Katherine Goode

Curriculum Vitae, October 2021

Contact Information

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Education

Jan 2016 - June 2021 **Doctor of Philosophy, Statistics**
Iowa State University, Ames, IA
Major Professor: Dr. Heike Hofmann
Dissertation: *Visual Diagnostics for Explaining Machine Learning Models*

Aug 2013 - May 2015 **Master of Science, Statistics**
University of Wisconsin, Madison, WI

Sep 2009 - June 2013 **Bachelor of Arts, Mathematics**
Lawrence University, Appleton, WI
Graduated Magna Cum Laude
Senior Capstone: *An Explanation of Double-Error-Correcting BCH Codes*

Awards and Honors

2019 **Midwest Statistical Machine Learning Colloquium Poster Award**
Awarded for poster "Using LIME to Interpret a Random Forest Model with an Application to Bullet Matching Data"

2018 **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.

2017 **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.

Research Interests

Model Assessment, Interpretation of Machine Learning Algorithms, Data Visualization, Random Forest Models, Mixed Model Residuals, R Package Development

Professional and Research Experience

Sep 2021 - Current **Postdoctoral Researcher**
Statistical Sciences Department, Sandia National Laboratories
- Performed research on inverse models with functional data
- Implemented shape analysis methods with national security data
- Prepared manuscript for submission to peer reviewed journal

Dec 2019 - Sep 2021 **Research and Development Intern**
Statistical Sciences Department, Sandia National Laboratories
- Performed research on neural networks explainability with functional data

- Applied explainability methods to machine learning models
- Presented on work at internal and external events

Jan 2021 - June 2021 **Research Assisstant**
Department Natural Resource Ecology and Management, Iowa State University
- 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

May 2016 - Dec 2020 **Statistical Consultant** (Senior consultant from May 2018 to May 2020)
Agriculture Experiment Station, Iowa State University
- Helped with administrative decisions and trained 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

May 2019 - Aug 2019 **Research Assistant**
Department Natural Resource Ecology and Management, Iowa State University
- 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

Dec 2015 **Data Analyst**
Research Administration Office, Lawrence University
- 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

Data Collection Assistant
Sep 2014 - May 2015 *Research Administration Office, Lawrence University*
- 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

Papers and Technical Reports

Goode K., M. J. Weber, A. Matthews, and C. L. Pierce. In press. Evaluation of a random forest model to identify invasive carp eggs based on morphometric features. North American Journal of Fisheries Management. https://doi.org/10.1002/nafm.10616.

Goode K. and H. Hofmann. 2021. Visual diagnostics of an explainer model: Tools for the assessment of LIME explanations. Stat Anal Data Min: The ASA Data Sci Journal: 1-16. https://doi.org/10.1002/sam.11500.

Dixon, P. M., **K. Goode**, and C. Lay. 2020. Profile likelihood confidence intervals for ECx. Iowa State Digital Repository: Technical Reports. https://lib.dr.iastate.edu/stat_las_reports/1.

Ball, E. E., **K. Goode**, and M. J. Weber. 2019. Effects of transport duration and water quality on age-0 walleye stress and survival. North American Journal of Aquaculture 82:33–42. https://doi.org/10.1002/naaq.10114.

Under Review/In Preparation

English, L., J. Niemi, B. Wilsey, **K. Goode**, and M. Liebman. Understanding the variation in vegetation composition of prairie restorations within crop yields. *Submitted to Ecological Restoration.*

Goode, K., M. J. Weber, and P. M. Dixon. WhoseEgg: Classification software for invasive carp eggs. *Submitted to Fisheries Magazine.*

Lansing, J., L. D. Ellingson, **K. Goode**, and J. D. Meyer. Comparison of self-efficacy for reducing sedentary time to self-efficacy for increasing physical activity. *Submitted to Psychology of Sport and Exercise.*

Goode, K., D. Ries, H. Hofmann, and J. D. Tucker. An explainable pipeline for machine learning with functional data.

Goode, K. and H. Hofmann. Tracing trees: Extending trace plots to visualize random forest tree variability.

Contributed Talks

Goode, K., Ries, D., and Zollweg, J. "Explaining Neural Networks with Functional Data Using PCA and Feature Importance". AAAI 2020 Fall Symposium on AI in the Government and Public Sector. November 13-14, 2020.

