# Bei Wang Phillips

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## Education

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| 2010 | Ph.D. in Computer Science, Duke University |
| | Thesis: Separating Features from Noise with Persistence and Statistics |
| | Advisor: Herbert Edelsbrunner |
| 2010 | Certificate in Computational Biology and Bioinformatics, Duke University |
| 2003 | B.S. in Computer Science and Mathematics, Minor in Psychology |
| | Summa Cum Laude, University of Bridgeport |

## Professional Experience

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| 2022 – Present | Associate Professor, School of Computing, Univ. of Utah |
| 2016 – Present | Faculty Member, SCI Institute, Univ. of Utah |
| 2019 – Present | Adjunct Professor, Department of Mathematics, Univ. of Utah |
| 2016 – 2022 | Assistant Professor, School of Computing, Univ. of Utah |
| 2011 – 2016 | Research Computer Scientist, SCI Institute, Univ. of Utah |
| 2010 – 2011 | Postdoctoral Fellow, SCI Institute, Univ. of Utah |
| 2009 – 2010 | Visiting Researcher, Institute of Science and Technology, Austria |

## Awards

- **NSF CAREER** awardee, 2022 - 2027.
- **DOE Early Career Research Program (ECRP)** awardee, 2020-2025.
- **Visual Computer Second Best Paper Award** at Computer Graphics International (CGI), 2022. Visual Computer journal **Cover of the Year 2023**.
- **Honorable Mention Paper Award** at IEEE Workshop on Topological Data Analysis and Visualization (TopoInVis), 2022.
- **Best Paper** Award at Shape Modeling International (SMI), 2019.
- **Best Poster** at China Visualization and Visual Analytics Conference (ChinaVis), 2019.
- **Best Paper** Award at International Workshop on Connectomics in NeuroImaging (CNI) at MICCAI, 2018.
- **Best Paper** Award at IEEE Pacific Visualization (PacificVis), 2016.
- **Best Paper** Award at IEEE Pacific Visualization (PacificVis), 2014.

# Publications[1]

**Peer-Reviewed Journal Publications**

1. Kevin G. Hicks, Ahmad A. Cluntun, Heidi L. Schubert, Sean R. Hackett, Jordan A. Berg, Paul G. Leonard, Mariana A. Ajalla Aleixo, Youjia Zhou, Alex J. Bott, Sonia R. Salvatore, Fei Chang, Aubrie Blevins, Paige Barta, Samantha Tilley, Aaron Leifer, Andrea Guzman, Ajak Arok, Sarah Fogarty, Jacob M. Winter, Hee-Chul Ahn, Karen N. Allen, Samuel Block, Iara A. Cardoso, Jianping Ding, Ingrid Dreveny, Clarke Gasper, Quinn Ho, Atsushi Matsuura, Michael J. Palladino, Sabin Prajapati, PengKai Sun, Kai Tittmann, Dean R. Tolan, Judith Unterlass, Andrew P. VanDemark, Matthew G. Vander Heiden, Bradley A. Webb, Cai-Hong Yun, PengKai Zhap, Bei Wang, Francisco J. Schopfer, Christopher P. Hill, Maria Cristina Nonato, Florian L. Muller, James E. Cox, and Jared Rutter. Protein-metabolite interactomics of carbohydrate metabolism reveal regulation of lactate dehydrogenase. *Science*, 379(6636):996–1003, 2023.

2. Jordan A. Berg, Youjia Zhou, Yeyun Ouyang, Ahmad A. Cluntun, T. Cameron Waller, Megan E. Conway, Sara M. Nowinski, Tyler Van Ry, Ian George, James E. Cox, Bei Wang, and Jared Rutter. Metaboverse enables automated discovery and visualization of diverse metabolic regulatory patterns. *Nature Cell Biology*, 25:616–625, 2023.

3. Lin Yan, Paul Aaron Ullrich, Luke P. Van Roekel, Bei Wang, and Hanqi Guo. Multilevel robustness for 2D vector field feature tracking, selection, and comparison. *Computer Graphics Forum*, 2023.

4. Archit Rathore, Yichu Zhou, Vivek Srikumar, and Bei Wang. TopoBERT: Exploring the topology of fine-tuned word representations. *Information Visualization*, 2023.

5. Lin Yan, Talha Bin Masood, Farhan Rasheed, Ingrid Hotz, and Bei Wang. Geometry-aware merge tree comparisons for time-varying data with interleaving distances. *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 2022.

6. Youjia Zhou, Archit Rathore, Emilie Purvine, and Bei Wang. Topological simplifications of hypergraphs. *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 2022.

7. Tushar Athawale, Dan Maljovec, Lin Yan, Chris R. Johnson, Valerio Pascucci, and Bei Wang. Uncertainty visualization of 2D Morse complex ensembles using statistical summary maps. *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 28(4):1955–1966, 2022.

8. Kevin Knudson and Bei Wang. Discrete stratified Morse theory: Algorithms and a user's guide. *Discrete & Computational Geometry (DCG)*, 2022.

9. Fangfei Lan, Michael Young, Lauren Anderson, Anders Ynnerman, Alexander Bock, Michelle A. Borkin, Angus G. Forbes, Juna A. Kollmeier, and Bei Wang. Visualization in astrophysics: Developing new methods, discovering our universe, and educating the earth. *Computer Graphics Forum (CGF)*, 40(3):635–663, 2021.

10. Lin Yan, Talha Bin Masood, Raghavendra Sridharamurthy, Farhan Rasheed, Vijay Natarajan, Ingrid Hotz, and Bei Wang. Scalar field comparison with topological descriptors: Properties and applications for scientific visualization. *Computer Graphics Forum (CGF)*, 40(3):599–633, 2021.

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[1]Student advisees, other students.

11. Archit Rathore, Nithin Chalapathi, Sourabh Palande, and Bei Wang. TopoAct: Visually exploring the shape of activations in deep learning. *Computer Graphics Forum (CGF)*, 40(1):382–397, 2021.

12. Adam Brown and Bei Wang. Sheaf-theoretic stratification learning from geometric and topological perspectives. *Discrete & Computational Geometry (DCG)*, 65:1166–1198, 2021.

13. Adam Brown, Omer Bobrowski, Elizabeth Munch, and Bei Wang. Probabilistic convergence and stability of random mapper graphs. *Journal of Applied and Computational Topology (APCT)*, 5:99–140, 2021.

14. Roxana Bujack, Lin Yan, Ingrid Hotz, Christoph Garth, and Bei Wang. State of the art in time-dependent flow topology: Interpreting physical meaningfulness through mathematical properties. *Computer Graphics Forum (CGF)*, 39(3):811–835, 2020.

15. Braxton Osting, Sourabh Palande, and Bei Wang. Spectral sparsification of simplicial complexes for clustering and label propagation. *Journal of Computational Geometry (JoCG)*, 11(1), 2020.

16. Michael J. Catanzaro, Justin M. Curry, Brittany Terese Fasy, Janis Lazovskis, Greg Malen, Hans Riess, Bei Wang, and Matthew Zabka. Moduli spaces of Morse functions for persistence. *Journal of Applied and Computational Topology (APCT)*, 4:353–385, 2020.

17. Michal Adamaszek, Henry Adams, Ellen Gasparovic, Maria Gommel, Emilie Purvine, Radmila Sazdanovic, Bei Wang, Yusu Wang, and Lori Ziegelmeier. On homotopy types of Vietoris–Rips complexes of metric gluings. *Journal of Applied and Computational Topology (APCT)*, 4:425–454, 2020.

18. Lin Yan, Yusu Wang, Elizabeth Munch, Ellen Gasparovic, and Bei Wang. A structural average of labeled merge trees for uncertainty visualization. *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 26(1):832–842, 2020.

19. Ashley Suh, Mustafa Hajij, Bei Wang, Carlos Scheidegger, and Paul Rosen. Persistent homology guided force-directed graph layouts. *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 26(1):697–707, 2020.

20. Yuan Wang and Bei Wang. Topological inference of manifolds with boundary. *Computational Geometry: Theory and Applications (CGTA)*, 88(101606), 2020.

21. Ellen Gasparovic, Maria Gommel, Emilie Purvine, Radmila Sazdanovic, Bei Wang, Yusu Wang, and Lori Ziegelmeier. The relationship between the intrinsic Čech and persistence distortion distances for metric graphs. *Journal of Computational Geometry (JoCG)*, 10(1):477–499, 2019.

22. Jochen Jankowai, Bei Wang, and Ingrid Hotz. Robust extraction and simplification of 2D tensor field topology. *Computer Graphics Forum (CGF)*, 38(3):337–349, 2019.

