth of meandric numbers
with Kayla Cummings and Edgar Jaramillo Rodriguez.
Transcription in *DIMACS-DIMATIA REU booklet (pp. 33-36)*, 2017.

Teaching

Instructor (UCLA)

PIC 10B: Intermediate Programming (C++)	Winter, Spring 2025
PIC 10A: Introduction to Programming (C++)	Winter, Fall 2024
PIC 16A: Python with Applications I	Spring 2024

Graduate student instructor (UC Berkeley)

MATH 10B: Methods of mathematics	Spring 2023
MATH 54: Linear algebra and differential equations	Fall 2022

Directed reading program mentor (UC Berkeley)

Topics: algebraic combinatorics and graph theory	Spring 2020

Teaching assistant (Wesleyan University)

MATH 231: Probability theory	Fall 2017, Fall 2018
MATH 274: Graph theory	Spring 2018

Talks

key: ★=invited/colloquium; †=contributed; △=seminar/lecture.

Constraining the outputs of ReLU neural networks

★ New Directions in Algebraic Statistics at IMSI, Chicago	July 2025
★ AMS special session on algebra and discrete mathematics in machine learning at Cal Poly, SLO	May 2025

Can algebra be applied?

★ UMSA Professor talk at UCLA	March 2025

Mixtures of Discrete Decomposable Graphical Models

★ SIAM Conference on Applied Algebraic Geometry in Madison	July 2025
★ AMS special session on discrete and algebraic methods in mathematical biology at Cal Poly, SLO	May 2025
△ UW-Madison Applied Algebra Seminar	November 2024

Maximum information divergence from linear and toric models
△ Math Machine Learning seminar MPI MIS + UCLA February 2024

Moment varieties for mixtures of products
† International Symposium on Symbolic and Algebraic Computation (ISSAC) in Tromsø July 2023
★ AMS special session on mathematics in data science at Spring Western sectional meeting May 2023
★ SFSU Algebra, Geometry, and Combinatorics day March 2023

Computing logarithmic Voronoi cells
★ AMS special session on polynomial systems, homotopy continuation and applications at the JMM January 2023

Decomposable context-specific models
★ CEG Workshop in Warwick (virtual) September 2022

Logarithmic Voronoi Cells
★ Naval Postgraduate School in Monterey CA June 2023
★ Santa Clara University math and CS colloquium October 2022
△ Discrete Math & Geometry seminar at TU-Berlin (virtual) October 2022
△ SFSU Algebra, Geometry, and Combinatorics Seminar October 2021
△ Berkeley Combinatorics Research Seminar (virtual) April 2021
△ Nonlinear Algebra Seminar Online (virtual) April 2020

Logarithmic Voronoi polytopes
△ Mathematical Methods in Data Analysis in Tirana, Albania July 2022

Combinatorics of logarithmic Voronoi cells
△ Algebra and Geometry seminar at University of Magdeburg July 2022

Logarithmic Voronoi cells for Gaussian models
★ SIAM Conference on Applied Algebraic Geometry in Eindhoven July 2023
† Effective Methods in Algebraic Geometry in Kraków, Poland June 2022
△ Applied CATS seminar at KTH (virtual) May 2022

Logarithmic Voronoi polytopes for discrete linear models
† Algebraic Statistics at the University of Hawai'i at Manoa May 2022
★ AMS Spring Central Sectional Meeting (virtual) March 2022

Introduction to SAGE
† Mathematical computing virtual workshop by UCB and UBC Apr 2022

Linear Spaces and Grassmannians
△ Nonlinear Algebra course at MPI MiS (Leipzig, Germany) June 2019

Caratheodory, Radon, and Helly theorems in convex geometry
△ Minicourse on Convex Geometry at MPI MiS (Leipzig, Germany) July 2021

Ice Models for Types A and B (two talks)
△ Berkeley Combinatorics Reading Seminar October 2019

Combinatorial Nullstellensatz
Wesleyan University Thesis Defense January 2019

Visibility Graphs of Staircase Polygons
† Berkeley Undergraduate Number Theory Conference April 2018

Visiting positions

Institute for Mathematical and Statistical Innovation Sep–Dec 2013
Long-term visitor for *Algebraic Statistics and Our Changing World*

Max Planck Institute for Mathematics in the Sciences 2019, '20, '22, '24
Summer visitor

Skills

Programming
Macaulay2, SAGE, Mathematica, Singular, LaTeX,
C, C++, Python, Julia, OCaml, SML, HTML

Languages
English (native), Russian (native), Hebrew (intermediate)

Service

Organizing
AMS Special Session *Algebraic Statistics In Our Changing World*
AMS Special Session *Algebraic Methods in Machine Learning and Optimization*
co-organizer, *Joint Math Meeting* (JMM 2025) Jan 2025
Berkeley nonlinear algebra seminar, co-organizer Fall 2022

Mentorship and outreach
Women in math mentorship program, mentor, *UCLA* Fall 2024
STEMinist club, invited speaker, *Berkeley High School* Nov 2021
Noetherian Ring, member, *UC Berkeley* 2019–present
Math Club graduate school panel, panelist, *Wesleyan University* 2020
Directed reading program (DRP), mentor, *UC Berkeley* 2020
Unbounded Representation (URep), officer, *UC Berkeley* 2019–2020

Reviewing

Advances in Applied Mathematics
SIAM Journal on Discrete Mathematics
SIAM Journal on Applied Algebra and Geometry
Algebraic Statistics