Goode, K. and Hofmann, H. "Visual Diagnostics of a Model Explainer: Tools for the Assessment of LIME Explanations from Random Forests". Joint Statistical Meetings. July 29, 2019.

Goode, K. "A Review and Discussion of Residuals for Mixed Models". NCCC-170 Meeting. June 20, 2019.

Contributed Posters

Goode, K. and Hofmann, H. "Using LIME to Interpret a Random Forest Model with an Application to Bullet Matching Data", Midwest Statistical Machine Learning Colloquium. May 13, 2019.

Goode, K. and Hofmann, H. "Using LIME to Interpret a Random Forest Model with an Application to Bullet Matching Data", Iowa State University Graduate and Professional Student Research Conference. April 10, 2019.

Goode, K. and Rey, K. "Introducing ggResidpanel: An R Package for Easy Visualization of Residuals". Kansas State University Conference on Applied Statistics in Agriculture. Contributed Poster. May 2018.

Software Development

`WhoseEgg`**: An R Shiny app for predicting the identification of fish eggs with an objective of detecting invasive carp.** Joint work with Dr. Michael Weber and Dr. Philip Dixon. Available at `https://whoseegg.stat.iastate.edu/`. Source code available at `https://github.com/goodekat/WhoseEgg`.

`ggResidpanel`**: An R package for easy visualization of model diagnostic plots.** Joint work with Dr. Kathleen Rey. Source code available at `https://goodekat.github.io/ggResidpanel/`.

`limeaid`**: An R package for visually diagnosing LIME explanations.** Source code available at `https://github.com/goodekat/limeaid`.

`redres`**: An R for computing residuals for linear mixed effects models.** Joint work with Kellie McClernon, Jing Zhao, Yudi Zhang, and Yonghui Huo. Source code available at `https://github.com/goodekat/redres`.

Workshops

July 2019 **Industrial Math/Stat Modeling (IMSM) Workshop for Graduate Students**
The Statistical and Applied Mathematical Sciences Institute (SAMSI)
- 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 Experience

Seminar Leader Aug 2018 and 2019 **Predictive plant phenomics graduate student statistics bootcamp**
Iowa State University
- Led a one day statistics bootcamp
- Discussed randomization, confidence intervals, and design of experiments
- Prepared slides

Instructor Spring 2016 **STAT 101: Introduction to statistics**
Iowa State University
- Prepared and led lectures
- Wrote and graded exams
- Topics included summary statistics, visualization, normal distribution, hypothesis testing, confidence intervals, and JMP

Fall 2015 **MATH 107: Elementary statistics**
Lawrence University
- 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 Spring 2015 **BMI 552: Regression methods for population health graduate students**
UW Madison
- Taught labs
- Held office hours
- Topics included simple and multiple linear regression, logistic regression, survival analysis, and SAS

Fall 2014 **BMI 551: Introduction to biostatistics for population health graduate students**
UW Madison
- Taught labs
- Held office hours
- Topics included summary statistics, visualizations, probability, normal distributions, hypothesis testing, confidence intervals, and R.

Summer 2014 **STAT 301: Introduction to statistical methods for non-statistics majors**
UW Madison
- Prepared and led discussions
- Graded homework and exams
- Held office hours
- Topics included summary statistics, visualizations, probability, normal distributions, hypothesis testing, and confidence intervals

	Spring 2014	**STAT 302: Accelerated introduction to statistical methods for statistics undergraduate majors** *UW Madison* - 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
	Fall 2013	**STAT 371: Introductory applied statistics for the life sciences** *UW Madison* - 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	Sep 2014 - May 2015	**Academic Mentor for Minority and First Generation Undergraduates** *Center for Academic Excellence, University of Wisconsin, Madison* - 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	Fall 2014 - Spring 2015	Tutored undergraduate students in various introductory statistics courses at UW Madison

Service

Sep 2019 - May 2020	Iowa State statistical graphics working group weekly meeting organizer
Sep 2018 - May 2019	Graduate student representative to ISU statistics department faculty meetings
Sep 2017 - 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

Computing Skills

Working Knowledge: GitHub, JMP, LaTeX, Python, R, R Markdown, SAS, Shiny
Basic Knowledge: C, SPSS