

ALEXANDER WIKNER

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PRIMARY INTERESTS

Machine Learning; Nonlinear Dynamics and Dynamical Systems; Network Science; Computational Science; Algorithms for High Performance Computing

EDUCATION

B.S. Physics

2014-2018

Rice University, Houston, TX

Concentration: Computational Physics, Minor: Computational and Applied Mathematics

Graduated Magna Cum Laude with Distinction in Research and Creative Work

GPA: 4.07/4.33

Ph.D. Physics (Expected May 2023)

2018-

University of Maryland, College Park, MD

Advisor: Prof. Edward Ott

Current GPA: 4.00/4.00

PROFESSIONAL EXPERIENCE

Ford R&A Summer Intern

May 2021-Aug. 2021

Ford Motor Company

Developing machine learning techniques for learning models of selective catalytic reduction in diesel tailpipes.

Graduate Research Assistant

Jan. 2019-

University of Maryland Institute for Research in Electronics

& Applied Physics

Developing techniques for combining knowledge-based prediction methods with scalable artificial neural network-based machine learning algorithms for predicting and analyzing large, complex, multiscale dynamical systems.

PUBLICATIONS & PRESENTATIONS

Wikner, A., Pathak, J., Hunt, B., Szunyogh, I., Girvan, M., Ott, E. (2021) "Using data assimilation to train a hybrid forecast system that combines machine-learning and knowledge-based components". In: *Chaos* 31, p. 053114.

Wikner, A., Pathak, J., Hunt, B., Girvan, M., Arcomano, T., Szunyogh, I., Pomerance, A., Ott, E. (2020) "Combining Machine Learning with Knowledge-Based

Modeling for Scalable Forecasting and Subgrid-Scale Closure of Large, Complex, Spatiotemporal Systems”. In: *Chaos* 30, p. 053111.

Wikner, A., Pathak, J., Arcomano, T., Szunyogh, I., Hunt, B., Girvan, M., Ott, E. (2020, January) “Data-assisted forecasting of high-dimensional chaotic dynamics using machine learning”. Poster session presented at Dynamics Days 2020 in Hartford, CT.

Arcomano, T., Szunyogh, I., Wikner, A., Hunt, B., Ott, E. (2021) “Hybrid Approach to Atmospheric Modeling that Combines Machine Learning with a Physics-Based Numerical Model”. In: *JAMES*. Review in Progress.

Arcomano, T., Szunyogh, I., Pathak, J., Wikner, A., Hunt, B., Ott, E. (2020) “A Machine Learning-Based Global Atmospheric Forecast Model”. In: *Geophysical Research Letters* 47 (9), e2020GL087776.

Pathak, J., Wikner, A., Fussel, R., Chandra, S., Hunt, B., Girvan, M., Ott, E. (2018) “Hybrid Forecasting of Chaotic Processes: Using Machine Learning in Conjunction with a Knowledge-Based Model”. In: *Chaos* 28.4, p. 041101.

Wikner, A. (2016). “Advanced Analysis of Microwave Surface Impedance Data”. CLASSE 2016 Student Projects.

RESEARCH EXPERIENCE

The Reservoir Computing Group

2017-Present

Developed technique to combine knowledge-based prediction methods with machine learning prediction using recurrent neural networks; greatly improved existing prediction of chaotic dynamical systems.

Advisor: Prof. Michelle Girvan. University of Maryland, College Park.

The Amin Research Group

2017-2018

Computationally determining stability of axionic dark matter solitons.

Advisor: Prof. Mustafa Amin. Rice University.

The Killian Research Group

2015-2017

Debugged and analyzed convergence of equilibrating ultra-cold plasma simulation on high performance computing cluster; gathered data to visualize spatial modes. Developed software to calibrate optical lattice arms by simulating Kaptiza-Dirac diffraction.

Advisor: Prof. Thomas Killian. Rice University.

The Liepe Research Group

2016

Analyzed superconducting cavity data to determine magnitude and sources of error; extracted cavity parameters to verify expected quench mechanism from numerical model.

Advisor: Prof. Matthias Liepe. Cornell University CLASSE REU Program.

AWARDS & HONORS

One Year National Science Foundation Fellowship with COMBINE (2020-2021)
University of Maryland Dean's Fellowship (2018-2020)
Ralph Myers & Friends of Physics Award for Outstanding Graduate TA (2019)
Phi Beta Kappa Academic Honor Society Member (2018-Present)
Louis J. Walsh Engineering Scholarship (2017-2018)
Rice University President's Honor Roll (6 Semesters)

MEMBERSHIPS

COMBINE (Computation and Mathematics for Biological Networks) Fellow (2019-Present)

REFERENCES

Professor Edward Ott, Email: edott@umd.edu, Phone: (301)-405-5033
Dr. Devesh Upadhyay, Email: dupadhya@ford.com