

# Katherine Goode

RESEARCH AND DEVELOPMENT STATISTICIAN

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*I'm a research and development statistician at Sandia National Labs. My research interests include model assessment, explainable machine learning, and data visualization. I enjoy consulting and collaborating with scientists on data analyses.*

## Education

### Iowa State University

DOCTOR OF PHILOSOPHY, STATISTICS

- Dissertation: Visual Diagnostics for Explaining Machine Learning Models
- Major Professor: Dr. Heike Hofmann

[Ames, IA](#)

2016-2021

### University of Wisconsin, Madison

MASTER OF SCIENCE, STATISTICS

[Madison, WI](#)

2013-2015

### Lawrence University

BACHELOR OF ARTS, MATHEMATICS

- Graduated Magna Cum Laude
- Senior Capstone: An Explanation of Double-Error-Correcting BCH Codes

[Appleton, WI](#)

2009-2013

## Awards

### Midwest Statistical Machine Learning Colloquium Poster Award

AWARDED FOR 'USING LIME TO INTERPRET A RANDOM FOREST MODEL WITH AN APPLICATION TO BULLET MATCHING DATA'

2019

### ISU Department of Statistics Dan Mowrey Consulting Excellence Award

AWARDED IN RECOGNITION OF OUTSTANDING CONTRIBUTIONS IN THE AREA OF STATISTICAL CONSULTING WHILE WORKING TOWARD A GRADUATE DEGREE.

2018

### ISU Department of Statistics Award for Experiential Development

PRESENTED TO A GRADUATE STUDENT FOR EXCELLENT PERFORMANCE IN MULTIPLE STATISTICAL EFFORTS (TEACHING AND CONSULTING) AS PART OF THE GRADUATE PROGRAM.

2017

## Experience

### Senior Member of Technical Staff

STATISTICAL SCIENCES DEPARTMENT

- Research and development statistician

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Dec 2021 - Current

### Postdoctoral Researcher

STATISTICAL SCIENCES DEPARTMENT

- Performed research on inverse models with functional data
- Implemented shape analysis methods with national security data
- Prepared manuscript for submission to peer reviewed journal

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Sep 2021 - Dec 2021

### Research and Development Intern

STATISTICAL SCIENCES DEPARTMENT

- Performed research on neural networks explainability with functional data
- Applied explainability methods to machine learning models
- Presented on work at internal and external events

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Dec 2019 - Sep 2021

### Graduate Research Assistant

NATURAL RESOURCE ECOLOGY AND MANAGEMENT

- Developed R Shiny application to predict taxonomy of fish eggs using random forests
- Assisted in writing manuscript to present the application
- Advised by Dr. Michael Weber and Dr. Philip Dixon

[Iowa State University](#)

Jan 2021 - June 2021

## Statistical Consultant

AGRICULTURE EXPERIMENT STATION

- Senior consultant from May 2018 to May 2020
- Helped with administrative decisions
- Trained and mentored new consultants
- Provided statistical support on research projects for graduate students, professors, and staff from the colleges of agriculture and life sciences, engineering, human sciences, liberal arts and sciences, and veterinary medicine
- Assisted with the implementation of analyses in R, SAS, JMP, and SPSS

Iowa State University

May 2016 - Dec 2020

## Graduate Research Assistant

DEPARTMENT NATURAL RESOURCE ECOLOGY AND MANAGEMENT

- Assisted with analysis of toxicology study of monarch butterfly larvae exposed to insecticides
- Wrote R code to compute profile confidence intervals for dose response curve models
- Collaboration with Dr. Steven Bradbury and PhD Student Niranjana Krishnan

Iowa State University

May 2019 - Aug 2019

## Data Analyst

RESEARCH ADMINISTRATION OFFICE

- Analyzed data from a study to compare the academic success and mood towards the university of undergraduates from freshman to sophomore years
- Performed statistical analyses using SPSS

Lawrence University

2015

## Data Collection Assistant

RESEARCH ADMINISTRATION OFFICE

- Assisted with the data collection for a study on the evaluation of warning lights installed at a busy crosswalk on the university campus
- Used Tracker software to determine the deceleration rate of vehicles from videos taken of cars approaching the crosswalk