23. René Corbet, Ulderico Fugacci, Michael Kerber, Claudia Landi, and Bei Wang. A kernel for multi-parameter persistent homology. *Computers & Graphics: X*, 2(100005), 2019.

24. Sourabh Palande, Vipin Jose, Brandon Zielinski, Jeffrey Anderson, P. Thomas Fletcher, and Bei Wang. Revisiting abnormalities in brain network architecture underlying autism using topology-inspired statistical inference. *Brain Connectivity*, 9(1):13–21, 2019.

25. Shusen Liu, Peer-Timo Bremer, Jayaraman J. Thiagarajan, Vivek Srikumar, Bei Wang, Yarden Livnat, and Valerio Pascucci. Visual exploration of semantic relationships in neural word embeddings. *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 24(1):553–562, 2018.

26. Shusen Liu, Dan Maljovec, Bei Wang, Peer-Timo Bremer, and Valerio Pascucci. Visualizing high-dimensional data: Advances in the past decade. *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 23(3):1249–1268, 2017.

27. Primoz Skraba, Paul Rosen, Bei Wang, Guoning Chen, Harsh Bhatia, and Valerio Pascucci. Critical point cancellation in 3D vector fields: Robustness and discussion. *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 22(6):1683–1693, 2016.

28. Shusen Liu, Peer-Timo Bremer, Jayaraman J. Thiagarajan, Bei Wang, Brian Summa, and Valerio Pascucci. Grassmannian atlas: A general framework for exploring linear projections of high-dimensional data. *Computer Graphics Forum (CGF)*, 35(3):1–10, 2016.

29. Attila Gyulassy, Aaron Knoll, Kah Chun Lau, Bei Wang, Peer-Timo Bremer, Michael E. Papka, Larry A. Curtiss, and Valerio Pascucci. Interstitial and interlayer Ion diffusion geometry extraction in graphitic nanosphere battery materials. *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 22(1):916–925, 2016.

30. Dan Maljovec, Shusen Liu, Bei Wang, Valerio Pascucci, Peer-Timo Bremer, Diego Mandelli, and Curtis Smith. Analyzing simulation-based PRA data through traditional and topological clustering: A BWR station blackout case study. *Reliability Engineering & System Safety (RESS)*, 145:262–276, 2016.

31. Primoz Skraba, Bei Wang, Guoning Chen, and Paul Rosen. Robustness-based simplification of 2D steady and unsteady vector fields. *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 21(8):930 – 944, 2015.

32. Harsh Bhatia, Bei Wang, Gregory Norgard, Valerio Pascucci, and Peer-Timo Bremer. Local, smooth, and consistent Jacobi set simplification. *Computational Geometry: Theory and Applications (CGTA)*, 48(4):311–332, 2015.

33. Peer-Timo Bremer, Dan Maljovec, Avishek Saha, Bei Wang, Jim Gaffney, Brian K. Spears, and Valerio Pascucci. ND2AV: N-dimensional data analysis and visualization – analysis for the national ignition campaign. *Computing and Visualization in Science (CVS)*, 17(1):1–18, 2015.

34. Shusen Liu, Bei Wang, Jayaraman J. Thiagarajan, Peer-Timo Bremer, and Valerio Pascucci. Visual exploration of high-dimensional data through subspace analysis and dynamic projections. *Computer Graphics Forum (CGF)*, 34(3):271–280, 2015.

35. Shusen Liu, Bei Wang, Peer-Timo Bremer, and Valerio Pascucci. Distortion-guided structure-driven interactive exploration of high-dimensional data. *Computer Graphics Forum (CGF)*, 33(3):101–110, 2014.

36. Bei Wang, Paul Rosen, Primoz Skraba, Harsh Bhatia, and Valerio Pascucci. Visualizing robustness of critical points for 2D time-varying vector fields. *Computer Graphics Forum (CGF)*, 32(3pt2):221–230, 2013.

37. Dan Maljovec, Bei Wang, Ana Kupresanin, Gardard Johannesson, Valerio Pascucci, and Peer-Timo Bremer. Adaptive sampling with topological scores. *International Journal for Uncertainty Quantification (IJUQ)*, 3(2):119–141, 2013.

38. Bei Wang, Brian Summa, Valerio Pascucci, and Mikael Vejdemo-Johansson. Branching and circular features in high dimensional data. *IEEE Transactions on Visualization and Computer Graphics (TVCG)*, 17(12):1902–1911, 2011.

39. Bei Wang, Herbert Edelsbrunner, and Dmitriy Morozov. Computing elevation maxima by searching the gauss sphere. *ACM Journal of Experimental Algorithmics (JEA)*, 16:1–13, 2011.

40. Mats Enster ö, Örjan Åkerborg, Daniel Lundin, Bei Wang, Terrence S Furey, Marie Öhman, and Jens Lagergren. A computational screen for site selective A-to-I editing detects novel sites in neuron specific Hu proteins. *BMC Bioinformatics*, 11(6), 2010.

41. Bei Wang, Dimitris Papamichail, Steffen Mueller, and Steven Skiena. Two proteins for the price of one: The design of maximally compressed coding sequences. *Natural Computing*, 6(4):359–370, 2007.

42. Tarek M. Sobh, Bei Wang, and Kurt W. Coble. Experimental robot musicians. *Journal of Intelligent and Robotic Systems (JIRS)*, 38(2):197–212, 2003.

43. Tarek M. Sobh, Bei Wang, and Sarosh Patel. A mobile wireless and web-based analysis tool for robot design and dynamic control simulation from task points description. *Journal of Internet Technology*, 4(3):153–161, 2003.

44. Tarek M. Sobh, Rajeev Sanyal, and Bei Wang. Web based remote surveillance of mobile robot. *Journal of Internet Technology*, 4(3):179–184, 2003.

## Peer-Reviewed Conference Publications

1. Nate Clause, Tamal K. Dey, Facundo Mémoli, and Bei Wang. Meta-diagrams for 2-parameter persistence. *International Symposium on Computational Geometry (SOCG)*, 2023

2. Emilie Purvine, Davis Brown, Brett Jefferson, Cliff Joslyn, Brenda Praggastis, Archit Rathore, Madelyn Shapiro, Bei Wang, and Youjia Zhou. Experimental observations of the topology of convolutional neural network activations. *Proceedings of the 37th AAAI Conference on Artificial Intelligence (AAAI)*, 2023.

3. Gabrielius A. Kudirka, Xinyuan Yan, Sarah Kunzler, Yirong Zhou, Bei Wang, and Xiaoyue Cathy Liu. Enable decision making for battery electric bus deployment using robust high-resolution interdependent visualization. *Transportation Research Board (TRB) 102nd Annual Meeting*, 2023.

4. Daniel Klötzl, Tim Krake, Youjia Zhou, Jonathan Stober, Kathrin Schulte, Ingrid Hotz, Bei Wang, and Daniel Weiskopf. Reduced connectivity for local bilinear jacobi sets. *IEEE Workshop on Topological Data Analysis and Visualization (TopoInVis) at IEEE VIS*, 2022.

5. Bhavana Doppalapudi, Bei Wang, and Paul Rosen. Untangling force-directed layouts using persistent homology. *IEEE Workshop on Topological Data Analysis and Visualization (TopoInVis) at IEEE VIS*, 2022.

6. Daniel Klötzl, Tim Krake, Youjia Zhou, Ingrid Hotz, Bei Wan, and Daniel Weiskopf. Local bilinear computation of jacobi sets. *Computer Graphics International (CGI)*, 2022.

7. Bei Wang, Arul Mishra, and Himanshu Mishra. Humans as mitigators of biases in risk prediction via field studies. *Workshop on Responsible AI and Data Ethics (RAIDE) at IEEE International Conference on Big Data (IEEE BigData)*, 2022.

8. Fangfei Lan, Sourabh Palande, Michael Young, and Bei Wang. Uncertainty visualization for graph coarsening. *Workshop on Graph Techniques for Adversarial Activity Analytics (GTA3) at IEEE International Conference on Big Data (IEEE BigData)*, 2022.

9. Archit Rathore, Sunipa Dev, Jeff Phillips, Vivek Srikumar, Yan Zheng, Chin-Chia Michael Yeh, Junpeng Wang, Wei Zhang, and Bei Wang. An interactive visual demo of bias mitigation techniques for word representations. *Proceedings of the NeurIPS 2021 Competitions and Demonstrations Track, PMLR*, 176:330–334, 2022.

10. Nithin Chalapathi, Youjia Zhou, and Bei Wang. Adaptive covers for mapper graphs using information criteria. *IEEE International Conference on Big Data (IEEE BigData)*, 2021.

