

# Joseph Zemmels

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## EDUCATION

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**Ph.D. in Statistics**, Iowa State University (ISU), Ames, IA **2020 – Present (exp. April 2023)**

Major: Statistics (GPA: 3.95/4.0)

Dissertation: "A Cartridge Case Comparison Pipeline"

Major Professor: Dr. Heike Hofmann, Department of Statistics

**M.Sc. in Statistics**, Iowa State University (ISU), Ames, IA **2018 - 2020**

Major: Statistics (GPA: 4.0/4.0)

Thesis: "Open-source implementation of the Congruent Matching Cells method for cartridge case identification"

Major Professor: Dr. Heike Hofmann, Department of Statistics

**B.Sc. in Mathematics**, Winona State University, Winona, MN **2013 - 2017**

Major: Honors Mathematics & Mathematics: Secondary Education

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## RESEARCH FOCUS

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Pattern recognition and forensic statistics, with an emphasis on firearm and toolmark evidence. Interest in developing statistically-sound and accessible algorithms to objectively compare forensic evidence.

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## RESEARCH EXPERIENCE

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**Graduate Research Assistant** **Spring 2020 - Present**

Center for Statistics and Applications in Forensic Evidence (CSAFE) , Ames, IA

- Develop an algorithm to process and objectively compare firearm and toolmark evidence
- Implement our algorithm in three open-source packages in the R programming language
- Create an interactive web application for practitioners to explore and diagnose various cartridge case comparison algorithms
- Led a weekly journal article discussion group focused on the intersection of forensics and statistics/data analysis (from January 2021 – July 2022)
- Wrote a series of "Stats Starters" tutorials to introduce forensic and legal practitioners to concepts such as probabilistic sample size calculation

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## TEACHING EXPERIENCE

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### Teaching Assistant

Fall 2018 - Present

Iowa State University, Ames, IA

- Prepare lectures and class activities for STAT 528: Visual Business Analytics (approx. 20 Master of Business Analytics students)
- Prepared lectures and class activities for STAT 226: Introduction to Business Statistics I (approx. 50 undergraduate students, 4.62 average instructor rating on a 5-point scale from 21 students)
- Graded online homework assignments for STAT 226: Introduction to Business Statistics I (approx. 1000 undergraduate students)
- Oversaw weekly enrichment labs of STAT 101: Introduction to Statistics and STAT 326: Introduction to Business Statistics II (approx. 100 undergraduate students)

### Teaching Assistant

Fall 2020 – Spring 2022

Center for Statistics and Applications in Forensic Evidence (CSAFE), Ames, IA

- Created 15 quiz and Excel lab assignments for a Statistical Thinking for Forensic Practitioners course to engage with the course material (approx. 30 forensic professional students)
- Wrote, proctored, and graded the Statistical Thinking for Forensic Practitioners final exam
- Developed a practicum for a Sampling for Forensic Practitioners courses with 13 exercises to apply concepts from the course to real data using Microsoft Excel (approx. 70 forensic professional students)
- Produced multimedia videos to better connect with the practicum material

### Long-Term Substitute Teacher

Spring 2018

Blaine High School – Center for Engineering, Mathematics, and Science, Blaine, MN

- Substituted for a math teacher on paternity leave to teach Honors Pre-Calculus, Geometry, and Intermediate Algebra (approx. 100 high school students)
- Filled in for other classes on an as-needed basis.

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## WORK EXPERIENCE

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### Graduate Fellow

Summer 2021

Data Science for the Public Good, Ames, IA

- Supervised a team of three undergraduate students to analyze workforce and economic development data
- Summarized our analyses in a series of four posters called *"Just the Facts" on Workforce and Economic Development* for the Iowa Department of Human Rights to present to legislators
- Created an interactive web application to explore language usage across Iowa using the R programming language

### **Data Analyst Intern**

**Summer 2019**

John Deere, Moline, IL

- Analyzed machine usage data using time series models to predict maintenance needs
- Formulated a model evaluation pipeline to easily validate and compare proposed models
- Identified data anomalies originating from John Deere certified dealers which improved the data collection process

### **Test Prep and Academic Mathematics Tutor**

**June 2017 – August 2018**

Kay Tutoring, Minnetonka, MN

- Prepared high school students for the math sections of the ACT and SAT using a proprietary curriculum
- Assisted middle school, high school, and college students with their mathematics coursework ranging from Pre-Algebra to Calculus II
- Refined the test prep curriculum materials using pedagogical best practices
- Trained new tutors in how to work with students and administer the test prep curriculum