Lawrence University

Sep 2014 May 2015

## Publications

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1. English, L., J., N., B., W., K., G., & M., L. (2023). Understanding the variation in vegetation composition of prairie restorations within crop yields. *Submitted to Ecological Restoration*.
2. Goode, K., Weber, M. J., & Dixon, P. M. (2023). WhoseEgg: Classification software for invasive carp eggs. *Accepted by PeerJ Life and Environment*.
3. Ausdemore, M. A., McCombs, A., Ries, D., Zhang, A., Shuler, K., Tucker, J. D., Goode, K., & Huerta, J. G. (2022). A probabilistic inverse prediction method for predicting plutonium processing conditions. *Frontiers in Nuclear Engineering*, 1. <https://doi.org/10.3389/fnuen.2022.1083164>
4. Goode, K., Weber, M. J., Matthews, A., & Pierce, C. L. (2022). Evaluation of a random forest model to identify invasive carp eggs based on morphometric features. *North American Journal of Fisheries Management*. <https://doi.org/https://doi.org/10.1002/nafm.10616>
5. Goode, K., & Hofmann, H. (2021). Visual diagnostics of an explainer model: Tools for the assessment of LIME explanations. *Statistical Analysis and Data Mining: The ASA Data Science Journal*, 14(2), 185–200. <https://doi.org/https://doi.org/10.1002/sam.11500>
6. Ball, E. E., Goode, K. J., & Weber, M. J. (2020). Effects of transport duration and water quality on age-0 walleye stress and survival. *North American Journal of Aquaculture*, 82(1), 33–42. <https://doi.org/https://doi.org/10.1002/naaq.10114>
7. Dixon, P. M., Goode, K., & Lay, C. (2020). *Profile likelihood confidence intervals for ECx*. <https://dr.lib.iastate.edu/entities/publication/7e0d7d0a-f514-4642-9814-c3b7bd821cc0>
8. Goode, K., Ries, D., & Zollweg, J. (2020). Explaining neural network predictions for functional data using principal component analysis and feature importance. *AAAI FSS-20: Artificial Intelligence in Government and Public Sector*. <https://doi.org/10.48550/ARXIV.2010.12063>

## Talks

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1. Goode, K., Tucker, J. D., & Ries, D. (2022, August). Functional inverse prediction with elastic shape analysis. *Joint Statistical Meetings*.
2. Goode, K., Tucker, J. D., Ries, D., & Hofmann, H. (2022, June). An explainable pipeline for machine learning with functional data. *8th European Congress on Computational Methods in Applied Sciences and Engineering (ECCOMAS Congress 2022)*.
3. Goode, K., Ries, D., & Zollweg, J. (2020, November). Explaining neural networks with functional data using PCA and feature importance. *AAAI 2020 Fall Symposium on AI in the Government and Public Sector*.
4. Goode, K., & Hofmann, H. (2019, July). Visual diagnostics of a model explainer: Tools for the assessment of LIME explanations from random forests. *Joint Statistical Meetings*.
5. Goode, K. (2019, June). A review and discussion of residuals for mixed models. *NCCC-170 Meeting*.

## Posters

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1. Goode, K., Ries, D., Tucker, J. D., & Shand, L. (2022, May). Feature importance with deep echo state models for long-term climate forecasting. *Climate Informatics*.
2. Goode, K., & Hofmann, H. (2019, May). Using LIME to interpret a random forest model with an application to bullet matching data. *Midwest Statistical Machine Learning Colloquium*.
3. Goode, K., & Hofmann, H. (2019, April). Using LIME to interpret a random forest model with an application to bullet matching data. *Iowa State University Graduate and Professional Student Research Conference*.
4. Goode, K., & Rey, K. (2018, May). Introducing ggResidpanel: An r package for easy visualization of residuals. *Kansas State University Conference on Applied Statistics in Agriculture*.

## Software

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1. Goode, K. (2022). *TreeTracer: Trace plots using ggplot2*. <https://github.com/goodekat/TreeTracer/>
2. Goode, K. (2022). *Limeaid: Diagnose LIME explanations*. <https://github.com/goodekat/limeaid>
3. Goode, K., McCleron, K., Zhao, J., Zhang, Y., & Huo, Y. (2022). *Redres: Residuals and diagnostic plots for mixed models*. <https://github.com/goodekat/redres.git>
4. Goode, K., & Rey, K. (2019). *ggResidpanel: Panels and interactive versions of diagnostic plots using 'ggplot2'*. <https://CRAN.R-project.org/package=ggResidpanel>

## Workshops

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### Industrial Math/Stat Modeling (IMSM) Workshop for Graduate Students

