

# ANNIE SAUER BOOTH

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## CONTACT INFO

Department of Statistics  
NC State University  
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## RESEARCH INTERESTS

Bayesian statistics, surrogate modeling, statistical computing, design of experiments, uncertainty quantification, optimization, calibration, reliability. With applications to computer experiments.

## EDUCATION

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY  
**Ph.D.** Statistics, May 2023, advised by Robert B. Gramacy & David Higdon  
Dissertation: *Deep Gaussian Process Surrogates for Computer Experiments*  
**M.S.** Statistics, December 2019

AUBURN UNIVERSITY  
Honors Scholar; 4.00 GPA  
**B.S.** Applied Mathematics, May 2018  
**B.A.** Psychology, May 2018

## PROFESSIONAL POSITIONS

**Assistant Professor**, Department of Statistics, NC State University 2023 - Present

## HONORS & AWARDS

ISBA Savage Award Finalist; 2023  
Shewell Award for presentation at Fall Technical Conference; 2023  
Mary G. and Joseph Natrella Scholarship; 2022  
ASA Physical and Engineering Sciences Section Student Paper Competition Winner; 2022  
ISBA Best Student/Postdoc Contributed Paper Award; 2021  
ISBA Industrial Statistics Student Presentation Award, Honorable Mention; 2021  
Virginia Tech Myers Award for excellence in linear models and design of experiments; 2019  
Virginia Tech Boyd Harshbarger Award for excellence as a first-year graduate student; 2019  
Virginia Tech Jean D. Gibbons Fellowship; 2018  
Auburn University Dean's Medal in Mathematics; 2018  
Auburn University Dean's Award for Academic Excellence; 2018

## IN REVIEW

**Booth, A.** & Renganathan, S. A. (2024). Hybrid Monte Carlo for failure probability estimation with Gaussian process surrogates. arXiv:2410.04496

Barnett, S., Beesley, L. J., **Booth, A. S.**, Gramacy, R. B., & Osthus, D. (2024). Monotonic warpings for additive and deep Gaussian processes. arXiv:2408.01540

Wycoff, N., Smith, J. W., **Booth, A. S.**, & Gramacy, R. B. (2024). Voronoi candidates for Bayesian optimization. arXiv:2402.04922

**PEER-  
REVIEWED  
PAPERS**

**Booth, A. S.,** Renganathan, S. A., & Gramacy, R. B. (2024). Contour location for reliability in air-foil simulation experiments using deep Gaussian processes. *Annals of Applied Statistics, to appear*. arXiv:2308.04420

**Sauer, A.,** Cooper, A., & Gramacy, R. B. (2023). Vecchia-approximated deep Gaussian processes for computer experiments. *Journal of Computational and Graphical Statistics, 32*(3), 824-837. arXiv:2204.02904

Gramacy, R. B., **Sauer, A.,** & Wycoff, N. (2022). Triangulation candidates for Bayesian optimization. *Advances in Neural Information Processing Systems (NeurIPS), 35*, 35933-35945. arXiv:2112.07457

**Sauer, A.,** Gramacy, R. B., & Higdon, D. (2021). Active learning for deep Gaussian process surrogates. *Technometrics, 65*(1), 4-18. arXiv:2012.08015

**OTHER  
PUBLICATIONS**

**Booth, A. S.,** Gramacy, R. B., & Renganathan A. (2024). Actively learning deep Gaussian process models for failure contour and reliability estimation. In *AIAA Scitech 2024 Forum* (p.0577).

**Sauer, A.,** Cooper, A., & Gramacy, R. B. (2023). Non-stationary Gaussian process surrogates. *Handbook of Uncertainty Quantification, to appear*; arXiv:2305.19242

**Sauer, A.** (2022). deepgp: an R-package for Bayesian deep Gaussian processes. *ISBA Bulletin, Software Highlight*; December, 29(4).

