

Alperen Ali Ergür

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Education

2016	PhD in Mathematics - <i>Texas A&M University, USA</i>
2011	MS in Mathematics- <i>Tobb University, Turkey</i>
2009	BS in Mathematics- <i>Bilkent University, Turkey</i>

Employment

Aug 2020-present	University of Texas at San Antonio <i>Assistant Professor</i> Computer Science Department (25 %) Mathematics Department (75 %)
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Sep 2019-Aug 2020	Carnegie Mellon University, Theoretical Computer Science Group <i>Postdoctoral Fellow</i> Mentors: Venkatesan Guruswami and Pravesh Kothari
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May 2017-Aug 2019	Technical University of Berlin, Algorithmic Algebra Group <i>Einstein Postdoctoral Fellow</i> Mentors: Peter Bürgisser and Felipe Cucker
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Aug 2016-May 2017	North Carolina State University, Symbolic Computation Group <i>Postdoctoral Research Scholar</i> Mentor: Cynthia Vinzant
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Sep 2011-Aug 2016	Texas A&M University, Probability Theory and Algebraic Geometry Groups <i>Graduate Research/Teaching Assistant, and REU Instructor</i> Mentors: Grigoris Paouris and J. Maurice Rojas
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Research Interest

Real Algebraic Geometry, Convex Geometry, Optimization, Theory of Computation
High Dimensional Probability, Randomized Numerical Algorithms, Reinforcement Learning

Grants, Awards, etc

- Dec 2025** Collaborate @ ICERM: A small grant for collaborative research at ICERM, Brown University
- Dec 2024** The Kay and Steve Robbins Faculty Teaching Fellowship in Computer Science
- Sept 2024** NSF-CCF-2414160, Algorithmic Foundations Program, Single-PI
Title: Algorithmic Foundations for Processing Algebraic Sets, Amount: $\sim 450K$
- 2023+** MAA NExt Fellow, 2023 Class
- Oct 2021** NSF-CCF-2110075, Algorithmic Foundations Program, Single-PI
Title: Beyond Worst-Case Analysis for Computing with Polynomials, Amount: $\sim 100K$
- Jan 2017** Postdoctoral Fellowship by Einstein Foundation
- 2014-2015** Travel Grants by University of Trento, Institut Henri Poincare, and AMS
- Sept 2009** Full Scholarship by Tobb University including tuition and stipend
- Sept 2004** Full Scholarship by Bilkent University including tuition and stipend
- < 2004** Two Bronze, One Silver Medal in National Math Competitions

Publications and Preprints

Google scholar

UTSA students and postdocs are in bold.

Probability

1. The Rank of Sparse Random Matrices
(with A. Coja-Oghlan, Pu Gao, S. Hettereich, H. Rolvien)
Random Structures and Algorithms, 2022
<https://doi.org/10.1002/rsa.21085>
2. Probabilistic Condition Number Estimates for Real Polynomials I
(with G. Paouris and J.M. Rojas)
Foundations of Computational Mathematics, 2019
<https://doi.org/10.1007/s10208-018-9380-5>
3. Smoothed Analysis for the Condition Number of Structured Real Polynomial Systems
(with G. Paouris and J.M. Rojas)
Mathematics of Computation, 2021
<https://doi.org/10.1090/mcom/3647>
4. On the Expected Number of Zeros of Random Fewnomials
(with P. Bürgisser and J. Tonelli-Cueto)
SIAM Journal on Applied Algebra and Geometry (SIAGA), 2019
<https://doi.org/10.1137/18M1228682>
5. On the Number of Real Zeros of Random Sparse Polynomial Systems
(with Mate Telek, **Josue Tonelli-Cueto**) available at Arxiv submitted to SIAGA journal
6. Strategic Gradient Manipulation for Membership Inference Attacks in Machine Unlearning
(with **Abu Noman Sakib**, **Zihensen Wang**, Zijie Zhang, and Yang Zhou)
in preperation to be submitted to Neurips 2026

