Kylie Ariel Bemis

(formerly Kyle Dwayne Bemis)

January 7, 2024

Mobile: (317) 690-0847
Email: k.bemis@northeastern.edu
http://kuwisdelu.github.io

Assistant Teaching Professor
Khoury College of Computer Sciences, Northeastern University
360 Huntington Ave., Boston, MA 02115

Research interests

Computer languages and environments for data analysis, computational methods for statistical inference, data visualization, massive data, machine learning, computational linguistics, spatial statistics.

Education

2016 Ph.D., Statistics, Purdue University

2011 M.S., Applied Statistics, Purdue University

2010 B.S., Statistics and Mathematics, Purdue University

Awards

2015 John M. Chambers Statistical Software Award, American Statistical Association.

2012 Graduate Research Fellowship, National Science Foundation.

2011 Indigenous Graduate Partnership Scholarship, 2011, Alfred P. Sloan Foundation.

2008 Zeta of Indiana Chapter Member, Phi Beta Kappa Society

2008 National Merit Scholarship, National Merit Scholarship Corporation

2007 Purdue University Academic Success Award, Purdue University

2007 Indiana Resident Top Scholar Award, Purdue University

2007 Class of 1954 Presidential Scholarship, Purdue University

2007 Presidential Scholar Candidate, U.S. Presidential Scholars Program

Experience

09/19-present Assistant Teaching Professor. Khoury College of Computer Sciences., Northeastern University, Boston, MA.

- Develop curriculum for MS in Data Science program and instruct data science courses.
- Research areas include large-scale statistical computing for bioinformatics.

08/16-8/19

Future Faculty Fellow. Khoury College of Computer Sciences, Northeastern University, Boston, MA.

- Develop statistical computing infrastructure for high-throughput imaging experiments. Supervisor Olga Vitek.

09/17-present Instructor. College of Computer and Information Sci., Northeastern University, Boston, MA.

- Design and teach "Introduction to Data Management and Processing" course. Supervisor Rajmohan Rajaraman.

01/15-05/15 Teaching Assistant. Dpt. of Statistics, Purdue University, W. Lafayette, IN.

- Led computer labs, help sessions, grade homework, and proctor exams. Supervisor Laura Cayon.

01/13-06/13 Intern. Canary Center for Cancer Early Detection, Stanford University, Palo Alto, CA.

- Develop open-source software package for MALDI-imaging experiments. Supervisor Mark Stolowitz.

08/11-05/12 Research Assistant. Dpt. of Statistics, Purdue University, W. Lafayette, IN.

- Develop methods for statistical analysis of DESI-imaging experiments. Supervisor Olga Vitek.

08/11-05/12 Consultant. Statistical Consulting Service, Dpt. of Statistics, Purdue University, W. Lafayette, IN.

- Design experiments and statistical analyses for students, faculty, and staff. Supervisor Bruce Craig.

06/09-05/10 Intern. School of Aeronautics and Astronautics, Purdue University, W. Lafayette, IN.

- Data mining of large airline itinerary databases. Supervisor Daniel DeLaurentis.

08/09–12/09 Teaching Assistant. Dpt. of Mathematics, Purdue University, W. Lafayette, IN.

- Lead computer labs, help sessions, and grade homework. Supervisor Min Chen.

Publications

1. **K. A. Bemis**, M. C. Foell, D. Guo, S. S. Lakkimsetty, and O. Vitek. "Cardinal v3 - a versatile open source software for mass spectrometry imaging analysis." *Nature Methods.* 2023. https://doi.org/10.1038/s41592-023-02070-z

2. D. Guo, M. C. Foell, **K. A. Bemis**, and O. Vitek. "A noise-robust deep clustering of biomolecular ions improves interpretability of mass spectrometric images." *Bioinformatics.* 2023. https://doi.org/10.1093/bioinformatics/btad067

3. D. Guo, **K. A. Bemis**, C. Rawlins, J. Agar, and O. Vitek. "Unsupervised segmentation of mass spectrometric ion images characterizes morphology of tissues." *Bioinformatics.* 2019. doi:10.1093/bioinformatics/btz345

4. **K. A. Bemis**, D. Guo, A. Harry, M. Thomas, I. Lanekoff, M. Stenzel-Poore, S. Stevens, J. Laskin, and O. Vitek. "Statistical detection of differentially abundant ions in mass spectrometry-based imaging experiments with complex designs." *International Journal of Mass Spectrometry.* 2019. doi:10.1016/j.ijms.2018.07.006

5. **K. A. Bemis** and O. Vitek. "`matter`: an R package for rapid prototyping with larger-than-memory datasets on disk." *Bioinformatics.* 2017. doi:10.1093/bioinformatics/btx392

6. **K. D. Bemis**, A. Harry, L. S. Eberlin, C. Ferreira, S. M. van de Ven, P. Mallick, M. Stolowitz, and O. Vitek. "Probabilistic segmentation of mass spectrometry images helps select important ions and characterize confidence in the resulting segments." *Molecular & Cellular Proteomics.* 2016. doi:10.1074/mcp.O115.053918

