Marc Härkönen

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Education

Georgia Institute of Technology, Atlanta, Georgia, USA
PhD, Mathematics 2017–2022

- Thesis: Dual representations of polynomial modules with applications to partial differential equations
- Advisor: Professor Anton Leykin
- Cumulative GPA: 4.00/4.00;
- Minor in Probability and Statistics
- Research visits to ICERM (Brown University, Providence, RI), Institute of Statistical Mathematics (Tokyo, Japan), Sorbonne Université (Paris, France), Max Planck Insitute (Leipzig, Germany)
- Selected coursework: Toric algebraic geometry; algebraic topology; linear statistical models; testing statistical hypotheses.

Aalto University, Espoo, Finland
Master of Science (Tech.), Mathematics 2015–2017

- Cumulative GPA: 5.00/5.00; Minor in Computational Science and Engineering
- Master's thesis: Holonomic Extended Least Angle Regression
- Advisors: Prof. Tomonari Sei (U. Tokyo) and Prof. Kaie Kubjas
- Selected coursework: algebraic statistic; computational algebraic geometry; mathematical tools for coding theory and data storage.

University of Tokyo, Tokyo, Japan
Exchange studies (Master's) aug 2016– jun 2017

- Cumulative GPA: 4.00/4.00;
- Exchange studies at the Department of Mathematical Informatics, Graduate School of Information Science and Technology
- Selected coursework: Stochastic processes; Mathematical semantics of computer systems; Japanese

Aalto University, Espoo, Finland
Bachelor of Science (Tech.), Mathematics 2012–2015

- Cumulative GPA: 4.96/5.00
- Bachelor's thesis: Distributed Storage Systems and Product Matrix Codes
- Advisor: Prof. Camilla Hollanti
- Exchange studies at the University of Hong Kong and Stanford University.

University of Hong Kong, Hong Kong SAR, China
Exchange studies aug 2014– jun 2015

- Cumulative GPA: 4.00/4.00
- Exchange studies.
- Selected coursework: Data analysis and modelling in physics; Game theory and strategy; Fuzzy systems and neural networks; Cantonese

Stanford University, Palo Alto, CA, USA
Exchange studies jun 2014– aug 2014
- Cumulative GPA: 4.00/4.00
- Exchange studies (Stanford Summer International Honors Program).
- Selected coursework: Design and analysis of algorithms; Introduction to scientific computing.

Professional Experience

Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany
Postdoctoral researcher may 2022–dec 2022
- Research in differential algebra and applications, in particular to solving systems of partial differential equations via algebra and computational aspects (Macaulay2 development).
- Mentored by Prof. Bernd Sturmfels; member of the Nonlinear Algebra research group.
- Collaboration with researchers in mathematical analysis and control theory.

Georgia Institute of Technology, Atlanta, GA, USA
Graduate student instructor, graduate teaching assistant aug 2017–may 2022
- Instructor of record for two semesters, teaching assistant for 7 semesters.
- Grader for graduate algebra.
- In spring 2022, interviewed prospective undergraduate teaching assistants.

Aalto University, Espoo, Finland
Teaching assistant 2016
- Teaching assistant for algebra and discrete mathematics.

CERN, Geneva, Switzerland
Summer trainee jun 2015–sep 2015
- Data analysis of diffractive processes with 7 TeV and 13 TeV proton-proton collisions in the Large Hadron Collider.
- Particle identification in central diffractive processes with the ALICE collaboration.
- Used the ROOT data analysis framework (C++).

Aalto University, School of Chemical Technology, Espoo, Finland
Research assistant jun 2013–sep 2013
- Research in the Novel Materials via Self-Assembly research group.
- Set up and ran molecular dynamics simulation using GROMACS, both locally and on high performance computational clusters.
- Programmed a C++ conversion tool for file formats used in molecular dynamics simulations.

