Sierra Nicole Merkes

CONTACT INFORMATION

Department of Statistics
Virginia Tech
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Blacksburg, VA 24061

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A statistician deeply interested in combing my technical pursuits with developing a modern statistical curriculum and pedagogy for the classroom within a research-based, teaching university.

RESEARCH INTERESTS

Bayesian statistic, mixture models, anomaly detection methodologies, sports analytics, visual analytics, Monte Carlo Markov Chain

EDUCATION

Virginia Polytechnic Institute and State University, Blacksburg, VA

Ph.D., Statistics, August 2022

- Dissertation Title: Robust Bayesian Anomaly Detection Methods for Large-Scale Sensor Systems

M.S., Statistics, December 2017

Radford University, Radford, VA

B.S., Mathematics, May 2016

CURRENT PROFESSIONAL POSITION

Virginia Polytechnic Institute and State University, Blacksburg, Virginia USA
Collegiate Assistant Professor 2022 - present
The Department of Statistics

Course Taught:

- Methods of Regression Analysis: STAT 4214

  Years Taught: Fall 2022, Spring 2023

- Advance Method Regression: STAT 5214G (graduate)

  Years Taught: Fall 2022, Spring 2023

- Integrated Quantitative Sciences: CMDA 2005

  Years Taught: Spring 2023

Virginia Polytechnic Institute and State University, Blacksburg, Virginia USA
Instructor of Record 2020 - 2022
The Department of Statistics

Course Taught:

- Statistics for Engineers: STAT 4705

  Years Taught: Spring 2022

- Statistics in Research II: STAT 5616 (graduate)

  Years Taught: Spring 2021

- Probability and Statistics for Engineers: STAT 4714

  Years Taught: Summer 2020

GUEST LECTURES

Virginia Polytechnic Institute and State University, Blacksburg, Virginia USA
Collegiate Assistant Professor Guest Lecturer 2022 - present
The Department of Statistics

Course Taught:

- Discovering Computational Modeling and Data Analytics: CMDA 1634
  Lecture Discussion: Data Visualization in R

- Experience Learning from Data: STAT 1004
  Lecture Discussion: What can you do with a statistics degree?

Virginia Polytechnic Institute and State University, Blacksburg, Virginia USA
Graduate Student Guest Lecturer **2019 - 2022**
The Department of Statistics

Course Taught:

- Statistics in Social Sciences: STAT 3604
  Lecture Discussions (20 lectures): Discrete and Continuous Random Variables, PMF, and CDF, expectation and variance of random variables, Probability distributions: Bernoulli, binomial, Normal distribution, uniform distribution, sampling distributions, confidence intervals, hypothesis testing, ANOVA, two-way ANOVA, multiple linear regression
- Inference Fundamentals: STAT 5114
  Lecture Discussions (2 lectures): Gaussian Mixture Models and Expectation Maximization Algorithm
- Bayesian Statistics: STAT 5444
  Lecture Discussions (4 lectures): Gaussian Mixture Models, Gibbs Sampler, Behrens-Fisher problem under the Classist and Bayesian perspectives, introduction to Jefferys' prior

PUBLICATIONS

S.Merkes, (2022); "***Robust Bayesian Anomaly Detection Methods for Large Scale Sensor Systems***", Dissertation, Virginia Tech, 2022.

A. Defreitas, W. N. Alexander, W. J. Devenport, S. Merkes, S. Leman, E. Smith, and A. Borgoltz, (2022); "***Anomaly detection in wind tunnel experiments by principal component analysis.***", AIAA Journal, 60(4), 2297-2307.

***** 2021 AIAA Sensor Systems and Information Fusion Best Paper Award *****
S. Merkes, S. Leman, E. Smith, A. Defreitas, W. N. Alexander, and W. J. Devenport, (2021); "***A Bayesian Mixture Model Approach to Anomaly Detection with Application to Wind Tunnel Experiments***", AIAA Scitech 2021 Forum, https://doi.org/10.2514/6.2021-1268.

A. Defreitas, W. N. Alexander, W. J. Devenport, **S. Merkes**, S. Leman, E.Smith, and A. Borgoltz, (2020); "***Improved Anomaly Detection in Experimental Wind Tunnel Data using PCA***", AIAA Scitech 2020 Forum, https://doi.org/10.2514/6.2020-1198.

S. Merkes, A. Defreitas, E. Smith, W. N. Alexander, W. J. Devenport, and S. Leman, (2019); "***Robust Anomaly Detection for Large Scale Multi-Type Sensor Systems***", AIAA Scitech 2019 Forum, https://doi.org/10.2514/6.2019-2265.