Optimization

7. Approximating Nonnegative Polynomials via Spectral Sparsification
SIAM Journal on Optimization, 2019
<https://doi.org/10.1137/17M1121743>
8. Multihomogenous Nonnegative Polynomials and Sums of Squares
Discrete & Computational Geometry, 2018
<https://doi.org/10.1007/s00454-018-0011-3>
9. Approximate Real Symmetric Tensor Rank
(with **J. Rebollo-Bueno**, P. Valettas)
Arnold Mathematical Journal, 2023
<https://doi.org/10.1007/s40598-023-00235-4>
10. Optimal Preconditioning is a Geodesically Convex Optimization Problem
(with M.L. Doğan, E. Tsigaridas),
submitted to FOCM Journal
<https://arxiv.org/abs/2512.06618>

Algorithms in Algebra and Geometry - Conferences

11. Plantinga-Vegter Algorithm Takes Average Polynomial Time
(with F. Cucker, J. Tonelli-Cueto)
ACM Symposium on Symbolic and Algebraic Computation (ISSAC), 2019
<https://doi.org/10.1145/3326229.3326252>
12. The Rank of Sparse Random Matrices
(with A. Coja-Oghlan, Pu Gao, S. Hettereich, H. Rolvien)
ACM Symposium on Discrete Algorithms (SODA), 2020
<https://epubs.siam.org/doi/pdf/10.1137/1.9781611975994.35>
13. Beyond Worst-Case Analysis for Root Isolation Algorithms
(with **J. Tonelli-Cueto**, E. Tsigaridas)
ACM Symposium on Symbolic and Algebraic Computation, (ISSAC), 2022
<https://doi.acm.org?doi=3476446.3535475>
14. On the Number of Iterations of the DBA Algorithm
(with F. Brüning, A. Driemel, H. Röglin)
SIAM Conference on Data Mining, 2024
<https://epubs.siam.org/doi/pdf/10.1137/1.9781611978032.20>
15. Feasibility of Circuit Polynomials without Purple Swans
(with W. Deng, G. Paouris, J.M. Rojas)
ACM Symposium on Symbolic and Algebraic Computation, (ISSAC), 2024
<https://dl.acm.org/doi/abs/10.1145/3666000.3669716>
16. Accuracy and Stability of Algorithms for Computing the Fundamental Matrix
(with S. Agarwal, E. Connelly, R. Thomas)
in preperation to be submitted to computer vision venues (conference, and journal)

Algorithms in Algebra and Geometry - Journals

17. Tropical Varieties for Exponential Sums
(with G. Paouris and J.M. Rojas)
Mathematische Annalen, 2020
<https://doi.org/10.1007/s00208-019-01808-5>
18. On the Complexity of Plantinga-Vegter Algorithm
(with F. Cucker and **J. Tonelli-Cueto**)
Discrete & Computational Geometry, 2022
<https://doi.org/10.1007/s00454-022-00403-x>
19. A Polyhedral Homotopy Algorithm for Real Zeros
(with T. de Wolff)
Arnold Mathematical Journal, 2022
<https://doi.org/10.1007/s40598-022-00219-w>
20. Functional Norms, Condition Numbers, and Numerical Algorithms
in Algebraic Geometry (with F. Cucker, **J. Tonelli-Cueto**)
Forum Mathematics Sigma, 2022
<https://doi.org/10.1017/fms.2022.89>
21. On the Complexity of Chow and Hurwitz Forms
(with M. L. Doğan, E. Tsigaridas)
ACM Communication in Computer Algebra, 2024
<https://doi.org/10.1145/3653002.3653003>
22. On the Number of Iterations of the DBA Algorithm
(with F. Brünig, A. Driemel, H. Röglin)
Knowledge Discovery and Data Mining, 2025
<https://link.springer.com/article/10.1007/s10618-025-01116-4>

Algebraic Geometry and Combinatorics

23. The Geometry of Rank Drop in a Class of Face-Splitting Matrix Products
(with S. Agarwal, E. Connelly, R. Thomas)
Advances in Geometry, 2024
<https://www.degruyter.com/document/doi/10.1515/advgeom-2024-0016/html>
24. The Multivariate Schwartz-Zippel Lemma
(with M. L. Doğan, J. Mundo, E. Tsigaridas)
SIAM Journal of Discrete Mathematics, 2022
<https://doi.org/10.1137/20M1333869>
25. Toric Compactifications for Analytic Combinatorics
(with T. George, S. Gillen, S. Melczer, R. Pemantle)
– in prep to be submitted to Mathematics of Computation

