

# ANNIE SAUER BOOTH

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## CONTACT INFO

Department of Statistics  
Virginia Tech  
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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

|  |                |
|--|----------------|
| <b>Assistant Professor</b> , Department of Statistics, VIRGINIA TECH       | 2025 - Present |
| <b>Assistant Professor</b> , Department of Statistics, NC STATE UNIVERSITY | 2023 - 2024    |

## 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

Cooper, A., **Booth, A. S.**, & Gramacy, R. B. (2025). Modernizing full posterior inference for surrogate modeling of categorical-output simulation experiments. arXiv:2501.14946

**Booth, A. S.** & Renganathan, S. A. (2025). Two-stage design for failure probability estimation with Gaussian process surrogates. arXiv:2410.04496

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

Moran, K. R., Payne, R., Lawrence, E., Higdon, D., Walsh, S. A., **Booth, A. S.**, Kwan, J., Day, A., Habib S. & Heitmann, K. (2024). Bayesian deep process convolutions: An application in cosmology. arXiv:2411.14747

**PEER-  
REVIEWED  
PAPERS**

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

**Booth, A. S.**, Renganathan, S. A., & Gramacy, R. B. (2025). Contour location for reliability in airfoil simulation experiments using deep Gaussian processes. *Annals of Applied Statistics*, 19(1), 191-211. 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).

**Booth, A. S.**, Cooper, A., & Gramacy, R. B. (2024). Nonstationary 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**

Lawrence Livermore National Laboratory, Academic Collaboration Team: Dimension reduction with deep Gaussian process models [PI] Awarded in December 2024 for 3 years, with Kevin Quinlan and Laura Wendelberger. \$258,446

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

Two-stage design for failure probability estimation with Gaussian process surrogates

|    |           |  |
|----|-----------|--|
| IT | June 2025 | <b>Spring Research Conference</b> , New York, NY                               |
| S  | May 2025  | <b>IMSI Workshop on UQ and ML for Complex Physical Systems</b> , Chicago, IL   |
| S  | Feb 2025  | <b>IMSI Workshop on UQ for Digital Twins</b> , Chicago, IL                     |
| S  | Feb 2025  | <b>Insper (São Paulo, Brazil)</b> , virtual                                    |
| CT | Oct 2024  | <b>Adv. in Interdisciplinary Statistics and Combinatorics</b> , Greensboro, NC |

Contour location using deep Gaussian processes

|    |           |   |
|----|-----------|---|
| S  | Nov 2024  | <b>Chemical and Process Industries Division Webinar</b> , virtual     |
| IT | May 2024  | <b>Design and 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

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|----|-----------|--|
| S  | Mar 2025  | <b>Virginia Tech National Security Institute</b> , Blacksburg, VA        |
| IT | July 2024 | <b>ISBA World Meeting</b> , Venice, Italy                                |
| S  | Mar 2024  | <b>ASA Section on Defense and 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

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|----|----------|--|
| 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 and 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>Adv. 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 Workshop 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. Tri-weekly 50 minute lectures; Spring 2025.

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.

**SERVICE**

Fall Technical Conference Chair; 2026  
ASA Section on Physical and Engineering Sciences Council of Sections Representative; 2025  
Two-time panelist for NSF Division of Mathematical Sciences; 2024 and 2025  
CPID Fall Technical Conference Program Representative; 2024 - 2025  
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