Asheville, NC

THE STATISTICAL AND APPLIED MATHEMATICAL SCIENCES INSTITUTE (SAMS I)

July 2019

- Two week research workshop
- Worked in a research group mentored by senior statisticians from Rho Inc.
- Analyzed continuously monitored glucose data using functional data analysis
- Assisted with the writing of a report and presentation on the research analysis

## Teaching

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### Workshops

#### Predictive plant phenomics graduate student statistics bootcamp

Iowa State University

PREDICTIVE PLANT PHENOMICS PROGRAM

2018-2019

- Led a one day statistics bootcamp
- Discussed randomization, confidence intervals, and design of experiments
- Prepared slides

### Instructor

#### STAT 101: Introduction to statistics

Iowa State University

DEPARTMENT OF STATISTICS

Spring 2016

- Prepared and led lectures
- Wrote and graded exams
- Topics included summary statistics, visualization, normal distribution, hypothesis testing, confidence intervals, and JMP

#### MATH 107: Elementary statistics

Lawrence University

MATHEMATICS DEPARTMENT

Fall 2015

- Organized the curriculum
- Prepared and graded homework and exams
- Topics included summary statistics, visualizations, randomization tests, bootstrap, normal distribution, hypothesis testing, confidence intervals, and R

### Teaching Assistant

## BMI 552: Regression methods for population health graduate students

University of Wisconsin, Madison

DEPARTMENT OF BIOSTATISTICS & MEDICAL INFORMATICS

Spring 2015

- Taught labs
- Held office hours
- Topics included simple and multiple linear regression, logistic regression, survival analysis, and SAS

## BMI 551: Introduction to biostatistics for population health graduate students

University of Wisconsin, Madison

DEPARTMENT OF BIOSTATISTICS & MEDICAL INFORMATICS

Fall 2014

- Taught labs
- Held office hours
- Topics included summary statistics, visualizations, probability, normal distributions, hypothesis testing, confidence intervals, and R

## STAT 301: Introduction to statistical methods for nonstatistics majors

University of Wisconsin, Madison

DEPARTMENT OF STATISTICS

Summer 2014

- Prepared and led discussions
- Graded homework and exams
- Held office hours
- Topics included summary statistics, visualizations, probability, normal distributions, hypothesis testing, and confidence intervals

## STAT 302: Accelerated introduction to statistical methods for statistics undergraduate majors

University of Wisconsin, Madison

DEPARTMENT OF STATISTICS

Spring 2014

- Prepared and led discussions
- Graded homework and exams
- Held office hours
- Topics included summary statistics, visualizations, randomization tests, bootstrap, normal distribution, hypothesis testing, confidence intervals, and R

## STAT 371: Introductory applied statistics for the life sciences

University of Wisconsin, Madison

DEPARTMENT OF STATISTICS

Fall 2013

- Prepared and led discussions
- Graded homework and exams
- Held office hours and worked in the statistics help room
- Topics included summary statistics, visualizations, probability, normal distributions, hypothesis testing, confidence intervals, and R

## Mentor

### Academic Mentor for Minority and First Generation Undergraduates

University of Wisconsin, Madison

CENTER FOR ACADEMIC EXCELLENCE

Fall 2014 - Spring 2015

- Mentored minority and first generation undergraduate students enrolled in statistics courses
- Met weekly throughout the semester with individuals or small groups to review statistical concepts from class and make the material approachable
- Discussed and encouraged strategies for academic success

## Tutor

### Statistics Tutor

University of Wisconsin, Madison

DEPARTMENT OF STATISTICS

Fall 2014 - Spring 2015

- Tutored undergraduate students
- Various introductory statistics courses

## Service

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IOWA STATE STATISTICAL GRAPHICS WORKING GROUP WEEKLY SEMINAR ORGANIZER

Sep 2019 - May 2020

GRADUATE STUDENT REPRESENTATIVE TO ISU STATISTICS DEPARTMENT FACULTY MEETINGS

Sep 2018 - May 2019

RECYCLING COORDINATOR FOR ISU STATERS (STATISTICS GRADUATE STUDENT ORGANIZATION)

Sep 2017 - May 2019

TREASURER AND MEMBER OF STATCOM (STATISTICS IN THE COMMUNITY) AT IOWA STATE

Sep 2017 - May 2019

## Skills

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WORKING KNOWLEDGE: GITHUB, JMP, LATEX, PYTHON, R, R MARKDOWN, R SHINY, SAS

BASIC KNOWLEDGE: C, SPSS