### **Mathematics Peer Tutor**

**October 2013 – May 2017**

Winona State University Tutoring Services, Winona, MN

- Tutored fellow undergraduate students in their mathematics coursework ranging from college-level Algebra to Advanced Calculus
- Trained new tutors in how to work with students

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## **TECHNICAL SKILLS**

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- **Programming Language:** R, Python, MATLAB, HTML
- **Data Analysis:** dplyr, ggplot2, rmarkdown, purrr, sf, rvest, reticulate, pandas
- **Machine Learning:** caret, scikit-learn, tensorflow
- **App Development:** shiny, shinydashboard, HTML
- **Miscellaneous:** RStudio, LaTeX, GitHub, Spark, Databricks, Slack, ZOOM

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## **PUBLICATIONS**

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### **Journal Articles**

**(Total: 3)**

1. **Zemmels, J.**, VanderPlas, S., Hofmann, H. "Automatic Matching of Cartridge Case Impressions," (in preparation, to be submitted to The Journal of Data Science, Statistics, and Visualizations).
2. **Zemmels, J.**, VanderPlas, S., Hofmann, H. "Diagnostic Tools for Cartridge Case Comparison Algorithms," (in preparation, to be submitted to The Journal of Computational and Graphical Statistics).
3. **Zemmels, J.**, VanderPlas, S., Hofmann, H. "A Study in Reproducibility: the Congruent Matching Cells method and cmcR package" (submitted to The R Journal).

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## CONFERENCE PRESENTATIONS

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### Oral Presentations

(Total: 1)

1. **Zemmels, J.**, VanderPlas, S., Hofmann, H. (2022). "An Accessible Open-Source Implementation of the Congruent Matching Cells Algorithms for Cartridge Case Analysis," oral presentation at the American Academy of Forensic Science (AAFS) 74<sup>th</sup> Annual Meeting, Seattle, WA, February 21-25.

### Poster Presentations

(Total: 2)

1. **Zemmels, J.**, VanderPlas, S., Hofmann, H. (2022). "A Cartridge Case Comparison Pipeline," poster presentation at the International Association for Identification (IAI) 106th Annual Meeting, Omaha, NE, August 1-5.
2. Tai, X., Eddy, W., **Zemmels, J.** (2019). "Developing Methods for Cartridge Breechface Images," poster presentation at the CSAFE All-Hands meeting, Ames, IA, May 20-22.

### Webinar Presentations

(Total: 2)

1. **Zemmels, J.**, Schoen, A., Mack, D., Johnson, Z., Seeger C., Hanson, B. (2021). "DHR 'Just the Facts' on Economic and Workforce Development," webinar presentation for the Data Science for the Public Good Symposium, August 6.
2. **Zemmels, J.**, VanderPlas, S., Hofmann, H. (2020). "cmcR: Open-Source Implementation of the Congruent Matching Cells Method," webinar presentation for Firearms and Toolmarks Workshop, November 31 - December 1.

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## HONORS & AWARDS

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Early Academic Achievement Award (\$1000), August 2019

Graduated Summa Cum Laude, December 2017

Outstanding Student in Mathematics Award, December 2017

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## SERVICE & LEADERSHIP POSITIONS

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### Iowa STAT-ers Graduate Student Organization Board

Iowa State University of Science and Technology, Ames, IA

- Mentored incoming students regarding departmental procedures and information
- Planned and executed academic and professional events for statistics graduate students
- Managed the organization budget and purchases

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## MEMBERSHIPS & CERTIFICATIONS

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- Member of Pi Mu Epsilon Mathematics Honors Society **2015 - Present**
- Minnesota 5-12 Math Teaching License, Folder #505372 **2017 - Present**

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## REFERENCES

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**Dr. Heike Hofmann, Professor of Statistics, (she/her/hers)**

Department of Statistics

Iowa State University, Ames, IA 50111

(515)-441-5962; hofmann@iastate.edu

**Dr. Susan VanderPlas, Professor of Statistics, (she/her/hers)**

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University of Nebraska, Lincoln, NE 68588

(515)-509-6613; susan.vanderplas@unl.edu

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