11. Youjia Zhou, Methun Kamruzzaman, Patrick Schnable, Bala Krishnamoorthy, Ananth Kalyanaraman, and Bei Wang. Pheno-Mapper: an interactive toolbox for the visual exploration of phenomics data. *Proceedings of the 12th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics (ACM-BCB)*, pages 1–10, 2021.

12. Avishan Bagherinezhad, Michael Young, Bei Wang, and Masood Parvania. Spatio-temporal visualization of interdependent battery bus transit and power distribution systems. *IEEE PES Innovative Smart Grid Technologies Conference (ISGT)*, pages 1–5, 2021.

13. Youjia Zhou, Nithin Chalapathi, Archit Rathore, Yaodong Zhao, and Bei Wang. Mapper Interactive: A scalable, extendable, and interactive toolbox for the visual exploration of high-dimensional data. *IEEE 14th Pacific Visualization Symposium (PacificVis)*, 2021.

14. Archit Rathore, Sunipa Dev, Jeff M. Phillips, Vivek Srikumar, and Bei Wang. A visual tour of bias mitigation techniques for word representations (tutorial overview). *Proceedings of the 27th ACM SIGKDD Conference on Knowledge Discovery & Data Mining*, pages 4064–4065, 2021.

15. Han Han, Konstantinos Oikonomou, Nithin Chalapathi, Masood Parvania, and Bei Wang. Interactive visualization of interdependent power and water infrastructure operation. *IEEE PES Innovative Smart Grid Technologies Conference (ISGT)*, 2020

16. Archit Rathore, Sourabh Palande, Jeffrey Anderson, Brandon Zielinski, Tom Fletcher, and Bei Wang. Autism classification using topological features and deep learning: A cautionary tale. *International Conference on Medical Image Computing and Computer Assisted Intervention (MICCAI)*, 2019.

17. Paul Rosen, Anil Seth, Betsy Mills, Adam Ginsburg, Julia Kamenetzky, Jeff Kern, Chris R. Johnson, and Bei Wang. Using contour trees in the analysis and visualization of radio astronomy data cubes. *Proceedings of Topology-Based Methods in Visualization (TopoInVis)*, 2019.

18. Bei Wang, Roxana Bujack, Paul Rosen, Primoz Skraba, Harsh Bhatia, and Hans Hagen. Interpreting Galilean invariant vector field analysis via extended robustness. In *Topological Methods in Data Analysis and Visualization V: Theory, Algorithms, and Applications (Proceedings of TopoInVis 2017)*. Springer, 2019.

19. Keri L. Anderson, Jeffrey S. Anderson, Sourabh Palande, and Bei Wang. Topological data analysis of functional MRI connectivity in time and space domains. In Guorong Wu, Islem Rekik, Markus D. Schirmer, Ai Wern Chung, and Brent Munsell, editors, *Connectomics in NeuroImaging (Lecture Notes in Computer Science, Proceedings of International Workshop on Connectomics in NeuroImaging)*, volume 11083. Springer, 2018.

20. Kevin Knudson and Bei Wang. Discrete stratified Morse theory: A user's guide. *International Symposium on Computational Geometry (SOCG)*, 2018.

21. Adam Brown and Bei Wang. Sheaf-theoretic stratification learning. *International Symposium on Computational Geometry (SOCG)*, 2018.

22. Michal Adamaszek, Henry Adams, Ellen Gasparovic, Maria Gommel, Emilie Purvine, Radmila Sazdanovic, Bei Wang, Yusu Wang, and Lori Ziegelmeier. Vietoris-Rips and Čech complexes of metric gluings. *International Symposium on Computational Geometry (SOCG)*, 2018.

23. Mustafa Hajij, Bei Wang, Carlos Scheidegger, and Paul Rosen. Visual detection of structural changes in time-varying graphs using persistent homology. *IEEE 11th Pacific Visualization Symposium (PacificVis)*, 2018.

24. Lin Yan, Yaodong Zhao, Paul Rosen, Carlos Scheidegger, and Bei Wang. Homology-preserving dimensionality reduction via manifold landmarking and tearing. *Symposium on Visualization in Data Science (VDS) at IEEE VIS*, 2018.

25. Sourabh Palande, Vipin Jose, Brandon Zielinski, Jeffrey Anderson, P. Thomas Fletcher, and Bei Wang. Revisiting abnormalities in brain network architecture underlying autism using topology-inspired statistical inference. In Guorong Wu, Paul Laurienti, Leonardo Bonilha, and Brent C. Munsell, editors, *Connectomics Neuroimaging (Lecture Notes in Computer Science, Proceedings of International Workshop on Connectomics in NeuroImaging)*, volume 10511, pages 98–107. Springer, Cham, 2017.

26. Attila Gyulassy, Aaron Knoll, Kah Chun Lau, Bei Wang, Peer-Timo Bremer, Michael E. Papka, Larry A. Curtiss, and Valerio Pascucci. Morse-Smale analysis of ion diffusion in Ab initio battery materials simulations. In Hamish Carr, Christoph Garth, and Tino Weinkauf, editors, *Topological Methods in Data Analysis and Visualization IV: Theory, Algorithms, and Applications (Proceedings of TopoInVis 2015)*, pages 135–149. Springer, Cham, 2017.

27. Tim Sodergren, Jessica Hair, Jeff M. Phillips, and Bei Wang. Visualizing sensor network coverage with location uncertainty. *Symposium on Visualization in Data Science (VDS) at IEEE VIS*, 2017.

28. Wathsala Widanagamaachchi, Alexander Jacques, Bei Wang, Erik Crosman, Peer-Timo Bremer, Valerio Pascucci, and John Horel. Exploring the evolution of pressure-perturbations to understand atmospheric phenomena. *IEEE 10th Pacific Visualization Symposium (PacificVis)*, 2017.

29. Hoa Nguyen, Paul Rosen, and Bei Wang. Visual exploration of multiway dependencies in multivariate data. *ACM SIGGRAPH ASIA Symposium on Visualization*, 2016.

30. Elizabeth Munch and Bei Wang. Convergence between categorical representations of Reeb space and mapper. *International Symposium on Computational Geometry (SOCG)*, 2016.

31. Brittany T. Fasy and Bei Wang. Exploring persistent local homology in topological data analysis. *IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 6430–6434, 2016.

32. Dan Maljovec, Bei Wang, Paul Rosen, Andrea Alfonsi, Giovanni Pastore, Cristian Rabiti, and Valerio Pascucci. Rethinking sensitivity analysis of nuclear simulations with topology. *IEEE 8th Pacific Visualization Symposium (PacificVis)*, pages 64–71, 2016.

33. Jeff M. Phillips, Bei Wang, and Yan Zheng. Geometric inference on kernel density estimates. *International Symposium on Computational Geometry (SOCG)*, pages 857–871, 2015.

34. Eleanor Wong, Sourabh Palande, Bei Wang, Brandon Zielinski, Jeffrey Anderson, and P. Thomas Fletcher. Kernel partial least squares regression for relating functional brain network topology to clinical measures of behavior. *IEEE International Symposium on Biomedical Imaging (ISBI)*, 2015.

35. Primoz Skraba and Bei Wang. Approximating local homology from samples. *ACM-SIAM Symposium on Discrete Algorithms (SODA)*, pages 174–192, 2014.

36. Primoz Skraba and Bei Wang. Interpreting feature tracking through the lens of robustness. In Peer-Timo Bremer, Ingrid Hotz, Valerio Pascucci, and Ronald Peikert, editors, *Topological Methods in Data Analysis and Visualization III: Theory, Algorithms, and Applications (Proceedings of TopoInVis 2013)*, pages 19–38. Springer, 2014.

37. Primoz Skraba, Bei Wang, Guoning Chen, and Paul Rosen. 2D vector field simplification based on robustness. *IEEE 7th Pacific Visualization Symposium (PacificVis)*, pages 49–56, 2014.

38. Shusen Liu, Bei Wang, Jayaraman J. Thiagarajan, Peer-Timo Bremer, and Valerio Pascucci. Multivariate volume visualization through dynamic projections. *IEEE Symposium on Large Data Analysis and Visualization (LDAV)*, pages 35–42, 2014.

39. Diego Mandelli, Curtis Smith, Tom Riley, Joseph Nielsen, John Schroeder, Cristian Rabiti, Andrea Alfonsi, Joshua Cogliati, Robert Kinoshita, Valerio Pascucci, Bei Wang, and Dan Maljovec. Overview of new tools to perform safety analysis: BWR station black out test case. In *Probabilistic Safety Assessment & Management Conference (PSAM)*, 2014.

