

# Thomas Yahl

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## PROFILE

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Van Vleck Visiting Assistant Professor at University of Wisconsin - Madison with expertise in applied and computational algebraic geometry. I strive for excellence in meeting my team's goals by developing creative and original solutions and effectively communicating those solutions. Searching for a position as a mathematician, algorithms engineer, machine learning engineer, etc.

## SKILLS SUMMARY

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### Expert with:

- Python
- julia
- Macaulay2
- numpy
- Linux/Unix

### Experienced with:

- pandas
- scikit-learn
- Keras
- Git
- Bash

### Proficient with:

- PyTorch
- TensorFlow
- SQL
- R
- Matlab

- Quantitative: Geometric Reasoning, Numerical Algorithms, Machine Learning, Statistics
- Soft Skills: Communication and Presentation, Organization, Ingenuity, Teamwork

## LEADERSHIP EXPERIENCE

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**Math Assistance Center at Indiana University – Purdue University Indianapolis:** Indianapolis, IN      **2013 – 2017**

### *General Manager*

- Managed 30 tutors for calculus, differential equations, and linear algebra, including hiring, scheduling, and evaluation of tutors.
- Organized Exam Jam sessions preparing over 600 students over the course of 4 years for their final exams.
- Tutored upper-level undergraduate students in calculus, differential equations, and linear algebra courses.

## WORK EXPERIENCE

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**University of Wisconsin – Madison (UWM):** Madison, WI

**2023 – Present**

### *Van Vleck Visiting Assistant Professor*

- Conducted state of the art research in machine learning and statistics resulting in two new research articles [[Article1](#),[Article2](#)].
- Designed and instructed original course curricula for a special topics course on toric varieties to prepare students for research.
- Coordinated the Applied Algebra Seminar at UWM and organized sessions "[Symbolic-Numeric Aspects of Algebraic Geometry](#)" at [ICMS 2024](#) and "[Applications of Algebra and Geometry](#)" at [AMS Spring Central Sectional](#).
- Received the UWM Postdoctoral Excellence in Teaching Award for instructing courses including calculus, linear algebra, differential equations, and topology.

**Texas A&M University (TAMU):** College Station, TX

**2017 – 2023**

### *Graduate Research Assistant*

- Developed open source, peer reviewed math software packages in julia and Macaulay2 [[Software1](#),[Software2](#),[Software3](#)].
- Published 5 research articles in various research journals including Numerical Algorithms, Journal of Symbolic Computation, and Journal of Algebra and its Applications.
- Led a team of three undergraduate researchers which ran a novel computational experiment in Macaulay2 and produced over 900 instances of rare geometric phenomena leading to two new conjectures in algebraic geometry.
- Utilized numerical software packages HomotopyContinuation.jl in julia and alphaCertified in Macaulay2 to provably compute Galois groups of enumerative problems in algebraic geometry with as many as 75,000 solutions [[Article](#)].
- Awarded the Texas A&M University Association of Formal Students Graduate Merit Fellowship.

## SELECTED PROJECTS

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### Decomposable Sparse Systems – Texas A&M University [\[Slides,ResearchArticle,Software\]](#) **Fall 2020**

- This project leveraged theoretical results in Algebraic Geometry to produce a new algorithm which improves the speed and accuracy in solving structured polynomial systems. We utilized Python to test our implementation on over 10,000 instances of structured polynomial systems in parallel, which provided a nearly a 50% increase in speed for those systems.
- We created an open source Macaulay2 implementation of our algorithm that was peer reviewed by the Journal of Software for Algebra and Geometry and is accompanied by a published journal article describing the software [\[SoftwareArticle\]](#).
- Presented this work at over 6 different university seminars and conferences, including Georgia Tech, Max-Planck-Institut fur Mathematic, and SIAM TX-LA Sectional Meeting 2019

### TAMIFS Data Science Competition – Texas A&M University [\[Github\]](#) **Spring 2022**

- Our team strove to uncover how collaboration trends between the Mathematics, Statistics, and Computer Science departments have developed at Texas A&M University.
- Python was used to access the APIs of the preprint server arXiv and the research database Dimensions to collect data on over 20,000 research articles. Pandas and sklearn were used to clean and analyze the data and understand developments.
- We received the 4th place prize and the award for Best Use of Additional Data at the TAMIFS Data Science Competition.

### Homotopies in Cox Coordinates – Texas A&M University [\[Slides,ResearchArticle,Software\]](#) **Spring 2024**

- This project developed a new method of reliably computing all solutions of a polynomial system using numerical homotopy continuation based on the Cox quotient construction of a complete normal toric variety.
- In a numerical experiment of a polynomial system with 7,776 solutions, our open source julia implementation discovered over 200 solutions traditional solvers were unable to locate.
- Presented this work at the mathematics conferences SIAM Conference on Applied Algebraic Geometry 2021, SIAM TX-LA Sectional Meeting 2021, and Joint Mathematics Meetings 2022.

## EDUCATION

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Texas A&M University, Ph.D. Mathematics	(GPA = 3.89)	<b>2023</b>
Indiana University - Purdue University Indianapolis, B.S. Mathematics, Minor Computer Science	(GPA = 3.68)	<b>2017</b>

## PUBLICATIONS

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- [“Completions to Discrete Probability Distributions in Log-Linear Models”](#), Cai, May; Olesen Recke, Cecilie; Yahl, Thomas, *Algebraic Statistics* Vol. 15 (2024), no. 2, 225-247.
- [“Computing Galois groups of finite Fano problems”](#), Yahl, Thomas, *Journal of Symbolic Computation* Vol. 119 (2023), 81-89.
- [“Real solutions to systems of polynomial equations in Macaulay2”](#), Lopez Garcia, Jordy; Maluccio, Kelly; Sottile, Frank; Yahl, Thomas, *Journal of Software for Algebra and Geometry* Vol. 14 (2024), no. 1, 87-95.
- [“Polyhedral homotopies in Cox coordinates”](#), Duff, Tim; Telen, Simon; Walker, Elise; Yahl, Thomas, *Journal of Algebra and its Applications* Vol. 23 (2024), no. 4, Paper No. 2450073.
- [“Decomposable sparse polynomial systems”](#), Brysiewicz, Taylor; Rodriguez, Jose Israel; Sottile, Frank; Yahl, Thomas, *Journal of Software for Algebra and Geometry* Vol. 11 (2021), no. 1, 53-59.
- [“Solving decomposable sparse systems”](#), Brysiewicz, Taylor; Rodriguez, Jose Israel; Sottile, Frank; Yahl, Thomas, *Numerical Algorithms* Vol. 88 (2021), no. 1, 453-474.