Publications

Published
- J.Chen, M.Härkönen, R.Krone, A.Leykin: Noetherian operators and primary decomposition. *Journal of Symbolic Computation* 2022
- R.Ait El Manssour, M.Härkönen, B.Sturmfels: Linear PDE with Constant Coefficients. *Glasgow Mathematical Journal* 2021
- M.Härkönen, Y.Hirose, T.Sei: Holonomic extended least angle regression, *Information Geometry* 2020
- M.Härkönen, B.Hollering, F.Tarashi Kashani, J.I.Rodriguez: Algebraic Optimization Degree, *ACM Communications in Computer Algebra* 2020
- H.Antila, M.Härkönen, M.Sammalkorpi: Chemistry specificity of DNA-polycation complex salt response: A simulation study of DNA, polylysine and polyethyleneimine, *Physical Chemistry Chemical Physics*, 2015

Preprints

- M.Härkönen, B.Raiţă, L.Nicklasson: Syzygies, constant rank, and beyond. arXiv:2112.12663. Submitted for publication 2021
- M.Härkönen, J.Hirsch, B.Sturmfels: Making Waves. arXiv:2111.14045. Submitted for publication 2021
- J.Chen, Y.Cid-Ruiz, M.Härkönen, R.Krone, A.Leykin: Noetherian Operators in Macaulay2. arXiv:2101.01002. Submitted for publication 2021

Project Experience

University of Minnesota & Securian Financial, Minneapolis, MN
Math-to-Industry workshop (online) jun 2021 - jul 2021

- Predicted group life insurance client mortality during a pandemic.
- Data gathering (US census bureau, CDC, USDA), cleanup and manipulation using R (tidyverse and tidymodels packages).
- Applied several machine learning models, evaluated them statistically, tuned and trained the best one.
- Gained experience in time series forecasting, model explanation methods and using Python in machine learning.

Software Proficiencies

Working knowledge
R (tidyverse, ggplot2, tidymodels), Python (numpy, scipy, pandas, matplotlib, keras, scikit-learn), Macaulay2, Mathematica, C++, Git, LaTeX, Vim, Arch Linux, bash, Mac OS X, Microsoft Office Suite

Basic knowledge
HTML/CSS, Rust, C, Matlab, Julia

Leadership Experience

Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany
Workshop organizer 2022

- Co-organized a three day academic workshop with 40 in-person participants and 20 online.
- Contacted speakers and coordinated with administrative staff regarding visa, hotel, streaming, and catering related issues.

Georgia Institute of Technology, Atlanta, GA
Seminar organizer 2020-2022

- Co-organized the Georgia Tech Student Algebra Seminar.
- Updated website, booked room, found and corresponded with speakers.
- During pandemic, successfully converted the seminar to an online format.

Georgia Institute of Technology, Atlanta, GA
Graduate Student Instructor 2017-2022

- Served as instructor of record for two courses: MATH-3670 - Probability, Statistics and Applications; MATH-2552 - Differential Equations.
- Prepared syllabi, computational examples, exams, exercises and delivered lectures in an online format.
- Lead a team of two teaching assistants (grading, tutorial sessions).
- In addition, I served as a teaching assistant for several other mathematics courses

Honors & Awards

Outstanding Teaching Assistant, *Georgia Institute of Technology, Atlanta, GA* 2021
Outstanding MathLab Tutor, *Georgia Institute of Technology, Atlanta, GA* 2020

Chateaubriand Fellowship, *Embassy of France, Washington D.C.* 2019
SIAM student travel award, *Society for Industrial and Applied Mathematics* 2019
Vilho, Yrjö and Kalle Väisälä Foundation scholarship, *Finnish Academy of Sciences and Letters, Helsinki, Finland* 2019
Bob Price Travel award, *Georgia Tech, School of Mathematics, Atlanta, GA* 2018
Commendable Service as Electronic Warfare NCO, *Air Force Academy, Tikkakoski, Finland* 2012

Software & activities

Service: I organized the Student Algebra Seminar at Georgia Tech (2020-2022). In June 2022 I organized the Workshop on Differential Algebra at the Max Planck Institute, Leipzig, Germany

Peer-review: I have reviewed manuscripts for the following journals: Journal of the Royal Statistical Society Series B (Statistical Methodology), Algebraic Statistics.