**Sauer, A. &** Gramacy R. B. (2022). Discussion of paper by Marmin & Filippone. An invited discussion of “Deep Gaussian processes for calibration of computer models” by S. Marmin & M. Filippone. *Bayesian Analysis*, pp. 1-30.

Stanford, B., **Sauer, A.,** Jacobson, K., & Warner, J. (2022). Gradient-enhanced reliability analysis of transonic aeroelastic flutter. In *AIAA Scitech 2022 Forum* (p. 0632).

**THESIS**

Ph.D. Thesis, Department of Statistics. *Deep Gaussian Process Surrogates for Computer Experiments* (2023). Virginia Polytechnic Institute and State University; <http://hdl.handle.net/10919/114845>

**OPEN SOURCE  
SOFTWARE**

deepgp: An R-package for deep Gaussian processes using fully-Bayesian MCMC. <https://CRAN.R-project.org/package=deepgp>

runexp: An R-package for softball run expectancy using discrete Markov chains and Monte Carlo simulation; with S. Merkes. <https://CRAN.R-project.org/package=runexp>

**GRANTS**

National Science Foundation (NSF), Collaborative Research: MATH-DT: *Gradient-enhanced deep Gaussian processes for optimization of diffusive high-speed unsteady mixers* [PI] Awarded in August 2024 for 3 years, with James Braun. \$498,290

NCSU Controlled Environment Agriculture Consortium: *Computational fluid dynamics for enhanced understanding of air movement, sensor placement, and plant arrangement in controlled environment agriculture* [PI] Awarded in June 2024 for 1 year, with James Braun and Ricardo Hernandez. \$25,000

## TALKS & SEMINARS

Key: **S**  $\equiv$  Seminar  $\approx$  60m; **IT**  $\equiv$  Invited Talk  $\approx$  30m; **CT**  $\equiv$  Contributed Talk  $\approx$  20m; **P**  $\equiv$  Poster

### Contour location using deep Gaussian processes

IT	May 2024	<b>Design &amp; Analysis of Experiments Conference</b> , Blacksburg, VA
S	Mar 2024	<b>Arizona State University Fireside Chat</b> , virtual
CT	Jan 2024	<b>AIAA Scitech Forum</b> , Orlando, FL
IT	Oct 2023	<b>Fall Technical Conference</b> , Raleigh, NC
S	Sep 2023	<b>Duke University</b> , Durham, NC
S	July 2023	<b>NASA NSET Meeting</b> , virtual

### Deep Gaussian process surrogates

IT	July 2024	<b>ISBA World Meeting</b> , Venice, Italy
S	Mar 2024	<b>ASA Section on Defense &amp; National Security Webinar</b> , virtual
CT	Feb 2024	<b>SIAM Conference on UQ</b> , Trieste, Italy
S	Jan 2023	<b>Baylor University</b> , Waco, TX
S	Jan 2023	<b>North Carolina State University</b> , Raleigh, NC
S	Jan 2023	<b>University of Virginia</b> , Charlottesville, VA
S	Dec 2022	<b>National Institute of Standards and Technology</b> , Gaithersburg, MD
S	Dec 2022	<b>University of Florida</b> , Gainesville, FL
S	Nov 2022	<b>The Ohio State University</b> , Columbus, OH
S	Nov 2022	<b>University of South Carolina</b> , Columbia, SC

### Vecchia-approximated deep Gaussian processes for computer experiments

IT	Aug 2024	<b>Joint Statistical Meetings</b> , Portland, OR
IT	May 2023	<b>Spring Research Conference</b> , Banff, Alberta, Canada
IT	Aug 2022	<b>Joint Statistical Meetings</b> , Washington, D.C.
IT	Jun 2022	<b>Quality &amp; Productivity Research Conference</b> , virtual
CT	Apr 2022	<b>SIAM Conference on Uncertainty Quantification</b> , virtual
CT	May 2022	<b>Spring Research Conference</b> , virtual