40. Dan Maljovec, Bei Wang, Valerio Pascucci, Peer-Timo Bremer, Michael Pernice, Diego Mandelli, and Robert Nourgaliev. Exploration of high-dimensional scalar function for nuclear reactor safety analysis and visualization. *International Conference on Mathematics and Computational Methods Applied to Nuclear Science & Engineering (M&C)*, pages 712–723, 2013.

41. Dan Maljovec, Bei Wang, Diego Mandelli, Peer-Timo Bremer, and Valerio Pascucci. Analyze dynamic probabilistic risk assessment data through clustering. In *International Topical Meeting on Probabilistic Safety Assessment and Analysis (PSA)*, 2013.

42. Paul Bendich, Bei Wang, and Sayan Mukherjee. Local homology transfer and stratification learning. *ACM-SIAM Symposium on Discrete Algorithms (SODA)*, pages 1355–1370, 2012.

43. A.N.M. Imroz Choudhury, Bei Wang, Paul Rosen, and Valerio Pascucci. Topological analysis and visualization of cyclical behavior in memory reference traces. *IEEE 5th Pacific Visualization Symposium (PacificVis)*, pages 9–16, 2012.

44. Bei Wang, Jeff M. Phillips, Robert Schrieber, Dennis Wilkinson, Nina Mishra, and Robert Tarjan. Spatial scan statistics for graph clustering. *SIAM International Conference on Data Mining (SDM)*, 2008.

45. Sudheer Sahu, Bei Wang, and John H. Reif. A framework for modeling DNA based molecular systems. In Chengde Mao and Takashi Yokomori, editors, *DNA Computing, Lecture Notes in Computer Science (12th International Meeting on DNA Computing)*, volume 4287, pages 250–265. Springer, 2006.

46. Tarek M. Sobh, Bei Wang, and Sarosh H. Patel. Web enabled robot design and dynamic control simulation software solutions from task points description. *29th Annual Conference of the IEEE Industrial Electronics Society (IECON)*, 2:1221–1227, 2003.

**Peer-Reviewed Book Chapters**

1. Youjia Zhou, Nathaniel Saul, Ilkin Safarli, Bala Krishnamoorthy, and Bei Wang. Stitch fix for mapper and topological gains. In Ellen Gasparovic, Vanessa Robins, and Kate Turner, editors, *Research in Computational Topology 2*. Springer International Publishing, 2021.

2. Ellen Gasparovic, Maria Gommel, Emilie Purvine, Radmila Sazdanovic, Bei Wang, Yusu Wang, and Lori Ziegelmeier. Local versus global distances for zigzag persistence modules.

In Ellen Gasparovic, Vanessa Robins, and Kate Turner, editors, *Research in Computational Topology 2*. Springer International Publishing, 2021.

3. Ana Lucia Garcia-Pulido, Kathryn Hess, Jane Tan, Katharine Turner, Bei Wang, and Naya Yerolemou. Graph pseudometrics from a topological point of view. In Ellen Gasparovic, Vanessa Robins, and Kate Turner, editors, *Research in Computational Topology 2*. Springer International Publishing, 2021.

4. Ingrid Hotz, Roxana Bujack, Christoph Garth, and Bei Wang. Mathematical foundations in visualization. In Min Chen, Helwig Hauser, Penny Rheingans, and Gerik Scheuermann, editors, *Foundations of Data Visualization*, pages 87–119. Springer International Publishing, 2020.

5. Ellen Gasparovic, Maria Gommel, Emilie Purvine, Radmila Sazdanovic, Bei Wang, Yusu Wang, and Lori Ziegelmeier. A complete characterization of the 1-dimensional intrinsic Čech persistence diagrams for metric graphs. In Erin Chambers, Brittany Terese Fasy, and Lori Ziegelmeier, editors, *Research in Computational Topology*, pages 33–56. Springer International Publishing, 2018.

6. Bei Wang and Ingrid Hotz. Robustness for 2D symmetric tensor field topology. In Thomas Schultz, Evren Özarslan, and Ingrid Hotz, editors, *Modeling, Analysis, and Visualization of Anisotropy*, pages 3–27. Springer International Publishing, 2017.

## Peer-Reviewed Workshop Publications and Posters

1. Adam Brown, Primoz Skraba, and Bei Wang. Learning homological stratifications from finite samples. *Algebraic Topology: Methods, Computation, & Science (ATMCS)*, 2022.

2. Youjia Zhou, Kevin Knudson, and Bei Wang. Visual demo of discrete stratified Morse theory (media exposition). *International Symposium on Computational Geometry (SoCG)*, 2020.

3. Sourabh Palande and Bei Wang. Learning with topological features of functional brain networks (poster abstract). *Algebraic Topology: Methods, Computation, & Science (ATMCS)*, 2020 (cancelled due to the pandemic).

4. Youjia Zhou, Janis Lazovskis, Michael J. Catanzaro, Matthew Zabka, and Bei Wang. A visual exploration and design of morse vector fields (poster abstract). *Algebraic Topology: Methods, Computation, & Science (ATMCS)*, 2020 (cancelled due to the pandemic).

5. Youjia Zhou, Janis Lazovskis, Michael J. Catanzaro, Matthew Zabka, and Bei Wang. Persistence-driven design and visualization of morse vector fields (poster and extended abstract). *China Visualization and Visual Analytics Conference (ChinaVis)*, 2019.

6. Zhe Wang, Paul Rosen, Bei Wang, and Carlos Scheidegger. TopoCubes: Interactive exploration of persistent homology of large datasets (poster). *IEEE Visualization Conference*, 2017.

7. Elizabeth Munch and Bei Wang. Reeb space approximation with guarantees. *Fall Workshop on Computational Geometry (FWCG)*, 2015.

8. Dan Maljovec, Avishek Saha, Peter Lindstrom, Peer-Timo Bremer, Bei Wang, Carlos Correa, and Valerio Pascucci. A comparative study of Morse complex approximation using different neighborhood graphs (presentation). *Topology-Based Methods in Visualization (TopoInVis)*, 2013.

9. Jeff M. Phillips and Bei Wang. Kernel distance for geometric inference. *Fall Workshop on Computational Geometry (FWCG)*, 2012.

10. Paul Bendich, Sayan Mukherjee, and Bei Wang. Towards stratification learning through homology inference. *AAAI Fall Symposium on Manifold Learning and its Applications (AAAI)*, 2010.

## Other Publications

1. Michael Kerber, Vijay Natarajan, and Bei Wang. Report from Dagstuhl seminar 19212: Topology, computation and data analysis. *Dagstuhl Reports*, 9(5):110–131, 2019.

2. Hamish Carr, Michael Kerber, and Bei Wang. Report from Dagstuhl seminar 17292: Topology, computation and data analysis. *Dagstuhl Reports*, 7(7):88–109, 2018.

3. Brittany Terese Fasy and Bei Wang (with contributions by members of the WinComp-Top community). Open problems in computational topology. *SIGACT NEWS Open Problems Column*, 48(3), 2017.

## Manuscripts Under Review/Revision

1. Mingzhe Li, Xinyuan Yan, Lin Yan, Tom Needham, and Bei Wang. Flexible and probabilistic topology tracking with partial optimal transport. arXiv preprint arXiv:2302.02895, 2023.

2. Chedi Morchdi, Yi Zhou, Jie Ding, and Bei Wang. On the mysterious optimization geometry of deep neural network. Manuscript, 2023.

3. Brenda Praggastis, Davis Brown, Carlos Ortiz Marrero, Emilie Purvine, Madelyn Shapiro, and Bei Wang. The SVD of convolutional weights: A CNN interpretability framework. arXiv preprint arXiv:2208.06894, 2022.

4. Samir Chowdhury, Tom Needham, Ethan Semrad, Bei Wang, and Youjia Zhou. Hypergraph Co-Optimal transport: Metric and categorical properties. arXiv preprint arXiv: 2112.03904, 2021.

5. Archit Rathore, Sunipa Dev, Jeff M. Phillips, Vivek Srikumar, Yan Zheng, Chin-Chia Michael Yeh, Junpeng Wang, Wei Zhang, and Bei Wang. VERB: Visualizing and interpreting bias mitigation techniques for word representations. arXiv preprint arXiv:2104.02797, 2021.

6. Mingzhe Li, Sourabh Palande, Lin Yan, and Bei Wang. Sketching merge trees for scientific data visualization. arXiv preprint arXiv:2101.03196, 2021.

7. Avani Sharma, Benjamin Smarr, and Bei Wang. A topology-based visual exploration of core body temperature data for pregnant and jet-lagged mice. Manuscript, 2021.

