

Alexander Taveira Blomenhofer

Curriculum Vitae

Education

- 2022 **Dr. rer. nat. in Mathematics**, *Universität Konstanz, summa cum laude*,
Doctoral thesis:
“Gaussian Mixture Separation and Denoising on Parameterized Varieties”.
Advisors: Prof. Dr. Markus Schweighofer and Prof. Dr. Mateusz Michałek
- 2018 **M. Sc. Mathematics**, *Universität Konstanz*, 1.0.
Master’s thesis: “A new Algorithm for Overcomplete Tensor Decomposition based on Sums-of-Squares Optimisation” supervised by Prof. Dr. Markus Schweighofer.
- 2016 **B. Sc. Mathematics**, *Universität Konstanz*, 1.0.
Bachelor’s thesis: “Erweiterte Formulierungen für Polygone” (Extended Formulations of Polygons, 2016) supervised by Prof. Dr. Markus Schweighofer.
- 2013 **Abitur (High school graduation)**, *Droste-Hülshoff-Gymnasium Meersburg*.

Employment

- Jan 2023 - June 2024 **Postdoctoral Researcher within OPTIMAL**, *CWI, Amsterdam*.
- 2018-2022 **Research Assistant**, *Dep. Mathematics and Statistics, Universität Konstanz, Konstanz*, in full time since ST 2019.

Teaching

- 2019-2022 **(Co-)Supervision of various Bachelor’s and Master’s theses**, *Univ. Konstanz*.
- 2022/23-WT **TA: Linear Algebra I**, *Univ. Konstanz*.
- 2022-ST **TA: Linear Algebra II**, *Univ. Konstanz*.
- 2021/22-WT **TA: Linear Algebra I**, *Univ. Konstanz*.
- 2021/22-WT **TA: Geometry of Linear Matrix Inequalities**, *Univ. Konstanz*.
- 2021-ST **TA: Real Algebraic Geometry II**, *Univ. Konstanz*.
- 2021-ST **TA: Vectors, Matrices and Tensors for Data Analysis with Julia**, *Advanced Data and Information Literacy Track (ADILT), Konstanz*.
- 2020/21-WT **TA: Real Algebraic Geometry I**, *Univ. Konstanz*.
- 2020/21-WT **TA: Algorithmic Spectral Graph Theory**, *Univ. Konstanz*.
- 2020-ST **TA: Commutative Algebra**, *Univ. Konstanz*.

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- 2019/20-WT **TA: Algorithmic Algebraic Geometry**, Univ. Konstanz.
2019-ST **TA: Polynomial Optimization**, Univ. Konstanz.
2019-ST **TA: Number Theory**, Univ. Konstanz.
2018/19-WT **TA: Introduction to Algebra**, Univ. Konstanz.

Organization

- 2023 **Networks & Optimization Seminar**, biweekly seminar at CWI, with Sander Borst, Hilde Verbeek and Danish Kashaev, CWI Amsterdam.
2020-ST **Seminar on Real Geometry and Algebra**, with Markus Schweighofer, Univ. Konstanz.
2019/20-WT **Seminar on Real Geometry and Algebra**, with Markus Schweighofer, Univ. Konstanz.

Publications

- 2022 **Identifiability for Mixtures of Centered Gaussians and Sums of Powers of Quadratics**, with Alex Casarotti, Mateusz Michałek and Alessandro Oneto.
In: Bulletin of L.M.S., id: BLMS12871
2021 **Ideals of Spaces of Degenerate Matrices**, with Mateusz Michałek und Julian Vill.
In: Linear Algebra and Its Applications (LAA-D-21-00505R1),
[sciencedirect.com/science/article/abs/pii/S0024379522001677](https://www.sciencedirect.com/science/article/abs/pii/S0024379522001677)

Preprints

- 2023 **Gaussian Mixture Identifiability from degree 6 Moments**
arxiv:2307.03850
2023 **Unique powers-of-forms decompositions from simple Gram spectrahedra**
arxiv:2305.06860

Work-in-Progress

- 2023 **Nondefectivity of GL_n -invariant secant varieties**
General result on the dimension of secant varieties of a base variety that is closed under the GL_n -action.

Talks, Posters, Conferences and other Venues

Upcoming

- May 2024 **SIAM LA**, Sorbonne Université, Paris.
Invited minisymposium talk: *Nondefectivity of GL_n -invariant secant varieties*.
April 2024 **Nederlands Mathematisch Congress**, TU Delft.
Invited talk: *Algebraic Geometry in Machine Learning*.
Nov 2023 **Research Stay**, Università di Trento.
I am glad to be received by Alessandro Oneto at the university of Trento for a week.

