Christopher J. Tralie

• Contributions since starting at Ursinus

Research Interests

Geometric signal processing, music information retrieval, applied topology, nonlinear time series analysis, video processing, computer graphics

Academic Positions

- 1/1/2025 Associate Professor of Mathematics And Computer Science (with tenure), Ursinus Present College. Collegeville, Pennsylvania.
- 8/1/2019 Assistant Professor of Mathematics And Computer Science, Ursinus College. Col-12/31/2024 legeville, Pennsylvania.
 - 1/2019 **Postdoctoral Fellow, Department of Chemical And Biomedical Engineering**, *Johns* 6/2019 *Hopkins University. Baltimore, Maryland.*
 - 4/2017 Postdoctoral Associate, Department of Mathematics, Duke University. Durham,
 - 12/2018 North Carolina.

Education

2011 - 2017 Ph.D., Duke University, Durham, NC, Electrical and Computer Engineering with Certificate in College Teaching.
Advisers: Guillermo Sapiro, John Harer

Dissertation Title: "Geometric Multimedia Time Series"

- 2011 2013 M.S., Duke University, Durham, NC, Electrical and Computer Engineering.
- 2007 2011 **B.S.E.**, *Princeton University*, Princeton, NJ, *Electrical Engineering with Certificate in Computer Science* (Cum Laude).

Honors and Awards

- 2022 Voted "faculty of the month" by students at Ursinus College
- 2018 Deezer Hacking Audio And Music Research (HAMR) Best Code Award, Paris, France
- 2016 Top 5% Teachers At Duke: Dean's award for ranking among top 5% (university wide) in student evaluations for *Quality of Course or Intellectual Stimulation*, Duke University, Spring 2016
- 2015 Duke University Department of Electrical Engineering Best Poster Award
- 2015 Duke University Bass Family Teaching Fellowship
- 2011 National Science Foundation Graduate Fellowship
- 2011 G. David Forney Jr. Prize in Signals and Systems at Princeton University
- 2009 Summer Undergraduate Fellowship in Robotics at Duke University: Awarded through the National Science Foundation's Research Experience for Undergraduates (REU) Program
- 2007 Lockheed Martin National Merit Scholar
- 2006 Pennsylvania Governor School for the Sciences, Carnegie Mellon University

Publications

(*) Denotes undergraduate co-author

Journal Publications

Paul Bendich, Ellen Gasparovic, John Harer, and Christopher J. Tralie. Scaffoldings and spines: Organizing high-dimensional data using cover trees, local principal component analysis, and persistent homology. *Research in Computational Topology*, 13, 2018.

Anh Phong Tran, Christopher J Tralie, José Reyes, Caroline Moosmüller, Zehor Belkhatir, Ioannis G Kevrekidis, Arnold J Levine, Joseph O Deasy, and Allen R Tannenbaum. Long-term p21 and p53 dynamics regulate the frequency of mitosis events and cell cycle arrest following radiation damage. *Cell Death & Differentiation*, pages 1–13, 2022.

Furkan Yesiler, Guillaume Doras, Rachel M Bittner, Christopher J Tralie, and Joan Serrà. Audiobased musical version identification: Elements and challenges. *IEEE Signal Processing Magazine*, 38(6):115–136, 2021.

Christopher J Tralie. Self-similarity based time warping. *arXiv preprint arXiv:1711.07513 (In Submission).*

Christopher J. Tralie and Jose A. Perea. (quasi)periodicity quantification in video data, using topology. *SIAM Journal on Imaging Sciences*, 11(2):1049–1077, 2018.

Boyan Xu(*), Christopher J. Tralie, Alice Antia(*), Michael Lin(*), and Jose A. Perea. Twisty takens: A geometric characterization of good observations on dense trajectories. *Journal of Applied And Computational Topology (JACT)*, 2019.

Published Refereed Conference Proceedings

Caroline Moosmüller, Christopher. J Tralie, Mahdi Kooshkbaghi, Zehor Belkhatir, Maryam Pouryahya, Jose Reyes, Joseph O Deasy, Allen R Tannenbaum, and Ioannis G Kevrekidis. Periodicity scoring of time series encodes dynamical behavior of the tumor suppressor p53. In *Proceedings of The 24th International Symposium on Mathematical Theory of Networks and Systems (MTNS 2020)*, 2021.

Francis Motta and Christopher J. Tralie. Hyperparameter optimization of topological features for machine learning applications. In *Proceedings of the 18th IEE International Conference on Machine Learning Applications (ICMLA 2019): 2019 Dec 16-18; Boca Raton, Florida, USA*, 2019.

Christopher J Tralie. Artistic curve steganography carried by musical audio. In *International Conference on Computational Intelligence in Music, Sound, Art and Design (Part of EvoStar)*, pages 276–291. Springer, 2023.

Christopher J. Tralie and Ben Cantil. The concatenator: A bayesian approach to real time concatenative musaicing. In *Proceedings of the 25th Conference of the International Society for Music Information Retrieval (ISMIR 2024) (To Appear)*. International Society for Music Information Retrieval (ISMIR), 2024.