8. Jordan A. Berg, Youjia Zhou, T. Cameron Waller, Yeyun Ouyang, Sara M. Nowinski, Tyler Van Ry, Ian George, James E. Cox, Bei Wang, and Jared Rutter. Gazing into the Metabo-verse: Automated exploration and contextualization of metabolic data. bioRxiv preprint bioRxiv:10.1101/2020.06.25.171850, 2020.

9. Ilkin Safarli, Youjia Zhou, and Bei Wang. Interpreting graph drawing with multi-agent reinforcement learning. arXiv preprint arXiv:2011.00748, 2020.

10. Ellen Gasparovic, Elizabeth Munch, Steve Oudot, Katharine Turner, Bei Wang, and Yusu Wang. Intrinsic interleaving distance for merge trees. arXiv preprint arXiv:1908.00063, 2019.

11. <u>Youjia Zhou</u>, Janis Lazovskis, Michael J. Catanzaro, Matthew Zabka, and Bei Wang. MVF Designer: Design and visualization of Morse vector fields. arXiv preprint arXiv:1912.09580, 2019.

12. Mustafa Hajij, Bei Wang, and Paul Rosen. Mapper on graphs for network visualization. arXiv preprint arXiv:1804.11242, 2018.

# Selected Funded Projects

Total funding: $11,465,372
Total Utah funding: $7,120,152
My share of funding since joining Utah: **$5,998,220**
My share of funding since tenure-track (2016): **$5,729,403**

## External Projects

1. ***NSF** CAREER: A Measure Theoretic Framework for Topology-Based Visualization*
   NSF 2145499 (Jun. 2022 - May 2027)
   Role: **single PI**
   Total: $599,369; Utah share: $599,369; My share: **$599,369**.

2. ***NSF** Collaborative Research: Collaborative Research: SCH: Geometry and Topology for Interpretable and Reliable Deep Learning in Medical Imaging*
   NSF 2205418 (Sep. 2022 - Aug. 2026)
   Role: **PI**
   Total: $1,193,094; Utah share: $570,102; My share: **$570,102**.

3. ***DOE** Implicit Continuous Representations for Visualization of Complex Data*
   DOE DE-SC0023157. (Sep. 2022 - Aug. 2025)
   Role: **PI**
   Total: $2,700,000; Utah share: $450,000; My share: **$450,000**.

4. ***PNNL**: Integrating Visual Analytics and Topological Data Analysis with DDP Workflow for Interpretability*
   PNNL (Pacific Northwest National Laboratory) Subcontract. (Mar. 2022 - Sep. 2022)
   Role: **PI**.
   Total: $26,990; Utah share: $26,990; My share: **$26,990**.

5. ***Utah Commissioner of Higher Education (USHE)**: Bringing Fairness in AI to the Forefront of Education* (Nov. 2021 - Oct. 2024)
   Role: **PI**
   Total: $343,483; Utah share: $343,483; My share: **$217,819**.

6. ***NSF** Collaborative Research: SCALE MoDL: Advancing Theoretical Minimax Deep Learning: Optimization, Resilience, and Interpretability*
   NSF 2134223 (Sep. 2021 - Aug. 2024)
   Role: **Co-PI**
   Total: $850,000; Utah share: $576,113; My share: **$291,259**.

7. ***DOE** Early Career Research Program (ECRP): Topology-Preserving Data Sketching for Scientific Visualization*
   DOE DE-SC0021015. (Sep. 2020 - Aug. 2025)

Role: **single PI**
Total: $832,466; Utah share: $832,466; My share: **$832,466**.

8. **PNNL**: *Topological Analysis of Machine Learning Model Activations for Interpretability*
PNNL (Pacific Northwest National Laboratory) Subcontract 562880. (Apr. 2021 - Oct. 2021)
Role: **PI** for Utah.
Total: $65,865; Utah share: $65,865; My share: **$65,865**.

9. **NSF** *III: Small: Visualizing Robust Features in Vector and Tensor Fields*
NSF IIS-1910733. (Sep. 2019 - Aug. 2022)
Role: **single PI**
Total: $515,812; Utah share: $515,812 ($499,812 & REU $16,000); My share: **$515,812**.

10. **NSF** *ABI: Collaborative Research: A Scalable Framework for Visual Exploration and Hypotheses Extraction of Phenomics Data Using Topological Analytics.* (Aug. 2017 - Jul. 2021)
Role: **PI** for Utah.
Total: $1,249,561; Utah share: $288,131; My share: **$288,131**.

11. **Carnegie Science**: *Extracting the Full Information Content of Astrophysical Data Cubes.*
Carnegie Institution for Science Venture Grant. (May 2018 - June 2021)
Role: **PI** for Utah.
Total: $90,569; Utah share: $90,569; My share: **$90,569**.

12. **Industrial research collaboration** *with ArchiFiction Inc.*
ArchiFiction Inc. (Sep. 2018 - May. 2019)
Role: **single PI**.
Total: $62,953; Utah share: $62,953; My share: **$62,953**.

13. **NIH** *R01: Beyond Diagnostic Classification of Autism.*
NIH 1R01EB022876-01. (Oct. 2016 - Jun. 2020)
Role: **PI** for Y3-Y4. PI for Y1-Y2: Tom Fletcher.
Total: $1,137,500; Utah share: $1,137,500; My share: **$743,549**.

14. **NSF** *III: Medium: Collaborative Research: Topological Data Analysis for Large Network Visualization.*
NSF IIS-1513616. (Sep. 2015 - Aug. 2020)
Role: **PI**.
Total: $1,030,000; Utah share: $793,089 ($761,067 & REU: $16,302, $15,720); My share: **$793,089**.

15. **NRAO-NSF** *Feature Extraction and Visualization of ALMA Data Cubes through Topological Data Analysis.*
National Radio Astronomy Observatory (NRAO): NSF subcontract. (Feb. 2016 - Feb. 2017)
Role: **PI** for Utah.
Total: $185,133; Utah share: $185,133; My share: **$181,430**.

16. **INL** *(DOD Battelle Energy Alliance): Reliability Analysis Using Topological Decomposition.*
Idaho National Lab (INL) LDRD Project, INL contract No. 00158804 . (Jun. 2015 - Sep. 2015)
Role: **Co-PI**. Total: $100,076; Utah share: $100,076; My share: **$34,448**.

17. **INL** *Exploratory Nuclear Reactor Safety Analysis and Visualization via Integrated Topological and Geometric Techniques.*
Idaho National Lab (INL) LDRD Project, INL contract No. 00115847. (Sep. 2011- Aug.

2013)
Role: **Senior Personnel** (Postdoc at the time of proposal submission), PI: Diego Mandelli
(INL).
Total: $482,501; Utah share: $482,501; My share: **$234,369**.

## Internal Projects

- ***SEED2SOIL****: Telematic Data for Fleet Vehicles, A Data-Driven Solution Towards Optimal Fleet Management and Clean Vehicle Adoption.*
  Univ. of Utah SEED2SOIL Spring 2022 Research Grant. (August 1, 2022 - July 31, 2023)
  Role: **Co-PI**.
  Total: $88,436.
- ***CORI****: Network-aware databases and statistical methods for metabolic data analysis.*
  Computational Oncology Research Initiative (CORI) seed-grant. (May, 2021 - April, 2022)
  Role: **Co-PI**.
  Total: $30,000.
- ***CORI****: Sustaining Biodiversity: Combine Machine Learning with Molecular Networking in Drug and Natural Product Discovery.*
  NEXUS Pilot Funding. (Aug., 2020 - July, 2021)
  Role: **Co-PI**.
  Total: $12,500.

## Travel/Service Proposals

- ***NSF*** *IIS: Student Travel Support for the Doctoral Colloquium at 2020 IEEE Visualization Conference* (Apr. 2020- Mar. 2022)
  Role: **PI**.
  The grant provides travel support for the Doctoral Colloquium at IEEE Visualization Conference 2020, which is a mentoring forum for young visualization researchers.
  Award total: **$25,000**.
- ***MSRI*** *Summer Research for Women in Mathematics (SWiM)*
  Mathematical Sciences Research Institute (summer, 2021).
  Role: **Investigator**.
  The grant allowed a small group of six mathematicians and computer scientists to spend two weeks working on research problems at MSRI.
- ***AIM*** *SQuaREs grant: Persistence-Based Topological Summaries of Metric Graphs.* (Aug. 2017 - Aug. 2019)
  American Institute of Mathematics (AIM), Structured Quartet Research Ensembles (SQuaREs).
  Role: **Investigator**.
  The grant allowed a small group of seven mathematicians and computer scientists to spend one week a year for three years working on research problems at AIM in San Jose, California.
- ***NSF****: Student Travel Grant: International Workshop on Topological Data Analysis in Biomedicine, Seattle, October 2, 2016*
  Role: **Proposal writing/unofficial Co-PI**, workshop co-organizer.
  The grant provided travel support for students to attend a workshop on Topological Data

Analysis at the 7th ACM-BCB.
Award total: **$8,000**.