Past

- Oct 2023 **Chow Lectures**, MPI-MiS, Leipzig.

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- Sep 2023 **Conference on Applied Algebra**, *Universität Osnabrück*.
Poster: *Identifiability of Gaussian mixtures from sixth-order moments*.
- Jul 2023 **SIAM AG**, *TU Eindhoven*, Eindhoven.
Invited minisymposium talk: *Unique powers-of-forms decompositions from simple Gram spectrahedra*.
- Jun 2023 **FOCM**, *Sorbonne Université*, Paris.
Poster in the Data Science and Machine Learning session (II.4):
Identifiability of Gaussian mixtures from sixth-order moments.
- May 2023 **OPTIMAL meeting**, *TU Delft*, Delft.
Talk: *Unique power sum decompositions from simple Gram spectrahedra*.
- April 2023 **DIAMANT symposium**, *De Zalen van Zeven*, Utrecht.
Talk: *Identifiability of Gaussian Mixtures from their sixth moments*
- April 2023 **Dutch Mathematical Congress**, *Van der Walk Hotel*, Utrecht.
- Mar 2023 **Real Algebraic Geometry with a View toward Koopman Operator Methods**,
Mathematisches Forschungsinstitut Oberwolfach, Oberwolfach.
Talk: *A semidefinite algorithm for powers-of-forms decomposition*.
- 2022 **Workshop on Semidefinite and Polynomial Optimization**, *CWI*, Amsterdam.
- 2022 **International Conference on Continuous Optimization (ICCOPT)**, *Lehigh University*, Bethlehem, PA, USA.
Invited minisymposium talk: *Projecting towards the image set of a polynomial map with Sum-of-Squares Relaxations*.
- 2022 **MEGA 2022**, *Pedagogical University of Kraków*, Kraków, Poland.
Talk: *Identifiability for Mixtures of Gaussians* (joint work with A. Casarotti, M. Michałek and A. Oneto).
- 2020 **Real Algebraic Geometry with a View Toward Hyperbolic Programming and Free Probability**, *Mathematisches Forschungsinstitut Oberwolfach*, Oberwolfach.
- 2019 **SIAM Conference on Applied Algebraic Geometry**, *Universität Bern*, Bern.
- 2019 **Arctic Applied Algebra**, *University of Tromsø*, Tromsø.
Talk on the topic of my master's thesis.
- 2018 **International Conference on Polynomial and Tensor Optimization**, *Xiangtan University*, Xiangtan (Hunan Province, PR China).
Talk on the topic of my master's thesis.
- 2018 **Summer School on Numerical Computing in Algebraic Geometry**, *Max Planck Institute for Mathematics in the Sciences*, Leipzig.
Summer School with emphasis on Tensor decomposition, Sum-of-Squares programming and Homotopy Continuation. August 13 - 17.

Services

2019-* **Reviewer for zbMath.**

Miscellaneous

2021–2022 **Corona-News-Portal Regensburg.**

I wrote an automatic thematic news classifier for a regional Covid news portal, based on samples classified by volunteers.

2016–2018 **∃-Quest.**

Indie video game project built with PixiJs.

Programming Skills

Routined JULIA, particularly JuMP, MultivariatePolynomials, SumOfSquares and generally semidefinite and sum-of-squares optimization. Also DataFrames, LIBSVM etc. and partial experience with symbolic Computations (OSCAR, NEMO...)

Intermediate PYTHON, JavaScript, L^AT_EX, Bash/Shell, Jupyter

Basic C, Java

Languages

German **Native**

English **Fluent**

Portuguese **Fluent**

Dutch **Basic**

French **Basic**

Research Interests

- Algebraic Statistics
- Computational Complexity
- Machine Learning
- Computational Algebraic Geometry
- Invariant Theory
- Secant Varieties
- Data Science
- Semidefinite Programming

References

Monique Laurent, *Scientific Staff Member, CWI, Amsterdam and Professor at Universiteit Tilburg*, Phone: +31 20 592 4105, E-mail: M.Laurent@cwi.nl.

Markus Schweighofer, *Professor, Department of Mathematics and Statistics, Universität Konstanz*, Phone: +49 7531 88 2579, E-mail: markus.schweighofer@uni-konstanz.de.

Mateusz Michałek, *Professor, Department of Mathematics and Statistics, Universität Konstanz*, E-mail: mateusz.michalek@uni-konstanz.de.

Alessandro Oneto, *Associate Professor, Department of Mathematics, Università di Trento*, E-mail: alessandro.oneto@unitn.it.

Amsterdam, 2023 November 5

A. Blomenhofer

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