7. S. van de Ven, **K. D. Bemis**, K. Lau, R. Adusumilli, U. Kota, M. Stolowitz, O. Vitek, P. Mallick, S. S. Gambhir. "Protein biomarkers on tissue as imaged via MALDI mass spectrometry: A systematic approach to study the limits of detection." *Proteomics.* 2016. doi:10.1002/pmic.201500515

8. **K. D. Bemis**, A. Harry, L. S. Eberlin, C. Ferreira, S. M. van de Ven, P. Mallick, M. Stolowitz, and O. Vitek. "`Cardinal`: an R package for statistical analysis of mass spectrometry-based imaging experiments." *Bioinformatics.* 2015. doi:10.1093/bioinformatics/btv146

Software

Cardinal A mass spectrometry imaging toolbox for statistical analysis

- Available as a free and open-source `R` package on Bioconductor.
- News, installation instructions, and example workflows and datasets are available at
  - `http://www.cardinalmsi.org`
- Source code for *Cardinal* and its example workflows are available at
  - `https://github.com/kuwisdelu/Cardinal`

matter Out-of-memory dense and sparse signal arrays

- Available as a free and open-source `R` package on Bioconductor.
- Source code for *Cardinal* and its example workflows are available at
  - `https://github.com/kuwisdelu/matter`

Invited Talks

1. K. A. Bemis and S. S. Lakkimsetty. "What's New in `Cardinal` for MS Imaging Pre-Processing and Machine Learning." *38th Asilomar Conference on Mass Spectrometry*, Pacific Grove, CA, 2023.
2. K. A. Bemis. "Solving Challenges in AI for MSI with `Cardinal 3`." *US HUPO 2023*, Chicago, IL, 2023.
3. K. A. Bemis. "AI + ML for MSI using `Cardinal` and R." *Imaging Mass Spectrometry Society (IMSS) Summer Workshop*, Baltimore, MD, 2022.
4. K. A. Bemis. "Out-of-memory computing with `matter`." *Bioconductor Conference 2020*, Virtual, 2020.
5. K. A. Bemis. "Challenges in Statical Analysis for Mass Spectrometry Imaging." *Austrolasian Data Visualization and Bioinformatics Symposium* , Lorne, Australia, 2020.
6. K. A. Bemis. "Flexible file-based data structures with `matter`." *Directons in Statistical Computing*, Palo Alto, CA, 2019.
7. K. A. Bemis. "Computational and statistical methods for mass spectrometry imaging." *26th Conference on Joint Systems for Molecular Biology*, Chicago, IL, 2018.

8. K. A. Bemis. "Scalable R computing for big data on disk for bioinformatics and beyond." *9th International Purdue Symposium on Statistics*, West Lafayette, IN, 2018.

9. K. D. Bemis, A. Harry, D. Calligaris, A. Changelian, S. Santagata, N. Agar, and O. Vitek. "Supervised and Unsupervised Analysis of Mass Spectrometry Imaging Experiments Using Cardinal." *US HUPO 12th Annual Conference*, Boston, MA, 2016.

Presentations

1. K. A. Bemis. "An Open-Source Workflow for Scalable Statistical Analysis of Mass Spectrometry Imaging Experiments." *OurCon V*, Doorn, Netherlands, 2017.

2. K. A. Bemis and O. Vitek. "R-Based Computing with Big Data on Disk." *use R! 2017 Conference*, Brussels, Belgium, 2017.

3. K. A. Bemis and O. Vitek. "Scalable Analysis of Mass Spectrometry Imaging Experiments." *International Chinese Statistical Association (ICSA) Applied Statistics Symposium*, Chicago, IL, 2017.

4. K. D. Bemis, L. S. Eberlin, C. Zheng, C. Ferreira, R. G. Cooks, and O. Vitek. "Statistically Visualizing the Mass Spectra: Integrating chemistry and statistics to discover new biological insights with DESI-imaging." *American Indian Science and Engineering Society National Conference*, Anchorage, AK, 2012.

5. K. D. Bemis, L. S. Eberlin, C. Zheng, C. Ferreira, R. G. Cooks, and O. Vitek. "A Workflow for Efficient Processing and Spatial Segmentation (with Automated Feature Selection) for DESI Imaging Mass Spectrometry." *Bioinformatics Seminar Series*, Purdue University, W. Lafayette, IN, 2012.

6. K. D. Bemis, L. S. Eberlin, C. Ferreira, R. G. Cooks, and O. Vitek. "Regularized Spatial Segmentation of DESI Imaging Mass Spectrometry Data using Spatially-Aware Sparse Clustering." *MS-SIG: Computational Challenges in High-Throughput Proteomics*, Long Beach, CA, 2012.

7. K. D. Bemis, L. S. Eberlin, C. Ferreira, R. G. Cooks, and O. Vitek. "Regularized Spatial Segmentation of DESI Imaging Mass Spectrometry Data using Spatially-Aware Sparse Clustering." *International Society for Computational Biology Student Council Symposium*, Long Beach, CA, 2012.

