Miles Bakenhus

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EDUCATION

PhD | Illinois Institute of Technology | Applied Mathematics | Aug. 2025

- *Advisor:* Sonja Petrović
- *Dissertation:* Exploration and Approximation on Discrete Structures

MS Illinois Institute of Technology | Applied Mathematics | May 2020

BS | Texas State University | Applied Mathematics | May 2011 - Minored in Economics

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RESEARCH EXPERIENCE

Research Assistant | Illinois Institute of Technology | Chicago, IL | Jan. 2023 - Aug. 2025

Performed research in applied mathematics, including writing/publishing findings, collaboration with researchers, attending and speaking at conferences/workshops, and programming in Python, R, MATLAB, Macaulay2, Julia.

- *Research:* application of algebraic geometry to statistics and optimization, integer programs (MIPs), hypothesis testing, goodness-of-fit testing, MCMC algorithms, image denoising, topology optimization, graph theory, network similarity analysis, Bayesian analysis
- *Technology:* R, Python, Julia, Macaulay2, sbm, missSBM, ergm, LattE, 4ti2, algstat, Gurobi, CPLEX, scikit-learn, scikit-image, NumPy, Pandas, matplotlib, SciPy, Pyomo, NetworkX, SageMath, iGraph, Rmarkdown, Markdown, LaTeX, HTML, JSON, XML

Research Aide | Argonne National Laboratory | Lemont, IL | May - Aug. 2024

Returned ANL as a research aide in 2024 as part of an ongoing NSF grant in the summer research programs, of the MCS division of ANL. Worked closely with senior researchers and postdocs to develop and report on methods and algorithms for use in discrete optimization.

- Researched randomized algorithms for solving MIPs using methods from algebra.
- Implemented algorithms solving MIPs in Python, using Gurobi, CPLEX, and scikit-learn.

Long Program Participant | Institute for Mathematical and Statistical Innovation | Chicago, IL | Fall 2023

- Titled: *Algebraic Statistics in our Changing World*

- The long program was a series of workshops, talks, and reading groups on emerging topics in Algebraic Statistics.
- Presented a short overview of Bayesian sampling during "Lightning Talks."
- Primary research topics included censored Stochastic Block Models, Phase transition in 3-way contingency tables.

Givens Associate | Argonne National Laboratory | Lemont, IL | May - Sep. 2023

Awarded Givens associateship in 2023 to work with researchers solving Mixed Integer Programs (MIPs) at Argonne National Lab.

- Used methods from algebraic statistics and to solve MIPs.
- Implemented Lattice sampling algorithms in R, using sparse matrix vector operations

Mathematics Research Communities Participant | American Mathematical Society | Summer 2022

- *Titled:* Trees in Many Contexts
- Supervised by Stephan Wagner, Uppsala University
- The primary research topics were Graham equivalence classes and iterated line graphs on trees.
- Collaborated with other participants on research questions posed by MRC organizers.
- In addtion to reaserch the program included professional development program for graduate students and early career mathematicians.

PRESENTATIONS

Poster: *"Merge Operations on Labeled Stochastic Block Models,"* Illinois Institute of Technology, Menger Day, April 2025

Presentation: *"A Heuristic Augmentation Algorithm for Discrete Total-Variation Problems,"* AMS Special Session on Applied and Computational Commutative Algebra, Joint Mathematics Meetings, Jan. 2025

Poster: *"Randomly Updating Moving Bayesian Algorithm (RUMBA): An algorithm for sampling lattice points in a polytope,"* Illinois Institute of Technology, Menger Day, April 2024

Presentation: *"Randomly Updating Moving Bayesian Algorithm (RUMBA): An algorithm for sampling lattice points in a polytope,"* SIAM Conference on Applied Algebraic Geometry, July 2023

Presentation: *"Iterated Line Graphs on Trees,"* Joint Mathematics Meetings, Jan. 2023

Workshop: *"Introduction to R Programming,"* Women and Gender Minorities in STEM, Sept. 2021