Reinforcement Learning

26. Average and Extremal Power-Flow Configurations
(with J. Lindberg, **V. Miller**) – in preparation to be submitted to RLC 2026

27. Learning Biochemical Reaction Networks with Many Equilibrium States
(with **Y. Syeed**) – in preparation to be submitted to ECML 2026
28. Learning Fast Monomial Orders for Gröbner Basis Computations
(with C. Bunch, **M. Golestani**, M. Walewski, J. Tong, Y. Zeytuncu)
submitted to ICML 2026

Teaching Experience

1. San Antonio Creative Mathematics Circle, 2024 +
Rodrigo Velez, Süleyman Tek, and I started a math circle for middle school children.
We only admitted 7 sixth graders and plan to train them as a cohort.
2. University of Michigan
Led a group of student researchers (REU) on a reinforcement learning project in summer 25.
3. University of Texas at San Antonio
 - *Mentoring:*
Shamik Khowala (High School Student, Current)
Vincent Miller (M.S. in CS, Current)
Yaseen Syed (M.S. in Applied Math, Current)
Jonathan de Konig (undergrad researcher, 2025)
Melika Golestani (undergrad researcher, 2025)
Thanuka Hanseemeenu Wijenayaka (Visiting Scholar, Control Theory-RL, 2025)
Chris La Velle (M.S. in Pure Math, 2025)
Farhan Tajwar Romit (undergrad researcher, 2025 → Grad School @ Texas A&M)
Rahul Savishkumar (high school researcher, 2024 → UT Dallas CS)
Jesus Rebollo-Bueno (postdoc, 2022 → Lecturer @ Sevilla, Spain)
Josue Tonelli-Cueto (postdoc, 2023 → Postdoc @ John Hopkins Applied Math)
Abigail Martinez (M.S. student, 2022)
Ian Solis (undergrad researcher, 2022 → Southwest R&D, UT Austin Grad School)
Nina De La Torre, (undergrad researcher, 2023 → Grad School @ UT Austin)
Chris La Velle, (undergrad researcher, 2023 → Grad School @ UTSA)
 - *Reinforcement Learning Seminar*
In Fall 24, I run a seminar on fundamentals of RL where I lectured and we implemented basic algorithms together. [Link to resources](#)
 - *Student-accessible research seminar on Geometry, Probability, and Computing*
[Link to resources](#)
 - *New Course Design and Redesign*
Probability and Computing
Algorithmic Foundations of Data Science [Link to resources](#)
Introduction to Optimization (with C. Walton)
Abstract algebra series from an algorithmic view (under development)
 - *Instructor of the record @ UTSA School of Data Science:*
Probability and Computing, Algorithmic Foundations of Data Science
 - *Instructor of the record @ UTSA Main Campus:*
Linear Algebra, Probability and Computing, Abstract Algebra,
Algebra and Number Systems (intro to proofs), Calc 2

4. Technische Universität Berlin

- *Seminar*: Interior Point Methods in Convex Optimization (with T. de Wolff)
- *Graduate Class*: Effective Algebraic Geometry (with P. Bürgisser, J. Tonelli-Cueto)

5. NC State University

- Instructor of the Record: Linear Algebra for Science Majors, Calculus, Precalc

6. Texas A&M University

- *Assistant Instructor @ Research Experience for Undergraduates Program (REU)*
Mentored *eight* undergraduate research projects in four summers: 2013-2016
7 Students → grad school @ MIT, Harvard, Chicago, Notre Dame, Brown, UIUC
Two students won NSF gradate fellowship.
- Recitation Leader for Graduate Algebra, Probability, Advanced Calculus