8. K. D. Bemis, L. S. Eberlin, C. Ferreira, R. G. Cooks, and O. Vitek. "Signal Processing and Spatial Segmentation of DESI Imaging Mass Spectrometry Data with Regularized and Spatially-Aware Clustering." *RECOMB Satellite Conference on Computational Proteomics*, La Jolla, CA,, 2012.

Posters

1. K. D. Bemis, L. S. Eberlin, C. Ferreira, S. van de Ven, P. Mallick, M. Stolowitz, and O. Vitek. "Cardinal: open-source R package for statistical analysis of 2D and 3D mass spectrometry imaging experiments" *62nd American Society for Mass Spectrometry Conference on Mass Spectrometry and Allied Topics*, Baltimore, MD, 2014.

2. K. D. Bemis, L. S. Eberlin, C. Ferreira, S. van de Ven, P. Mallick, R. G. Cooks, M. Stolowitz, and O. Vitek. "Discovering Spatio-Chemical Structure in Tissue: Cardinal Software and Methods for Analysis of Mass Spectrometry Images." *American Indian Science and Engineering Society National Conference*, Denver, CO, 2013.

3. K. D. Bemis, L. S. Eberlin, C. Ferreira, R. G. Cooks, and O. Vitek. "Challenges in Between-Tissue Variation in DESI-Imaging: Spatial Segmentation of Multiple Sections of a Fetal Pig." *Scientific Meeting of the 3D-Massomics European Project*, Saint-Malo, France, 2013.

4. K. D. Bemis, L. S. Eberlin, C. Ferreira, S. van de Ven, P. Mallick, R. G. Cooks, M. Stolowitz, and O. Vitek. "Cardinal: open-source software for spatially-aware feature-sparse segmentation and classification of mass spectrometry images." *61st American Society for Mass Spectrometry Conference on Mass Spectrometry and Allied Topics*, Minneapolis, MN, 2013.

5. K. D. Bemis, L. S. Eberlin, C. Ferreira, R. G. Cooks, and O. Vitek. "Regularized Spatial Segmentation of DESI Imaging Mass Spectrometry Data using Spatially-Aware Sparse Clustering." *20th Annual International Conference on Intelligent Systems for Molecular Biology*, Long Beach, CA, 2012.

6. K. D. Bemis, L. S. Eberlin, C. Ferreira, R. G. Cooks, and O. Vitek. "Regularized Spatial Segmentation of DESI Imaging Mass Spectrometry Data using Spatially-Aware Sparse Clustering." *International Society for Computational Biology Student Council Symposium*, Long Beach, CA, 2012.

7. K. D. Bemis, L. S. Eberlin, C. Ferreira, R. G. Cooks, and O. Vitek. "Signal Processing and Spatial Segmentation of DESI Imaging Mass Spectrometry Data with Regularized and Spatially-Aware Clustering." *RECOMB Satellite Conference on Computational Proteomics*, La Jolla, CA, 2012.

8. K. D. Bemis, L. S. Eberlin, C. Zheng, C. Ferreira, R. G. Cooks, and O. Vitek. "Processing and Analysis of DESI Imaging Mass Spectrometry Data in Supervised and Unsupervised Settings." *American Indian Science and Engineering Society Regional Conference – Region VI*, Purdue University, W. Lafayette, IN, 2012.

Computing Skills

R, C, C++, Python, SAS, Matlab

Service and outreach

9/21	Member. Presidential Council on Diversity and Inclusion, Northeastern University, Boston, MA, 2021
9/21	Member. Transgender and Nonbinary Advisory Council, Northeastern University, Boston, MA, 2021
10/19	Co-chair. First Annual Indigenous Resilience Event, Northeastern University, Boston, MA, 2019
11/18	Co-chair. Imaging Mass Spectrometry Society II and OurCon VI Joint Meeting, Data Analysis session, Charleston, SC, 2018
10/17	Co-chair. Founding Meeting of the Imaging Mass Spectrometry Society, Data Analysis session, Waltham, MA, 2017
10/17	Mentor. Reach(OUT) LGBTQA+ Career Conference, Northeastern University, Boston MA
11/16	Mentor. Reach(OUT) LGBTQA+ Career Conference, Northeastern University, Boston MA
09/14-08/15	Secretary. Purdue chapter, American Indian Science and Engineering Society (AISES)
06/14	Mentor. Minority Education Through Traveling and Learning in the Sciences (METALS), Alaska Native/rural Alaskan high school students, Anchorage & Fairbanks, AK
09/13-08/14	President. Purdue chapter, American Indian Science and Engineering Society (AISES)
09/11-08/13	Vice President. Purdue chapter, American Indian Science and Engineering Society (AISES)
06/12	Mentor. Minority Education Through Traveling and Learning in the Sciences (METALS), Underrepresented minority high school students, Rocky Mountain Region.
06/12	Presenter. Alaska Native Science and Engineering Program (ANSEP) Acceleration Academy. University of Alaska, Anchorage, AK.
03/12	Co-organizer. American Indian Science and Engineering Society (AISES) Regional Conference.

Professional memberships

American Statistical Association (ASA)

American Society for Mass Spectrometry (ASMS)

American Indian Science and Engineering Society (AISES)

National Organization of Gay and Lesbian Scientists and Technical Professionals (NOGLSTP)