ROBERT KRONE

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EMPLOYMENT

2017–2020 Krener Assistant Professor, **University of California - Davis**

2015–2017 Postdoctoral Fellow, **Queen's University**

EDUCATION

2020–2020 Fellowship program in Data Science, **The Data Incubator**

2010–2015 Ph.D. in Mathematics, **Georgia Institute of Technology**
Advisor: Anton Leykin
Thesis: "Symmetric ideals and numerical primary decomposition"
Minor: Computer Science

2004–2008 B.A. in Mathematics, **Princeton University**
Certificate in Computer Science

RESEARCH INTERESTS

Applied algebraic geometry: using algebraic geometry tools to solve applied problems, and developing computational tools such as software packages for solving algebraic problems.

PAPERS

Justin Chen, Yairon Cid-Ruiz, Marc Härkönen, Robert Krone, Anton Leykin. Noetherian operators in Macaulay2, *preprint* arXiv:2101.01002 (2021).

Mareike Dressler and Robert Krone. Multiple typical ranks in matrix completion, *preprint* arXiv:2010.09777 (2020).

Justin Chen, Marc Härkönen, Robert Krone, Anton Leykin. Noetherian operators and primary decomposition, *preprint* arXiv:2006.13881 (2020).

Robert Krone and Kaie Kubjas. Uniqueness of nonnegative matrix factorizations by rigidity theory, *SIAM Journal on Matrix Analysis and Applications* 42.1, pages 134-164 (2021).

Daniel Irving Bernstein and Robert Krone. The tropical Cayley-Menger variety, *SIAM Journal on Discrete Mathematics* 33.3, pages 1725-1742 (2019).

Jesús A. De Loera, Serkan Hoşten, Robert Krone, Lily Silverstein. Average Behavior of Minimal Free Resolutions of Monomial Ideals, *Proceedings of the American Mathematical Society* 147.8, pages 3239-3257 (2019).

Hector Baños, Nathaniel Bushek, Ruth Davidson, Elizabeth Gross, Pamela E Harris, Robert Krone, Colby Long, Allen Stewart and Robert Walker. Dimensions of Group-

based Phylogenetic Mixtures, *Bulletin of Mathematical Biology* 81, pages 316–336 (2018).

Madeline Brandt, DJ Bruce, Taylor Brysiewicz, Robert Krone and Elina Robeva. The degree of SO(n), *Combinatorial Algebraic Geometry* (book), pages 229-246 (2016).

Hector Baños, Nathaniel Bushek, Ruth Davidson, Elizabeth Gross, Pamela E Harris, Robert Krone, Colby Long, Allen Stewart and Robert Walker. Phylogenetic Trees, *Journal of Software for Algebra and Geometry* 11.1, pages 1-7 (2021).

Chris Hillar, Robert Krone and Anton Leykin. Equivariant Gröbner bases, *The 50th Anniversary of Gröbner Bases* (book), pages 129-154 (2018).

Robert Krone, Anton Leykin and Andrew Snowden. Hilbert series of symmetric ideals in infinite polynomial rings via formal languages, *Journal of Algebra* 485, pages 353-362 (2016).

Robert Krone. Equivariant Gröbner bases of symmetric toric ideals, *In Proceedings of the 41th International Symposium on Symbolic and Algebraic Computation, ISSAC '16*, pages 311-318 (2016).

Robert Krone and Anton Leykin. Numerical algorithms for detecting embedded components, *Journal of Symbolic Computation* 82, pages 1-18 (2017).

Robert Krone and Anton Leykin. Eliminating dual spaces, *Journal of Symbolic Computation* 79, pages 609-622 (2017).

Thomas Kahle, Robert Krone, Anton Leykin. Equivariant lattice generators and markov bases, *In Proceedings of the 39th International Symposium on Symbolic and Algebraic Computation, ISSAC '14*, pages 264–271 (2014).

Jan Draisma, Rob Eggermont, Robert Krone, Anton Leykin. Noetherianity for infinite-dimensional toric varieties, *Algebra & Number Theory* 9.8, pages 1857–1880 (2015).

Robert Krone. Numerical algorithms for dual bases of positive-dimensional ideals, *Journal of Algebra and Its Applications* 12.6 (2013).

SOFTWARE

`PhylogeneticTrees` package for Macaulay2 computer algebra system for computing invariants of statistical models for evolutionary phylogenetic trees.