# Teaching at the University of Utah

Highlight: one of the **Dean of College of Engineering top instructors**, Spring 2018.

- Spring 2023: CS 3960 Algorithm Fairness in Machine Learning (undergraduate)
- Fall 2022: CS 2100 Discrete Structures (undergraduate)
- Spring 2022: COMP 5360 / MATH 4100 - Introduction to Data Science (undergraduate)
- Fall 2021: CS 6965 Advanced Data Visualization (graduate).
- Spring 2021: CS 6170 Computational Topology (graduate).
- Fall 2020: CS 2100 Discrete Structures (undergraduate).
- Spring 2020: CS 2100 Discrete Structures (undergraduate).
- Fall 2019: CS 6965 Advanced Data Visualization (graduate).
- Spring 2019: CS 6170 Computational Topology (graduate).
- Fall 2018: teaching release.
- Spring 2018: CS 6965 Advanced Data Visualization (graduate).
- Fall 2017: CS 2100 Discrete Structures (undergraduate).
- Fall 2017: CS 7941 Data Group Seminar (graduate).
- Spring 2017: CS 6170 Computational Topology (graduate).
- Fall 2016: CS 6210 Advanced Scientific Computing I (graduate).
- Fall 2016: CS 7941 Advanced Seminar (graduate).
- Spring 2016: CS 1060 Explorations in Computer Science (undergraduate).
- Spring 2016: CS 4960 Introduction to Computational Geometry (undergraduate).
- Fall 2015: CS 6210 Advanced Scientific Computing I (graduate).
- Spring 2011: Co-Instructor CS 6967 Computational Topology with Applications (graduate).

# Students[2]

**Student Awards**
- Nithin Chalapathi: Finalist, Computing Research Association (CRA) Outstanding Undergraduate Researcher Awards, 2021.
- Adam Brown: ISTplus Postdoctoral Fellowship Awardee from IST Austria, 2019-2021.
- Yiliang Shi: Honorable Mention, CRA Outstanding Undergraduate Researcher Awards, 2018.
- Keri Anderson: School of Computing Outstanding Graduating Senior Award at the University of Utah, 2018.
- William Garnes: GEM fellowship from the National GEM Consortium, 2018.

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[2]ABD: All but dissertation. RA: Research assistant.

## Current Ph.D. Students

- Fangfei (Fei) Lan: CS Ph.D., Fall 2019 - present, expected graduation: Spring 2024.
- Mingzhe Li: CS Ph.D., Fall 2020 - present, expected graduation: Spring 2025.
- Xinyuan Yan: CS Ph.D., Fall 2021 - present, expected graduation: Spring 2026.
- Weiran (Nancy) Lyu: CS Ph.D., Fall 2021 - present, expected graduation: Spring 2026.
- Zhichao Xu: CS Ph.D., Fall 2020 - present, expected graduation: Spring 2024. Co-advised with Vivek Srikumar.
- Peter Jacobs: CS Ph.D., Spring 2023 - present, expected graduation: Spring 2025. Co-advised with Jeff Phillips.
- Syed Ahmed: CS Ph.D., Spring 2023. Rotation.
- Guanqun Ma: CS Ph.D., Spring 2023. Rotation.

## Current MS Student

- Gabrielius (Gabe) Aleksandras Kudirka: CS MS RA, Fall 2022 - Spring 2023, expected graduation: Spring 2023.

## Current Undergraduate Students

- Carson Storm: CS Undergraduate RA, Spring 2023, expected graduation: Spring 2023.
- Austin Yang Li: CS Undergraduate RA, Fall 2022 - Spring 2023, expected graduation: Spring 2025.

## Former Ph.D. Students

- Youjia Zhou: CS Ph.D., graduated Spring 2023.
- Archit Rathore: CS Ph.D., defended Summer 2022, first job @ Stripe, Inc.
- Lin Yan: CS Ph.D., graduated Spring 2022, postdoc @ Argonne National Laboratory.
- Sourabh Palande: CS Ph.D., graduated Fall 2020, postdoc @ Michigan State.
- Adam Brown (informally advising): Math Ph.D., graduated Spring 2019, postdoc @ IST Austria and University of Oxford.

## Current and Former MS Students

- Ilkin Safarli: CS MS Project, graduated Summer 2021.
- Michael Young: CS MS RA, graduated Spring 2021, work @ Built For Teams.
- Yulong Liang: CS MS Thesis, graduated Spring 2019, first job @ Microsoft.
- Avani Sharma: CS MS Thesis, graduated Spring 2018, first job @ Goldman Sachs.
- Yixuan (Eric) Wang: ECE/CS MS Project, graduated Spring 2017, now @ Amazon.
- Yaodong Zhao: CS MS RA, graduated Spring 2019, first job @ LeanTaaS.

## Former Undergraduate Students

- Yi (Ama) Gan: CS Undergraduate RA, Fall 2022 - Spring 2023.
- Nithin Chalapathi: CS Undergraduate Thesis, graduated Spring 2021, graduate school @ University of California, Berkeley.
- Yiliang Shi: CS Undergraduate Thesis, graduated Spring 2018, graduate school @ Columbia University.
- Keri Anderson: CS Undergraduate Thesis, graduated Spring 2018.
- William Garnes: CS Undergraduate REU, graduated Spring 2018, graduate school @ Clemson University.

## Ph.D./MS Committee

### Current Students

- Benwei Shi: CS Ph.D., Advisor: Jeff Phillips.
- Mingxuan Han: CS Ph.D., Advisor: Jeff Phillips.
- Hasan Pourmahmoodaghababa: CS Ph.D., Advisor: Jeff Phillips.
- Prince Aboagye: CS Ph.D., Advisor: Jeff Phillips.
- Shibo Li: CS Ph.D., Advisor: Shandian Zhe.
- Shikan Fang: CS Ph.D., Advisor: Mike Kirby and Shandian Zhe.
- Madison Cooley: CS Ph.D., Advisor: Mike Kirby and Shandian Zhe.
- Samuel Levental:CS Ph.D., Advisor: Valerio Pascucci.
- Benjamin Gibson: Physics and Astronomy, Ph.D., advisor: Gail Zasowski.

### Former Students

- Pavol Klacansky: CS Ph.D., defended Spring 2022.
- Jordan Washington: CS MS project, graduated fall 2022.
- Petra Poklukar: KTH Royal Institute of Technology, Sweden, graduated summer 2022.
- Saradha Rajamani: CS MS thesis, graduated spring 2022.
- Chiara Marie Hergl: Dipl-Math., Leipzig University, Germany, Dissertation Review Committee, graduated fall 2022.
- Jordan A. Berg: Biochemistry, Ph.D., graduated summer 2022.
- Saradha Rajamani: CS MS Thesis, graduated spring 2022.
- Kris Campbell: CS Ph.D., graduated December 2021.
- Torin McDonald: CS MS Project, graduated Summer 2021.
- Steven K. Kauwe: Material Science and Engineering, Ph.D., graduated Spring 2021.
- Sharvaree Vadgama: CS MS Project, graduated Spring 2020.
- Pingfan Tang: CS Ph.D., graduated Fall 2019.
- Dan Maljovec: CS Ph.D., graduate Spring 2019.
- Philip Shen: CS MS Project, graduated Spring 2019.
- Zahra Fahimfar: CS MS Thesis, graduated Spring 2018.

- Shusen Liu: CS Ph.D., graduated Fall 2016.
- Mustafa Youldash (external examiner of Ph.D. thesis): CS Ph.D., graduated Spring 2016, La Trobe University, Australia.

**Research Project Mentoring**
- Independent study/lab rotation: Milena Belianovich (CS Ph.D. Fall 2022), Xiaoya Tang (CS Ph.D. Fall 2022), Khawar Murad Ahmed (CS Ph.D., Spring 2022), Tripti Agarwal (CS Ph.D., Spring 2021), David Miller (CS Ph.D., Fall 2020), Paul Kristoffersen (CS Ph.D., Spring 2019), Adam Conkey (CS Ph.D., Spring 2017), Samuel Leventhal (CS Ph.D., Spring 2016), Soumya S. Mishra (CS MS, Fall 2014).
- RA: Michael Young (CS MS, Spring 2020); Sravan Neerati (CS MS, Fall 2017); Chetal Patil (CS MS, Fall 2017); Tim Sodergren (CS Ph.D., Fall 2016 - Summer 2017); Vipin Jose (CS MS, Spring 2017).
- Undergraduate REU: Matt Howa (Undergraduate REU, Spring 2017).
- Project mentoring as a Research Computer Scientist (2011-2016): Brian Summa (CS Ph.D.), Harsh Bhatia (CS Ph.D.), Yan Zheng (CS Ph.D.), Hoa Nguyen (CS Ph.D.), Wathsala Widanaga-maachchi (CS Ph.D.), Liang He (CS MS).