### Active learning for deep Gaussian process surrogates

IT	Oct 2022	<b>Fall Technical Conference</b> , Park City, UT
CT	Oct 2022	<b>Advances in Interdisciplinary Statistics and Combinatorics</b> , Greensboro, NC
P	Oct 2022	<b>Virginia Tech Corporate Partners Conference</b> , Blacksburg, VA
P	Aug 2022	<b>IMSI Conference on Gaussian Processes</b> , Chicago, IL
CT	Feb 2022	<b>SIAM Conference on Parallel Processing for Scientific Computing</b> , virtual
CT	Oct 2021	<b>Virginia Tech Corporate Partners Conference</b> , Blacksburg, VA
CT	Oct 2021	<b>INFORMS Annual Meeting</b> , virtual
S	Oct 2021	<b>Virginia Tech Department of Statistics Colloquium</b> , virtual
IT	Aug 2021	<b>Joint Statistical Meetings</b> , virtual
CT	Jul 2021	<b>ISBA World Meeting</b> , virtual
S	Mar 2021	<b>Virginia State University</b> , virtual
CT	Oct 2020	<b>Virginia Tech Corporate Partners Conference</b> , virtual

## OTHER EMPLOYMENT

NASA LANGLEY RESEARCH CENTER: graduate research assistant; May - December 2021

EASTMAN CHEMICAL COMPANY: applied statistics intern; May - August 2019

## OTHER RESEARCH EXPERIENCE

VIRGINIA TECH SOFTBALL: senior analyst. Applying Markov chain theory and Monte Carlo simulation to advise coaching decisions; 2019 - 2020

VIRGINIA TECH STATISTICAL APPLICATIONS AND INNOVATIONS GROUP: lead consultant. Providing statistical consulting to graduate students and faculty; 2019 - 2020

## LECTURING

ST 370 PROBABILITY AND STATISTICS FOR ENGINEERS, NC STATE UNIVERSITY: undergraduate calculus-based introductory statistics course covering probability, estimation, hypothesis testing, regression, and analysis of variance with applications various engineering fields. Bi-weekly 75-minute lectures; Fall 2023 & Fall 2024.

STAT 4714 PROBABILITY AND STATISTICS FOR ELECTRICAL ENGINEERS, VIRGINIA TECH: undergraduate introductory statistics course covering probability, random variables, estimation, hypothesis testing, regression, and analysis of variance with applications in electrical engineering. Six-week online course; Summer 2023.

STAT 3615 BIOLOGICAL STATISTICS, VIRGINIA TECH: undergraduate introductory statistics course covering descriptive and inferential statistics with applications to biological sciences. Bi-weekly 75-minute lectures; Fall 2019 & Fall 2022.

## OTHER TEACHING EXPERIENCE

STAT 2004 INTRODUCTORY STATISTICS, VIRGINIA TECH: introductory statistics course for non-STEM majors. Teaching Assistant and Recitation Leader under Hamdy Mahmoud; Fall 2018 & Spring 2019.

STAT 3615 BIOLOGICAL STATISTICS, VIRGINIA TECH: undergraduate introductory statistics course. Teaching Assistant under Frances McCarty; Fall 2018.

VIRGINIA TECH STATISTICAL APPLICATIONS AND INNOVATIONS GROUP SHORT COURSES: instructing single-day courses in statistical methods and programming; 2019 - 2020.

## SERVICE

Reviewer on an NSF Division of Mathematical Sciences panel; 2024

CPID Fall Technical Conference Program Representative; 2024

Associate Editor, *Technometrics*; 2023 - Present

Virginia Tech Corporate Partners Committee; 2019-2021

Mu Sigma Rho, Vice President of Virginia Tech Chapter; 2020-2022

## PROFESSIONAL MEMBERSHIP

American Statistical Association, Section on Physical and Engineering Sciences; 2021 - Present

International Society for Bayesian Analysis; 2021 - Present