`RegularLanguages/OIModules` a package for Macaulay2 computer algebra system for working with regular languages and finite state automata, used for equivariant Hilbert series computation.

`NoetherianOperators` package for Macaulay2 computer algebra system for using differential operators to represent the multiplicity structure of primary components of schemes, and numerically computing local Hilbert functions.

`EquivariantGB` package for Macaulay2 computer algebra system for computing equivariant Gröbner bases of algebraic systems with symmetric group symmetry.

VISITING PROGRAMS

Sep–Dec 2018 ICERM Semester Program - Nonlinear Algebra (Brown University)

Aug–Sep 2016	Fields Institute Program - Combinatorial Algebraic Geometry apprenticeship weeks (University of Toronto)
Oct–Dec 2015	Fields Institute Program - Computer Algebra (University of Toronto)
Oct–Nov 2014	Simons Institute Program - Algorithms and Complexity in Algebraic Geometry (UC Berkeley)
Jul 2014	IMA PI Summer Program - Modern Applications of Representation Theory (University of Chicago)
Mar–Jun 2013	Research visit with Jan Draisma (TU Eindhoven)
Jun–Jul 2012	IMA PI Summer Program - Algebraic Geometry for Applications (Georgia Tech)

HONORS AND AWARDS

2016	Best Thesis Award, Georgia Institute of Technology - School of Mathematics
2015	Top Graduate Student Award, Georgia Institute of Technology - School of Mathematics
2014 Spring	Algorithms & Randomness Center Student Fellowship, Georgia Institute of Technology
2010–2014	President's Fellowship, Georgia Institute of Technology

SERVICE

Spring 2020	Bay Area Discrete Math Day - co-organizer
Apr 2020	AMS Western Sectional mini-symposium on Algebraic Geometry in Statistics and Machine Learning - co-organizer
Winter 2018	UC Davis Mathematics for Data Science and Decision Making seminar - organizer
Fall 2018	ICERM Nonlinear Algebra postdoc seminar - co-organizer
Jul 2017	SIAM Conference on Applied Algebraic Geometry mini-symposium on Theory of Numerical Algebraic Geometry - co-organizer
Jan 2017	AMS Joint Meeting mini-symposium on Numerical Algebraic Geometry - co-organizer
2012–2013	Georgia Tech Research Horizons seminar - co-organizer
2010–2014	Georgia Tech High School Math Competition - problem writer and grader

INVITED TALKS AND POSTERS

Sep 2019	AMS Central Sectional Meeting (University of Wisconsin) Talk: "Typical coranks"
Sep 2019	San Francisco State University - Algebra Seminar Talk: "Matrices on the nonnegative rank boundary"
Jul 2019	SIAM Conference on Applied Algebraic Geometry (Bern University) Talk: "FI-algebras: examples and counterexamples"
Jul 2019	Summer School on Randomness and Learning in Non-Linear Algebra (MPI Leipzig) Talk: "Predictions and learning with random monomial ideals"
Sep 2018	Conference on Core Computational Methods in Nonlinear Algebra (ICERM) Talk: "Computational tools for FI-algebras"
Aug 2018	Representation Stability Week (University of Michigan) Talk: "Computational tools for FI-algebras"
Jul 2018	SIAM 2018 Annual Meeting (Portland, OR) Talk: "Dimensions of group-based phylogenetic mixtures"
Apr 2018	University of Kentucky - Algebra Seminar Talk: "FI-algebras"
Aug 2017	SIAM Conference on Applied Algebraic Geometry (Georgia Tech)

Talk: "Modules over FI-algebras"

Jul 2017 Applied Macaulay2 Tutorials (Georgia Tech)
Talk: "Degree of SO(n)"

Jan 2017 AMS Joint Mathematics Meeting (Atlanta)
Talk: "The degree of the special orthogonal group"

Nov 2016 AMS Southern Sectional Meeting (North Carolina State University)
Talk: "Hilbert series of infinite symmetric ideals"

Jul 2016 ISSAC 2016 (Wilfrid Laurier University)
Talk: "Equivariant Gröbner Bases of Symmetric Toric Ideals"

Jul 2016 SIAM 2016 Annual Meeting (Boston, MA)
Talk: "Hilbert series of invariant ideals"

Jun 2016 Georgia Tech - Algebra Seminar
Talk: "Macaulay dual spaces and local Hilbert functions"

Apr 2016 Free Resolutions, Representations, and Asymptotic Algebra workshop (BIRS)
Talk: "Equivariant Gröbner bases"