Open source: I contribute to Macaulay2 and attend internal meetings

Other: I was a member of the Aalto University Algorithmic Problem Solving team, and attended the 2015 Northwestern Europe Regional Contest (NWERC) in Linköping, Sweden.

Selected talks, conferences etc.

- *Workshop on Differential Algebra,* Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany, **Organizer** 2022/06

- *SIAM Conference on Applied Algebraic Geometry,* Texas A&M, College Station, TX, USA, **Invited talk** 2021/08

- *ACA 2021, Algebraic and Algorithmic Aspects of Differential and Integral Operators,* Online, **Invited talk** 2021/07

- *Math-to-Industry workshop,* University of Minnesota, Minneapolis, MN, USA 2021/07

- *Workshop on Software and Applications of Numerical Nonlinear Algebra,* Max Planck Institute, Leipzig, Germany, 2021/06

- *ISSAC 2020 (virtual),* Kalamata, Greece, **Software presentation** 2020/06

- *Macaulay2 Workshop (virtual),* Cleveland State University, Cleveland, OH 2020/05

- *PGMO Days,* EDF'Lab Paris-Sarclay, Paris, France, **Invited talk** 2019/12

- *SIAM Conference on Applied Algebraic Geometry,* University of Bern, Bern, Switzerland, **Invited talk in Algebraic Statistics mini-symposium** 2019/07

- *Meeting on Applied Algebraic Geometry,* Georgia Institute of Technology, Atlanta, USA 2019/04

- *Nonlinear Algebra in Applications,* ICERM (Brown University), Providence, USA, **Part of the semester program in Nonlinear Algebra** 2018/09

- *Real Algebraic Geometry and Optimization,* ICERM (Brown University), Providence, USA,

Part of the semester program in Nonlinear Algebra 2018/09

- *Core computational methods,* ICERM (Brown University), Providence, USA, **Part of the semester program in Nonlinear Algebra** 2018/09

- *Nonlinear Algebra Bootcamp,* ICERM (Brown University), Providence, USA, **Part of the semester program in Nonlinear Algebra** 2018/09

- *Hyperplane arrangements and computations with CoCoA*, Hokkaido University, Sapporo, Japan 2018/08

- *Meeting on Applied Algebraic Geometry*, Georgia Tech, Atlanta, USA 2018/04

- *TAGS - Linking Topology to Algebraic Geometry and Statistics*, Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany**Poster presented: Holonomic extended least angle regression** 2018/02

- *Workshop on Non-Linear Algebra*, Max Planck Institute for Mathematics in the Sciences, Leipzig, Germany 2017/01

- *26th Jyväskylä Summer School*, Jyväskylä, Finland, **Attended course MA4: Lévy and Feller Processes and Applications** 2016/08

- *Summer School on Algebra, Statistics and Combinatorics*, Helsinki, Finland 2016/06

- *WE-Heraeus Physics School*, Diffractive and Electromagnetic processes at high energies, Bad Honnef, Germany, **Poster presented: Soft classification for particle identification in central exclusive production** 2015/08

Teaching Experience

Georgia Institute of Technology, Atlanta, GA
Graduate Student Instructor, School of Mathematics 2020–2022
MATH-3670 - Probability, Statistics and Applications
MATH-2552 - Differential Equations

Graduate Teaching Assistant 2017-2022
MATH 6121 - Graduate Algebra I (grader)
MATH-3670 - Probability, Statistics and Applications
MATH 2603 - Introduction to Discrete Mathematics
MATH-2552 - Differential Equations
MATH 2551 - Multivariable calculus
MATH 1553 - Introduction to Linear Algebra

Aalto University, Espoo, Finland
Teaching Assistant, 2016
MS-C1081 - Abstract Algebra
MS-A0401 - Intro to Discrete Mathematics

Language Skills

Fluent/native: English, Finnish, French

Intermediate: Japanese
Basics: Cantonese, Mandarin, Swedish, Portuguese, Russian

Hobbies & Interests

Rock climbing, bouldering, language learning, geography