# Selected Invited Talks

1. **Keynote**: TDA week, Japan, July 21 - August 4, 2023 (upcoming).
2. Colorado State University Topology Seminar, April 18, 2023.
3. Northeastern Topology Seminar, April 11, 2023.
4. Institute for Mathematical and Statistical Innovation (IMSI), Randomness in Topology and its Applications workshop, March 21, 2023.
5. **Keynote**: Machine Learning on Higher-Order Structured data (ML-HOS) Workshop at ICDM 2022. Hypergraph Co-Optimal Transport, November 28, 2022.
6. Dagstuhl Seminar on Set Visualization and Uncertainty, Germany. Visualizing Hypergraphs With Connections to Uncertainty Visualization. November 13-18, 2022.
7. Stochastic Seminar, Department of Mathematics, University of Utah, November 4, 2022.
8. Mini Symposium on Statistics and Machine Learning in Topological and Geometric Data Analysis at SIAM Conference on Mathematics of Data Science (MDS22), September 29, 2022.
9. Department of Energy Computer Graphics Forum, August 30, 2022.
10. Utah Center for Data Science (UCDS) Data Science Seminar, August 24, 2022.
11. Applied Topology in Frontier Sciences. Applied, Combinatorial and Toric Topology. Institute for Mathematical Sciences, Singapore, July 18 to 22, 2022.
12. Spring Western AMS Sectional Meeting, special session on Computational Topology and Applications, May 14-15, 2022.
13. Women in Data Science Ames Regional Event at the Iowa State University, April 21, 2022.
14. University of Iowa Mathematical Biology Seminar, April 18, 2022.

15. Colloquium Talk at Department of Computational Mathematics, Science, and Engineering (CMSE), Michigan State University, April 4, 2022.

16. Joint Mathematics Meetings AMS Special Session on Combinatorial Approaches to Topological Structures and Applications, April 9, 2022.

17. Joint Mathematics Meetings AWS Special Session on Women in Computational Topology, April 9, 2022.

18. Visualization Seminar at the University of Utah, March 23, 2022.

19. Workshop on Algebraic Combinatorics and Category Theory in Topological Data Analysis, March 12, 2022.

20. Institute for Mathematical and Statistical Innovation (IMSI), the Mathematics of Soft Matter Structure and Dynamics workshop, February 28, 2022.

21. TDA Week, Japan, February 18, 2022.

22. **Distinguished Seminar Speaker** SIAM Pacific Northwest (PNW) Distinguished Seminar, February 15, 2022.

23. Computational Persistence Workshop, November 3, 2021.

24. Seminar GEOTOP-A: Applications of geometry and topology, August 20, 2021.

25. ILJU Pohang University of Science Technology (POSTECH) Mathematical Institute for Data Science (MINDS) Workshop on Topological Data Analysis and Machine Learning, South Korea, July 7, 2021.

26. SIAM Conference on Applications of Dynamical Systems (DS21), Mini-symposium on Topological Signal Processing, May 26, 2021.

27. MSRI (Mathematical Sciences Research Institute) Hot Topics: Topological Insights In Neuroscience, May 2021.

28. Applied Algebraic Topology Research Network (AATRN) Vietoris-Rips Seminar, May 2021.

29. Geometry-Topology Seminar, Oregon State University, May 24, 2021.

30. Computational Mathematics, Science and Engineering (CMSE) Colloquiums, Michigan State University, April . 2021.

31. Meldrum Science Seminar Series, Westminster College, April . 2021.

32. CAM Colloquium, Committee on Computational and Applied Mathematics (CCAM), University of Chicago, Mar., 2021.

33. Pacific Northwest National Laboratory (PNNL) Mathematics for Artificial Reasoning in Science (MARS) Seminar Series, Jan. 2021.

34. Joint Mathematics Meetings (JMM) AMS Special Session on Combinatorial Approaches to Topological Structures, Jan. 2021.

35. Applied Topology Seminar at Swiss Federal Institute of Technology Lausanne (EPFL), Nov. 2020.

36. Machine Learning Seminar at Florida State University, Oct. 2020.

37. High-Performance Computing (HPC) China Seminar, Sep. 2020.

38. MBI Optimal Transport Workshop: Optimal Transport, Topological Data Analysis and Applications to Shape and Machine Learning, Jul., 2020.

39. GAMES: Graphics And Mixed Environment Seminar, Jul., 2020.

40. Applied Algebraic Topology Research Network, May, 2020.

41. Joint Mathematics Meetings (JMM) Special Session on Applied Topology, Jan. 2020.

42. American Mathematical Society (AMS) Sectional Meeting at University of Florida in Gainesville FL, Nov. 2019.

43. Dagstuhl seminar: Topology, Computation and Data Analysis, May 2019.

44. JMM AMS-AWM Special Session on Women in Applied and Computational Topology, Jan., 2019.

45. VISA Research, Dec., 2018.

46. Dagstuhl seminar: Visualization and Processing of Anisotropy in Imaging, Geometry, and Astronomy, Nov. 2018.

47. ICERM TRIPODS Summer Bootcamp: Topology and Machine Learning, Aug. 2018.

48. CG Week 3rd Workshop on Geometry and Machine Learning, Jun. 2018.

49. IMA Workshop Bridging Statistics and Sheaves, May 2018.

50. NII Shonan Meeting Seminar 122 Analyzing Large Collections of Time Series, Feb. 2018.

51. Discrete Math Seminar Talk, University of South Florida, Oct. 2017.

52. Math Department Colloquium, University of South Florida, Oct. 2017.

53. Topology Seminar Talk, University of Florida, Oct. 2017.

54. Interdisciplinary Data Science Consortium, University of South Florida, Oct. 2017.

55. BIRS Workshop: Topological Data Analysis: Developing Abstract Foundations, Jul. 2017.

56. Dagstuhl seminar: Computational Geometry, April . 2017.

57. BIRS Workshop: Topological Methods in Brain Network Analysis, May. 2017.

58. Topological Data Analysis and Related Topics (TDART), AIMR Tohoku University Advanced Institute for Materials Research, Feb. 2017.

59. Excellence Center at Linköping - Lund on Information Technology (ELLIIT) distinguished lecture, Linköping University, Sweden, May. 2016.

60. Topology, Geometry, and Data Analysis Conference at Ohio State University, May. 2016.

61. Pacific Northwest National Laboratory, 2015.

62. SAMSI workshop on Topological Data Analysis, research program on Low Dimensional Structure in High Dimensional Systems, 2014.

63. Computer Science Department, Ohio State University, 2014.

64. Computer Science Department Colloquium, University of Connecticut, 2013.

65. Colloquium Series in School of Engineering, University of Bridgeport, 2013.

66. IMA Workshop on Modern Applications of Homology and Cohomology, 2013.

67. PSA Technical Workshop on Topological Data Analysis and Visualization for Large-Scale and High-Dimensional Science Discovery (Organizer and Speaker), 2013.

68. SIAM Conference on Applied Algebraic Geometry (AG), Mini-symposium on Applied and Computational Topology, 2013.

69. AMS-MAA Joint Mathematics Meeting (JMM), special session on Computational and Applied Topology, 2012.

70. Theory Lunch, School of Computer Science, Carnegie Mellon University, 2012.

71. Applied Math Seminar, Department of mathematics, University of Utah, 2012.
72. Yaroslavl International Conference Discrete Geometry Dedicated to Centenary of A.D.Alexandrov, Russia, 2012.
73. Summer school of the Delaunay Laboratory, Russia, 2012.
74. ACM Symposium on Computational Geometry (SOCG) Workshop on Computational Topology, 2012.
75. Fields Institute for Research in Mathematical Sciences, Thematic Program on Discrete Geometry and Applications, Workshop on Computational Topology, 2011.

# Internal Service

CoE: College of Engineering. SoC: School of Computing.

## Current Roles
1. SoC Associate Director of Graduate Studies (July 2021 - present, 2 Years).
2. Associate Director of Outreach, Utah Center for Data Science (2019 - present, 3 Years): approval of UCDS center members, organize Utah Data Science Day.
3. Computational Linguistics Hiring Committee. Fall 2022-Spring 2023. Review applications for Department of Linguistics, College of Humanities.