PRESENTATIONS

Robust Bayesian Anomaly Detection Methods for Large Scale Sensor Systems - Thesis
2022; Graduate Life Center, Blacksburg, Virginia

A Modified Cauchy-Net Anomaly Detection Approach for Wind Tunnels - 15 min. Presentation
2021 Joint Statistical Meeting: August - Virtual

A Bayesian Mixture Model Approach to Anomaly Detection with Application to Wind Tunnel Experiments - 15 min. Presentation
2021 American Institute of Aeronautics and Astronautics SciTech Conference: January - Virtual

A Mixture Model Approach for Anomaly Detection for Wind Tunnel Applications - 15 min. Presentation
2020 Corporate Partners Conference: October - Virtual

High Dimensional Mixture Model Approach to Anomaly Detection in Wind Tunnels - Virtual Poster Presentation
2020 Joint Statistical Meeting (JSM): August - Blacksburg, VA, USA

Wind Tunnel Case Study for Robust Bayesian Monitoring System - Poster Presentation
2019 Corporate Partners Conference: October - Blacksburg, VA, USA

Robust Anomaly Detection for Large Scale Multi-Type Sensor Systems - 15 min. Presentation
2019 Joint Statistical Meeting (JSM): August - Denver, CO, USA

Monitoring System for Virginia Tech Stability Wind Tunnel - Poster Presentation
2019 Spring Research Conference: May - Blacksburg, VA, USA

Robust Anomaly Detection for Large Scale Multi-Type Sensor Systems - 20 min. Presentation
2019 American Institute of Aeronautics and Astronautics SciTech Conference: January - San Diego, CA, USA

RESEARCH EXPERIENCE

Anomaly Detection in Wind Tunnel Systems
Graduate Research Assistant Blacksburg,VA
Focuses on develop robust methodology to detect anomalous sensors in large-scale, multi-type, wind tunnel sensory dataset through an interdisciplinary collaboration with Virginia Tech aerospace engineers.Funded by Office of Naval Research (ONR).

Pattern Recognition for Sports Analytics with Virginia Tech Softball
Lead Research Assistant Blacksburg,VA
Collaborated with Virginia Tech Softball team and a group of undergraduates students to develop pattern recognition methodology and construct optimal line-up generator using Monte Carlo theory.

Uncertainty Quantification in Networks
Research Assistant Blacksburg,VA
Devising methodology to evaluate stability of community detection methods through a jackknife re-sampling technique in social networks. Supervised by Dr. Srijan Sengupta.

Bayesian Visual Analytics (BaVA) Group
Associate Collaborator Blacksburg,VA
Collaborated with computer scientists to standardize group methodology which combines Bayesian statistics and visual analytics to transform standard analytic methods into an interactive data exploration. Project funded by General Dynamics (GD).

DEPARTMENTAL SERVICE

Undergraduate Curriculum Committee *2022 - present*

Graduate Teaching Coordinator *2019 - present*
Maintains and coordinates the network of graduate student instructors for the semester. Tasks include:

- Maintains a repository for graduate student instructors containing various teaching material for ten courses.
- Holds bi-weekly meeting to discuss topics vary from developing exams and homework, accommodating students, and aiding instructors in the course curriculum.
- Aids in covering classes for sick instructors.

Corporate Partners Committee - Student Representative *2017-2021*
Corporate Partners is an annual event hosted by Virginia Tech Department of Statistics to build ties between the graduate statistics students and various industry, business, and government officials.

- Served as coordinating liaison for organizing Corporate Partners' schedules including, but not limited to scheduling student interviews, promoting student research, introducing Partners' during their presentations, and facilitating research break out sessions.

Graduate Student Leadership Council Director *2018 - 2020*

- Coordinated department logistics to fellow graduate students through mentoring and advising first-year student for their qualifying exam, guiding second-year students through their oral exam, and collecting past teaching materials to ensure the success of our graduate student teachers.
- Organized the graduate student office's and develops content for departmental information board and videos.

SCHOLARSHIPS/ AWARDS

2021 AIAA Sensor Systems and Information Fusion Best Paper Award *Fall 2021*
Awarded by the Sensor Systems and Information Fusion Technical Committee in the AIAA 2021 SciTech Forum for "A Bayesian Mixture Model Approach to Anomaly Detection with Application to Wind Tunnel Experiments".

The Jesse C. Arnold Teaching Award *Fall 2021*
The Jesse C. Arnold Award is given annually for outstanding teaching by a graduate teaching assistant. Award is selected based on a departmental faculty votes, student perception of teaching evaluations, and course load.

Rose Costain Graduate Fellowship - Awarded $4,000 *Fall 2019, Fall 2020, Fall 2021*
The Rose Wilkinson Costain Graduate Fellowship is selected based on a departmental faculty vote and awarded to a graduate student who has demonstrated outstanding citizenship in the Department of Statistics.

ASA Gertrude M. Cox Honorable Mention *Spring 2019*
The Gertrude M. Cox Award annually recognizes a statistician in early to mid-career who has made significant contributions to one or more of the areas of applied statistics in which Gertrude Cox worked: survey methodology, experimental design, biostatistics, and statistical computing.

Corporate Partners Scholarship - Awarded $2,000 *Aug. 2016*
Corporate Partners Scholarship is awarded to incoming graduate students with outstanding academic performance in their undergraduate degree.

Radford University Dean Scholar *May 2016*
The Radford University Dean Scholar for the Department of Mathematics and Statistics is selected based on a departmental faculty vote taking into account a variety of factors which may include but are not limited to: GPA, exemplary character and behavior both in and out of the classroom, respect for and cooperation with others, valuing diversity, engagement in student organizations, volunteerism, initiative, persistence, enthusiasm, reliability, and ability to accept and use constructive criticism.

PROFESSIONAL DEVELOPMENT

Technology-enhanced Learning and Online Strategies (TLOS) Courses

- Course Design Clinic (2022)
- Cybersecurity (2022)
- Tech Talks: Living in Canvas (2022)