Mathew Titus

Sunstrand, LLC
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PERSONAL DATA Citizenship: U.S.A.

EDUCATION

- *Ph.D. in mathematics*, Oregon State University, Oregon, September 2017
  Advisor: Edward Waymire
- *B.A. in mathematics and physics*, Willamette University, Oregon, May 2009

INTERESTS

Complex adaptive systems, dimension reduction, generative AI,
watershed modeling, prediction in ecology,
mixing times and cutoff phenomena, fractal fields, and branching processes

ACADEMIC POSITIONS

- Postdoctoral Researcher (DARPA funded)
  College of Earth, Ocean, and Atmospheric Sciences, Oregon State University
  August 2017 - February 2020
- Research Assistant (NSF funded)
  Department of Mathematics, Oregon State University
  June 2017 - August 2017
- Graduate Teaching Assistant
  Department of Mathematics, Oregon State University
  September 2010 - August 2017
- Research Assistant
  Department of Electrical Engineering and Computer Science, Oregon State University
  June 2014 - September 2014
- Mathematics Instructor
  Department of Mathematics, Oregon State University
  June 2011 - September 2011; September 2013 - August 2014

ENTREPRENEURSHIP

- CTO, Managing Member
  ClearWaterAnalytica, LLC
  April 2021 - present

  Cloud computing architect and web designer for a Software as a Service (SaaS) product, operationalizing data collection, processing, and machine learning predictions for reservoir management. Partnered with an engineering firm to lead a research effort investigating the utility of eXplainable Artificial Intelligence (XAI) in risk quantification for algal blooms.

- CTO, Managing Member
  The Prediction Lab, LLC
  June 2018 - present

  Worked on fundamental research to create a Bayesian Model Average approach to predicting oncoming harmful algal blooms (HABs) at Detroit Lake, Oregon. Improved client-public relations through speaking engagements and data visualizations. A blog and web application were made to display the state-of-the-reservoir and current risk levels. Managed subcontractors in modeling, satellite data collection, and web design. Also worked as the lead researcher on a DARPA-funded grant investigating new ways to detect and quantify causal connections in complex systems.

- Technical Consultant, Managing Member
  Northwest Mathematics, LLC
  June 2017 - April 2019

  Software design, development and client relations. Created an application and user interface for casino game design, estimating house earnings and jackpot sizes for a variety of parameters and design choices. This involved creating a new probabilistic method of simulating game outcomes that improved on the industry standard for such simulations.

SCHOLARSHIP AND CREATIVE ACTIVITY

Publications

In preparation

- **Mathew Titus**, *Fractal Behavior in Dispersion and Schrödinger Equations.*

Refereed journal publications

J1. Yevgeniy Kovchegov, Peter T. Otto, and **Mathew Titus**, *Mixing Times for the Mean-Field Blume-Capel Model via Aggregate Path Coupling*, Journal of Statistical Physics, Volume **144**, Number 5 (2011), pp. 1009-1027

J2. Zachary Gelbaum and **Mathew Titus**, *Simulation of Fractional Brownian Surfaces via Spectral Synthesis on Manifolds*, IEEE Transactions in Image Processing, Volume **23**, Issue 10 (2014), pp. 4383-4388

J3. James R. Watson, Zachary Gelbaum, **Mathew Titus**, Grant Zoch, and David Wrathall, *Identifying multiscale spatio-temporal patterns in human mobility using manifold learning*, (2020)

J4. **Mathew Titus** and James R. Watson, *Critical speeding up as an early warning signal for stochastic regime shifts*, (2020)

J5. **Mathew Titus**, George Hagstrom, and James R. Watson, *Unsupervised manifold learning of collective behavior*, (2021)

Other publications

O1. **Mathew Titus** , *Mixing Times for Diffusive Lattice-Based Markov Chains*, Thesis.

O2. **Mathew Titus**, George Hagstrom, and James R. Watson. *Unreal to real: Current abilities and knowledge gaps for measuring the realism of social simulations*, DARPA Report, (2021).

Professional meetings, symposia, invited talks, and conferences

23. March 2024 *AI Forecasting for Harmful Algal Blooms*, New Jersey DEP HABs Summit **(speaker)**

22. November 2023 *Assessing the Vulnerability of Source Waters to Toxic Cyanobacterial Blooms Using XAI*, Oregon Lakes Association Conference **(speaker)**

21. April 2022 *Creating a Crystal Ball: The Future of Harmful Algal Bloom Forecasting Using Artificial Intelligence*, AWWA Pacific Northwest Section Conference **(speaker)**

20. June 2019 *Predicting Harmful Algal Blooms in Municipal Water Systems*, City Focus Podcast **(speaker)**

19. May 2019 *Forecasting Harmful Algal Blooms in Detroit Lake*, North Santiam Basin Summit **(speaker)**

18. March 2019 *Predicting Cyanotoxins in Detroit Lake*, City of Salem, OR **(speaker)**

17. June 2018 *Unsupervised Detection of Collective Behavior*, Space and Naval Warfare Systems Command (SPAWAR), San Diego, CA **(poster presented)**

16. May 2018 *Unsupervised Detection of Collective Behavior*, OSU Mathematical Biology Seminar **(speaker)**

15. November 2017 *Applications of the Laplace Operator*, Willamette University Mathematics Colloquium **(speaker)**

14. May 2017 *Mixing Times of Diffusive Markov Chains*, OSU Probability Seminar **(speaker)**

13. May 2017 *Southeast Probability Conference*, Durham, NC **(poster presented)**

12. May 2017 *Mixing Times of Diffusive Markov Chains*, University of Oregon Probability Seminar, **(speaker)**

11. May 2017 *Lonseth Lecture Poster Session*, Oregon State University **(presenter)**

10. May 2016 *Frontier Probability Days*, Salt Lake City, UT **(attendee)**

9. January 2016 *Joint Mathematical Meetings of the AMS*, Seattle, WA **(speaker)**

8. May 2015 *SIAM Conference on Applications of Dynamical Systems*, Snowbird, UT **(speaker)**

7. October 2015 *Pacific Northwest Probability Seminar*, Seattle, WA **(attendee)**

6. August 2013 *Mathematical Congress of the Americas*, Guanajuato, MX **(attendee)**

5. July 29 - August 2, 2013 *Summer Short-Course on Mathematics of Climate Change, Related Natural Hazards, and Risks* , CIMAT, Guanajuato, MX **(participant)**

4. June 2012 *Workshop in Geometric Topology*, Oregon State University **(volunteer)**

3. April 2012 *Smooth Covering Spaces*, Topology Seminar, Oregon State University **(speaker)**

2. June 2011, *Summer Graduate School in Commutative Algebra*, Mathematical Sciences Research Institute (MSRI), Berkeley, CA **(attendee)**

1. April 2011 *Möbius and Lorentz Transformations*, Mathematics Colloquium Series, Willamette University **(speaker)**

COMMUNITY SERVICE

Reviewer: Water Resource Research, American Naturalist, Stochastics and Dynamics, Journal of Theoretical Biology, IEEE Transactions, The R Journal.

Organizer: Incoming Graduate Student summer preparatory course, OSU, 2016.

COMPUTING FRAMEWORKS

Scientific: Python, R, Matlab, scikit-learn
Cloud: AWS, Google Earth Engine
Production: C++, C#
Front-end: HTML, CSS, Javascript, Hugo
Command line tools: Bash, Git
GIS: Geopandas, Leaflet