## Past Roles
1. SoC/SCI visualization faculty hiring committee, Spring 2022.
2. Chair: SoC Undergraduate Scholarship Committee (2020 - 2021, 1 Year). Review 100+ scholarship applications for SoC and CoE.
3. SoC Diversity Committee (2019 - present, 2 Years): Organization committee for Utah NCWIT Award for Aspirations in Computing (2019-2021, 2 Years).
4. CoE Academic Misconduct Committee (2018 - present, 3 Years).
5. SoC Faculty Hiring Committee, All Areas (2021, 1 Year).
6. SoC Scholarship Committee Member (2017 - 2020, 3 Years).
7. SoC Graduate Admissions Committee (2016 - 2020, 4 Years).
8. Electrical and Computer Engineering (ECE) Faculty Recruiting Committee (AI/ML/Data Science) (2019-2020, 1 Year).
9. Organizer, Utah and West Coast Joint Party at IEEE VIS Conference (SoC and SCI Institute), 2017 (1 Year).

# External Service

## Editor
- Review Editor on the Editorial Board of Computer Graphics and Visualization (specialty section of Frontiers in Computer Science), 2021 - present.
- Editor of a special issue of the Journal of Computational Geometry (JoCG), 2019-2021.

- Editor of Report from Dagstuhl Seminar: Topology, Computation and Data Analysis (Dagstuhl Seminar 19212), 2019.
- Editor of Report from Dagstuhl Seminar: Topology, Computation and Data Analysis (Dagstuhl Seminar 17292), 2018.

## Chair and Paper Chair

- Paper Chair: EuroVis 2023 Short Paper.
- Chair: Topology in Visualization (TopoInVis) Steering Committee (2021-2023, 2 Years).
- Chair: IEEE VIS 2020 and 2021 Doctoral Colloquium Chairs (2019-2021, 2 Years).
- Paper Chair: EuroVis 2020 and 2021 STARs (State-of-the-art reports, 2020-2021, 2 Years).

## Program Committees

1. IEEE Visualization Conference (VIS), 2017, 2018, 2019, 2023.
2. EG/VGTC Conference on Visualization (EuroVis), 2017, 2018, 2022, 2023.
3. Eurographics Symposium on Parallel Graphics and Visualization (EGPGV), 2022.
4. SIAM Symposium on Algorithm Engineering and Experiments (ALENEX), 2022.
5. 2nd Workshop on Energy Data Visualization at ACM e-Energy, 2021.
6. China Visualization and Visual Analytics Conference (ChinaVis), 2021.
7. 18th IEEE International Conference on Machine Learning and Applications (ICMLA), 2019.
8. Scientific Visualization & Data Analytics Showcase at Super Computing (SC), 2019.
9. International Symposium on Computational Geometry (SOCG), 2019.
10. Symposium on Visualization in Data Science (VDS) at IEEE VIS, 2017, 2018, 2019.
11. IEEE Symposium on Large Data Analysis and Visualization (LDAV), 2016, 2017.
12. Spring Conference on Computer Graphics (SCCG), 2017.
13. High-Performance Computing (HPC) China, Scientific Visualization, 2016.
14. Topology-Based Methods in Visualization (TopoInVis), 2015, 2017, 2019.
15. Grace Hopper Conference Gaming/Graphics/Animation (GFX) track committee, 2016.
16. EG/VGTC Conference on Visualization (EuroVis), Short Paper Track, 2016.

## Other Organizational Committees

- EuroVis 2023 Ombuds Committee.
- Jury: Eurographics Medical Prize 2023.
- VGTC Visualization Dissertation award 2023.

## Workshop/Tutorial/Panel

1. Workshop organizer: Dagstuhl seminar: Topology, Computation and Data Analysis, May 8-12, 2023 (upcoming).
2. Tutorial organizer: Topological Analysis of Ensemble Scalar Data with TTK at IEEE Visualization Conference (VIS), October 17, 2022.
3. Workshop organizer: Topological Data Visualizaton Workshop, May, 2022.

4. AWM Research Symposium Special Session on Topological Data analysis, June, 2022.

5. Tutorial organizer: Topological Analysis of Ensemble Scalar Data with TTK at IEEE Visualization Conference (VIS), 2021.

6. Workshop organizer: A Visual Tour of Bias Mitigation Techniques for Word Representations at KDD, 2021.

7. Workshop organizer: Geometric and Topological Methods in Biomedical Image Analysis, co-located with International Symposium on Computational Geometry, 2021.

8. Workshop organizer: A Visual Tour of Bias Mitigation Techniques for Word Representations at AAAI Tutorial Forum, 2021.

9. Panelist: Why should I stay in Academia? Bridging Generations of Researchers in Visualization at IEEE VIS, 2020.

10. Workshop organizer: Visualization in Astrophysics: Developing New Methods, Discovering Our Universe, Educating the Earth at IEEE VIS, 2020.

11. Workshop organizer: Application Spotlights: Challenges in the Visualization of Bioelectric Fields for Cardiac and Neural Research at IEEE VIS, 2020.

12. Workshop organizer: Visualization in Astrophysics: Carnegie + SCI Mini-Workshop at SCI, 2020.

13. Workshop organizer: 8th Annual Mini-Symposium on Computational Topology, co-located with International Symposium on Computational Geometry, 2019.

14. Workshop organizer: Dagstuhl seminar: Topology, Computation and Data Analysis, 2019.

15. Workshop organizer: Dagstuhl seminar: Topology, Computation and Data Analysis, 2017.

16. Workshop organizer: 6th Annual Mini-Symposium on Computational Topology, co-located with International Symposium on Computational Geometry, 2017.

17. Workshop organizer and speaker: Topological Data Analysis in Biomedicine at the 7th ACM Conference on Bioinformatics, Computational Biology, and Health Informatics (ACM-BCB), 2016.

18. Tutorial organizer and speaker: Recent Advancements of Feature-based Flow Visualization and Analysis at IEEE Visualization Conference (VIS), 2016.

19. Tutorial organizer and speaker: Topological Data Analysis and Visualization for Large-Scale and High-Dimensional Science Discovery. International Topical Meeting on Probabilistic Safety Assessment and Analysis (PSA), 2013.

## Proposal Panelist
- Four NSF review panels since 2016.
- One NIH review panel since 2020.
- One DOE review panel since 2022.
- Two grant reviews for DOE since 2020.

## Journal/Conference Referee
- Journals: Nature Communications, Parallel Computing, IEEE Transactions on Parallel and Distributed Systems (TPDS), Journal of Applied and Computational Topology (APCT),

Transactions on Medical Imaging (TMI), Discrete & Computational Geometry (DCG), Computational Geometry Theory and Applications (CGTA), International Journal of Computational Geometry & Applications (IJCGA), Journal of Computational Geometry (JoCG), IEEE/ACM Transactions on Computational Biology and Bioinformatics (TCBB), IEEE Transactions on Visualization and Computer Graphics (TVCG), Applied and Numerical Harmonic Analysis Series (Birkhauser/Springer), etc.

- Conferences: IEEE Symposium on Foundations of Computer Science (FOCS), AMS Short Course in Joint Math Meetings (JMM), ACM Symposium on Theory of Computing (STOC), ACM-SIAM Symposium on Discrete Algorithms (SODA), (ACM) Symposium on Computational Geometry (SOCG), European Symposium on Algorithms (ESA), SIAM Algorithm Engineering and Experiments (ALENEX), IEEE Conference on Visualization (VIS), Eurographics Conference on Visualization (EuroVis), Topology-Based Methods in Visualization (TopoInVis), IEEE Symposium on Large Data Analysis and Visualization (LDAV), High-Performance Computing (HPC) China, etc.

## Community Engagement

- Lecturer/Module Designer at Hi-GEAR (Girls Engineering Abilities Realized) Camp, 2016, 2018-2022. Hi-GEAR is part of Engineering Summer Camps at the Univ. of Utah. It is designed to expose young women (currently in 9th-12th grade) to a variety of engineering and computer science careers with hands-on experiential learning and collaborative team projects.
- Invited Speaker at HackTheU, Oct. 2017. HackTheU is Utah's largest hackathon where students from across the state and nation develop their solutions to the various prompts through augmented reality, virtual reality, IoT, and many other kinds of applications.
- Invited speaker at the Future in Review (FiRe) Conference, 2017. The FiRe conference exposes world experts and participants to new ideas in a manner that produces an accurate portrait of the future in technology, including the global economy, cloud computing, biology and medical diagnostics, policy, netbooks, space travel, sustainability, and other fields that contribute to technology outcomes.