Brett Tregoning, PhD

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Profile Summary

Highly qualified scientist with advanced statistical, computational, and analytical skills. Record of successful collaborations in a range of scientific and software development problems with multi-cultural teams. Excellent interpersonal skills. Listens attentively, works to understand problems and tasks, and follows projects to completion diligently.

Skills

Scientific	Statistical Methods, Machine Learning, Bayesian Optimization, Adaptive Experimental Design, Deep Learning, Neural Networks, Decision Trees, Predictive Analytics, Time Series Analysis, Numerical Optimization, Network Science, Data Science, Numerical Methods, Fluid Mechanics, Dynamical Systems, Topological Data Analysis
Coding	Python, MATLAB, Latex, NumPy, Pandas, Scikit-Learn, PyTorch, BoTorch, Matplotlib, Seaborn, R, C, C++, SQL, Kubeflow, Docker, Git, Excel
Languages	English

Education

2016 – 2021 **Georgia Institute of Technology** School of Physics.
Thesis title: *Investigation of spatiotemporal chaos using persistent homology*
Doctor of Philosophy-Physics, President's Fellow

2012 – 2016 **Vanderbilt University**
Bachelor of Arts-Physics with Highest Honors
Thesis title: *Ps2- in a magnetic field : structure and stability in the M=0 state.*
Bachelor of Arts-Mathematics

Experience

Data Scientist
Corteva Agriscience, 2022 – · · · ·

- Discovered optimized recipes for testing obtained using machine learning techniques like Bayesian optimization and particle-swarm optimization that resulted in $10 million annual savings for the organization.
- Employed statistical techniques such as linear mixed modeling to isolate effects of certain types of variables in production processes.
- Developed an in-house adaptive experimental design software platform in collaboration with a small team.
- Provided statistical and data science support to process optimization at multiple points in the R&D scale-up pipeline.

Data Scientist
Self-directed, 2021 – 2022

- Applied modern data science and machine learning techniques to data sets with thousands of entries in health, economics, marketing, and physics to gain insights.
- Worked with simple neural networks, convolutional neural networks, recurrent neural networks, gradient boosted trees, and random forest.

Schatz Lab, Georgia Institute of Technology, School of Physics, Center for Non-linear Science
Advisors: Michael Schatz and Roman Grigoriev, 2016 – 2021

- Performed statistical analysis, including hypothesis testing, on distributions of fluid flow pattern features
- Predicted the evolution of fluid flows using convolutional neural networks and reservoir computing for about 10 Lyapunov time units
- Developed a technique to detect a specific sequence of flow snapshots in a turbulent flow over hundreds of time steps
- Used persistent homology to detect topological signatures in in very large (10^5 time steps) time-series of flow patterns consisting of 10^6 pixels
- Designed an experiment to detect surface waves on a centimeter-wide fluid flow using a shadowgraph imaging technique

Varga Group, Vanderbilt University, Physics Department
Advisor: Kalman Varga, 2015

- Calculated stability of positron-electron systems of up to 10 particles using a variational method.
- Applied computational methods in Linux

United States Naval Observatory
Advisor: Susan G. Stewart, 2014

- Studied navigational astronomy.
- Quantified visual navigational error of binary star systems.
- Studied weather effects on sky visibility.

Bolotin Group, Vanderbilt University, Physics Department
Advisor: Kirill Bolotin, 2013 – 2014

- Studied experimental condensed matter physics.
- Gained experience exfoliating graphene.
- Gained clean-room training and experience.

Research Publications

Publications

1. **Tregoning**, **B.**, George-Kennedy, A., Miroslav, K., Grigoriev, R., & Schatz, M. F. (2022). Using persistent homology to detect shadowing of unstable solutions (in preparation).
2. **Tregoning**, **B.**, Mukherjee, S., Suri, B., Mischaikow, K., Paul, M. R., & Schatz, M. F. (2022). Quantifying plume statistics in spatiotemporally chaotic Rayleigh-Bénard convection using persistent homology (under review).

3. **Tregoning, B.**, & Stewart, S. G. (2014). Predicting navigational error of visual binary stars. *Naval Engineering Journal, 126.4*, 169–172.
https://my.vanderbilt.edu/susanstewart/files/2015/05/Stewart_DEC2014.pdf

Conference Proceedings and Talks

1. Schatz, M., **Tregoning, B.**, Barnett, J., Yoda, M., & Grigoriev, R. (2019). Experimental Study of Roll-Hydrothermal Wave Coexistence in Convection Driven by Buoyancy and Thermocapillarity, In *72nd Annual Meeting of the APS Division of Fluid Dynamics (APS DFD 2019)*, Seattle, Washington, USA.
https://meetings.aps.org/Meeting/DFD19/Session/S08.3

2. **Tregoning, B.**, Mukherjee, S., Levanger, R., Cyranka, J., Mischaikow, K., Paul, M., & Schatz, M. (2019). Characterizing Spatiotemporal Dynamics in Fluid Flows using Persistent Homology, In *Invited Seminar at Los Alamos National Labs*, Los Alamos, New Mexico, USA.

3. **Tregoning, B.**, Mukherjee, S., Levanger, R., Xu, M., Cyranka, J., Mischaikow, K., Paul, M., & Schatz, M. (2019). Using Persistent Homology to Compare Chaotic Dynamics Between Experiments on and Simulations of Rayleigh-Bénard Convection, In *72nd Annual Meeting of the APS Division of Fluid Dynamics (APS DFD 2019)*, Seattle, Washington, USA.
https://meetings.aps.org/Meeting/DFD19/Session/G14.4

4. **Tregoning, B.**, Levanger, R., Cyranka, J., Mukherjee, S., Paul, M., Mischaikow, K., & Schatz, M. (2018). Using topology to identify large Lyapunov vector magnitude in Rayleigh-Bénard convection, In *71st Annual Meeting of the APS Division of Fluid Dynamics (APS DFD 2018)*, Atlanta, Georgia, USA.
http://meetings.aps.org/Meeting/DFD18/Session/G33.5

Leadership Experience

2020 – 2021 **Diversity, Equity, and Inclusion Task Force,** Georgia Tech School of Physics
2015 – 2016 **Music Director,** WRVU Vanderbilt College Radio
2014 – 2016 **President,** Vanderbilt Quiz Bowl
2013 – 2015 **Secretary,** Vanderbilt Society of Physics Students

Awards and Honors

2016 **President's Fellow,** Georgia Institute of Technology.
Highest Honors, Vanderbilt University Physics Department.
2012,2014,2016 **Dean's List,** Vanderbilt University.
2014 **Sigma Pi Sigma Physics Honor Society,** Vanderbilt University Physics Department.

References

Prof. Michael F. Schatz — Interim Chair, School of Physics, Georgia Institute of Technology-Atlanta, GA.
michael.schatz@physics.gatech.edu +1 (404) 445-4435

Dr. Rachel Levanger — Director of Data Science, Fidelity National Financial-Jacksonville, FL.
rachel.levanger@gmail.com +1 (904) 718-6842

References (continued)

Prof. Susan Gessner Stewart
Astronomer, U.S. Naval Observatory-Washington, DC.
Adjoint Professor, Vanderbilt University-Nashville, TN.
susan.g.stewart@vanderbilt.edu