PUBLICATIONS AND PRE-PRINTS

Félix Almendra Hernández, Miles Bakenhus, Vishesh Karwa, Mitsunori Ogawa, and Sonja Petrović, (2025 In Preparation) *"Non asymptotic selection of the number of communities in Count SBMs"*

Dominic Yang, Sven Leyffer, Miles Bakenhus (2025 pre-print) *"Augmentation Algorithms for Total Variation-Regularized Integer Programs"*, arXiv:2508.05822

Miles Bakenhus (2025) *"Exploration and Approximation on Discrete Structures"* PhD diss., Illinois Institue of Technology, ProQuest Dissertations & Theses

Yulia Alexandr, Miles Bakenhus, Maize Curiel, Sameer K. Deshpande, Elizabeth Gross, Yuqi Gu, Max Hill, Joseph Johnson, Bryson Kagy, Vishesh Karwa, Jiayi Li, Hanbaek Lyu, Sonja Petrović, Jose Israel Rodriguez (2024), *"New directions in algebraic statistics: Three challenges from 2023"*, Algebraic Statistics, arXiv:2402.13961

Miles Bakenhus and Sonja Petrović (2024), *"Sampling lattice points in a polytope: a Bayesian biased algorithm with random updates"* Algebraic Statistics, 15, 61–83

PROFESSIONAL AFFILIATIONS

Teaching Assistant | Illinois Institute of Technology | Chicago, IL | Aug. 2020 - Dec. 2022

Teaching assistant duties covered multiple classes and levels.

- Assistant for multiple, semester long courses: Discrete, Calculus, Linear Algebra, Statistics, etc.
- Graded homework assignments
- Answered student questions during office hours and via e-mail.

Senior Solutions Consultant | SensorInsight | Houston, TX | Jan. 2016 - Jul. 2018

Promoted to a senior role at SensorInsight, a subsidiary, at the time, of ElementBlue. Projects focused on delivering a SaaS solution, aggregating and visualizing data (timeseries, geospatial, etc.) for clients in industries, including agriculture and healthcare.

- Designed and systems architecture, including server architecture, network security, cloud operations on AWS.
- Implemented automation using shell/Bash and Python on Unix/Linux systems, as well as with the AWS CLI.
- Developed data pipelines for sensors, using Apache Camel, Redis, Cassandra, and Postgres/MySQL databases.
- Deployed both frontend and backend applications in using DevOps tools, such as Docker and Jenkins.
- Met with clients to define project requirements, explain technical details, and iterate feedback.
- Mentored new hires and performed interviews.

Solutions Consultant | ElementBlue | Houston, TX | Oct. 2013 – Dec. 2015

Worked on a variety projects, consulting for clients in healthcare and other industries. Responsible for managing network and server infrastructure for both on-site and cloud-based solutions. Deployed and maintained software.

- Installed, configured, and managed software solutions both on cloud infrastructure including VMware and AWS.
- Performed system administration tasks on Unix/Linux and Windows systems, automating backups and updates
- Software deployments: IBM Sametime 9.0, IBM Intelligent Operations Center, IBM Websphere, IBM Content Manager, IBM Maximo (including customization in Java), Sitecore

SKILLS

Programming Languages:
Python, R, Macaulay2, Julia, MATLAB, SQL, Shell, PowerShell, Java, .Net, C/C++

Python and R Libraries:
NumPy, Pandas, SciPy, SageMath, Scikit-learn, NLTK, NetworkX, pgmpy, Pyomo, tidyverse, knitr, igraph, ggplot2

Other Software and Technology:
MS Office suite (Word, Excel, Powerpoint, etc.), Windows, Unix/Linux, RDBMS (MySQL, SQL Server, PostgreSQL), NoSQL (Apache Cassandra, MongoDB), JSON, XML, LaTeX, Markdown, Rmarkdown, CPLEX, Gurobi, AWS, Azure, Google, VMware, VirtualBox, server-network architecture for enterprise systems, git

Research:
literature review, mathematical proof, algorithm development, copy writing/editing

Communication: public speaking at conferences, leading classroom discussions and lecture, facilitating client meetings

Other: consulting, assessment of organizational requirements, interpreting and responding to client feedback, time and expenses estimation, mentoring