Selected Talks

Aug 2025	ICERM Brown University, Random Polynomials and Applications Workshop
April 2025	UT Austin Oden Institute Scientific Computing Seminar
May 2024	Algebra and Geometry Seminar, New Mexico State
Oct 2023	Senior Seminar, Spielman College
Nov 2022	Algebraic Geometry and Complexity Theory Workshop, Polish Academy of Sciences
May 2022	Real Algebraic Geometry and Optimization Seminar, Purdue University
April 2022	Workshop on Analytical Combinatorics, AIM, San Jose, CA
Jul 2021	Mathematical Congress of Americas, Buenos Aires, Argentina
Jun 2021	Effective Methods in Algebraic Geometry, MEGA 2021, Tromsø Norway
Sept 2020	Data Seminar, U Missouri Columbia
Mar 2020	ACO Seminar, Carnegie Mellon University
Jul 2019	SIAM Conference on Applied Algebraic Geometry 2019, Bern, Switzerland
Jun 2019	Effective Methods in Algebraic Geometry (MEGA) 2019, Madrid, Spain
Apr 2019	Computational Geometry Workshop, Schloss Dagstuhl, Germany
Feb 2019	Universität Bonn, Theoretical Computer Science Seminar
Nov 2018	Goethe Universität Frankfurt, Applied Discrete Mathematics Seminar
Mar 2018	Emerging Trends in Geometric Functional Analysis, Banff (BIRS), Canada
Dec 2017	Methods on Discrete Structures Lecture Series, TU Berlin
Nov 2017	Algebra Meets Numerics Workshop, Berlin Academy of Sciences
Mar 2017	U Michigan Ann Arbor, Analysis and Probability Seminar
July 2016	Geometric Functional Analysis Concentration Week, Texas A&M
Apr 2016	MIT, LIDS Seminar
Apr 2016	Georgia Tech, Algebra Seminar
Mar 2016	Univ of Chicago, Scientific Computing Seminar
Mar 2016	NC State University, Symbolic Computation Seminar
Dec 2015	Colorado State University, FRAGMENT Seminar

- Oct 2015** Technical University of Munich, Applied Geometry Seminar, Germany
Sept 2015 University of Athens, Convex Geometric Analysis Seminar, Greece

Service

- Sept 25 +** Organizer, UTSA Algorithms Seminar
May 25 Panelist, NSF CCF Directory
2021-23 Organizer, Geometry, Probability, and Computing Seminar
 A student accessible research seminar co-organized with G. Paouris and P. Valettas
Sept 24 Organizer, AMS Meeting Minisymposia:
 with A. Shui and F. Sottile, Applications of Algebraic Geometry (22 speakers)
2023 PC Member, ACM Symposium in Algebraic Computation (ISSAC 2023)
March 23 Panelist, NSF CCF Directory
Nov 2021 Organizer, SIAM TX-Louisiana Section Meeting Minisymposia:
 with J. M. Rojas and F. Sottile, Algorithmic Algebra and Geometry (4 sessions)
July 2021 Organizer, Mathematical Congress of Americas Minisymposia:
 with D. Armentano, M. Bender, and J. Tonelli Cueto,
 Numeric-Symbolic Computation with Polynomials (3 Sessions)
April 2020 Panelist, NSF CCF Directory
July 2019 Organizer, SIAM Applied Algebraic Geometry Minisymposia:
 with P. Lairez, G. Malajovich, and J. Tonelli Cueto,
 Numerical Methods for Structured Polynomial System Solving (4 sessions)
Fall 2017 Organizer, Algorithmic Algebra OberSeminar, with P. Bürgisser, TU Berlin
Jan 2016 Organizer, Combinatorial Algebraic Geometry Workshop, Nesin Math Village
 with Ö. Kışisel, H. Güntürkün, and Ö. Öztürk

PhD Thesis Committee

- Maurice Rolvien, TU Dortmund Theoretical Computer Science, December 24
 Ethan Payne, UTSA Computer Science, August 24
 Jodh Pannu, UTSA Computer Science, August 24
 Kumar Thummapudi, UTSA Computer Science, August 24
 Sharvari Komajwar, UTSA Computer Science, August 21

References

Teaching Timothee Bryan (Term Assistant Professor of Mathematics, George Mason University)
 Peter Bürgisser (Professor of Algorithmic Algebra, Technical University of Berlin)
 Felipe Cucker (Professor of Mathematics, City University of Hong Kong)
 Pravesh Kothari (Assistant Professor of Computer Science, Princeton University)
 Grigoris Paouris (Professor of Mathematics, Texas A&M University)
 J.Maurice Rojas (Professor of Mathematics and Computer Science, Texas A&M University)
 Cynthia Vinzant (Associate Professor of Mathematics, University of Washington, Seattle)