Feb 2016 York University - Applied algebra seminar
Talk: "Noetherianity for infinite-dimensional symmetric toric varieties"

Nov 2015 McMaster University - Algebra seminar
Talk: "Numerical Primary Decomposition"

Oct 2015 Route 81 Conference (Queen's University)
Talk: "Equivariant Gröbner bases"

Oct 2015 AMS Central Sectional Meeting (Loyola University)
Talk: "Equivariant Gröbner bases of toric ideals"

Sep 2015 CUNY - Symbolic-Numeric Computing seminar
Talk: "Numerical primary decomposition"

Apr 2015 Meeting on Algebraic Geometry and Applications (Georgia Tech)
Talk: "Equivariant Gröbner basis algorithms"

Nov 2014 San Jose State University - Combinatorics seminar
Talk: "Finite generation of symmetric toric ideals"

Oct 2014 UC Berkeley - Computational Algebraic Geometry seminar
Talk: "Numerically detecting embedded components"

Oct 2014 AMS Western Sectional Meeting (San Francisco State)
Talk: "Finite generation of symmetric toric ideals"
Talk: "Equivariant lattice generators and Markov bases"

Oct 2014 UC Davis - CACAO seminar
Talk: "Finite generation of symmetric toric ideals"

Sep 2014 University of Georgia - Algebraic Geometry seminar
Talk: "Finite generation of symmetric toric ideals"

Jul 2014 ISSAC 2014 (Kobe University)
Talk: "Equivariant lattice generators and Markov bases"

Jul 2014 Workshop on applications of algebraic geometry and algebraic analysis (Kobe University)
Talk: "Finite generation of symmetric toric ideals"

Jun 2014 Computational Nonlinear Algebra conference (ICERM)
Poster: "Numerical Primary Decomposition"

Apr 2014 North Carolina State University - Symbolic Computation seminar
Talk: "Noetherianity for infinite-dimensional toric ideals"

Jan 2014 Macaulay2 Workshop (MSRI - UC Berkeley)
Talk: "Equivariant Gröbner Bases"

Aug 2013 SIAM Conference on Applied Algebraic Geometry (Colorado State)
Talk: "Macaulay Dual Space and Numerical Primary Decomposition"

Jun 2013 Effective Methods in Algebraic Geometry 2013 (Goethe-Universität)
Talk: "Algorithms for equivariant Gröbner Bases"

Jun 2013 DIAMANT Symposium 2013 (Heeze, Netherlands)
Talk: "Noetherianity for infinite-dimensional toric varieties"

Mar 2013	Technical University of Eindhoven - Discrete Mathematics seminar Talk: "Computing Equivariant Gröbner Bases"
Oct 2012	RTG Workshop: Tensors and their Geometry in High Dimensions (UC Berkeley) Talk: "Algorithms for symmetric Gröbner bases"
Apr 2012	Texas Algebraic Geometry Symposium 2012 (Texas A&M) Poster: "Numerical algorithms for dual bases of positive-dimensional ideals"
Oct 2011	SIAM Conference on Applied Algebraic Geometry (North Carolina State) Talk: "Numerical algorithms for dual bases of positive-dimensional ideals"

TEACHING

2020 Winter	MATH 150A: Modern Algebra A
2020 Winter	MATH 22A: Linear Algebra
2019 Fall	MATH 108: Intro to Abstract Math
2019 Spring	MATH 16A: Short Calculus A
2019 Winter	MATH 108: Intro to Abstract Math
2018 Winter	MATH 16B: Short Calculus B
2017 Fall	MATH 67: Modern Linear Algebra
2017 Fall	MATH 16B: Short Calculus B
2017 Winter	MATH 228: Complex Analysis
2016 Fall	MATH 221: Vector Calculus
2016 Spring	APSC 172: Calculus II
2016 Winter	APSC 171: Calculus I
2013 Fall	Lead Instructor - MATH 1522: Linear Algebra
2012 Fall	Recitation TA - MATH 1512: Honors Calculus II
2012 Spring	Recitation TA - MATH 2605: Linear and Discrete Mathematics
2011 Fall	Recitation TA - MATH 2605: Calculus III for Computer Science
2011 Spring	Recitation TA - MATH 2602: Linear and Discrete Mathematics
2010 Fall	Recitation TA - MATH 2602: Linear and Discrete Mathematics
2009–2010	Private Tutor - high school math and science