Christopher J. Tralie and Elizabeth Dempsey(*). Exact, parallelizable dynamic time warping alignment with linear memory. In *Proceedings of the 21st Conference of the International Society for Music Information Retrieval (ISMIR 2020)*. International Society for Music Information Retrieval (ISMIR), 2020.

Anh Phong Tran, Christopher J Tralie, José Reyes, Caroline Moosmüller, Zehor Belkhatir, Ioannis G Kevrekidis, Arnold J Levine, Joseph O Deasy, and Allen R Tannenbaum. Long-term p21 and p53 dynamics regulate the frequency of mitosis events and cell cycle arrest following radiation damage. *Cell Death & Differentiation*, pages 1–13, 2022.

Furkan Yesiler, Guillaume Doras, Rachel M Bittner, Christopher J Tralie, and Joan Serrà. Audiobased musical version identification: Elements and challenges. *IEEE Signal Processing Magazine*, 38(6):115–136, 2021. Travis Deyle, Christopher J Tralie, Matthew S Reynolds, and Charles C Kemp. In-hand radio frequency identification (rfid) for robotic manipulation. In *IEEE International Conference on Robotics and Automation (ICRA), Karusruhe, Germany*, pages 1234–1241. IEEE, 2013.

Christopher J Tralie. Early mfcc and hpcp fusion for robust cover song identification. In 18th International Society for Music Information Retrieval (ISMIR), Suzhou, China, 2017.

Christopher J Tralie. Cover song synthesis by analogy. In 19th International Society for Music Information Retrieval (ISMIR), Paris, France, 2018.

Christopher J Tralie and Paul Bendich. Cover song identification with timbral shape sequences. In *16th International Society for Music Information Retrieval (ISMIR), Malaga, Spain*, pages 38–44, 2015.

Christopher J Tralie, Paul Bendich, and John Harer. Multi-scale geometric summaries for similaritybased sensor fusion. In *The 40th IEEE Aerospace Conference, Big Sky, Montana*, 2019.

Christopher J Tralie and Matthew Berger. Topological eulerian synthesis of slow motion periodic videos. In *IEEE International Conference on Image Processing, Athens, Greece*, 2018.

Christopher J Tralie and Brian McFee. Enhanced hierarchical music structure annotations via feature level similarity fusion. In *ICASSP 2019-2019 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*, pages 201–205. IEEE, 2019.

Christopher J Tralie, Abraham Smith, Nathan Borggren, Jay Hineman, Paul Bendich, Peter Zulch, and John Harer. Geometric cross-modal comparison of heterogenous sensor data. In *Proceedings* of The 39th IEEE Aerospace Conference, Big Sky, Montana, 2018.

Furkan Yesiler, Chris Tralie, Albin Andrew Correya, Diego F Silva, Philip Tovstogan, Emilia Gómez Gutiérrez, and Xavier Serra. Da-tacos: A dataset for cover song identification and understanding. In *Proceedings of the 20th Conference of the International Society for Music Information Retrieval (ISMIR 2019): 2019 Nov 4-8; Delft, The Netherlands*. International Society for Music Information Retrieval (ISMIR), 2019.

Peer Reviewed Short Papers

Paul Bendich, Ellen Gasparovic, John Harer, and Christopher Tralie. Geometric models for musical audio data. In *Proceedings of the 32st International Symposium on Computational Geometry (SOCG), Boston, MA*, 2016.

Richard Berger(*), Vincent Ha(*), David Kratz(*), Michael Lin(*), Jeremy Moyer(*), and Christopher J Tralie. Godzilla onions: A skit and applet to explain euclidean half-plane fractional cascading (media exposition). In *39th International Symposium on Computational Geometry (SoCG 2023)*. Schloss Dagstuhl-Leibniz-Zentrum für Informatik, 2023.

Kacey Thien-Huu La(*), Jose E. Arbelo(*), and Christopher J Tralie. Visualizing lucas's hamiltonian paths through the associahedron 1-skeleton (media exposition). In 40th International Symposium on Computational Geometry (SoCG 2024). Schloss Dagstuhl-Leibniz-Zentrum für Informatik, 2024.

Jose A Perea, Luis Scoccola, and Christopher J Tralie. Dreimac: Dimensionality reduction with eilenberg-maclane coordinates. *Journal of Open Source Software*, 8(91):5791, 2023.

Christopher Tralie, Nathaniel Saul, and Rann Bar-On. Ripser.py: A lean persistent homology library for python. *The Journal of Open Source Software (JOSS)*, 2018.

Christopher J Tralie. High dimensional geometry of sliding window embeddings of periodic videos. In *Proceedings of the 32st International Symposium on Computational Geometry (SOCG), Boston, MA*, 2016.

Peer Reviewed Abstracts

Syed M. Adil, Pranav Warman, Andreas Seas, Tanner J. Zachem, Jihad Abdelgadir, Daniel Sexton, Benjamin Wissel, Jordan Komisarow, Steven Cook, Ralph A. Hachem, Peter Fecci, Shivanand Lad, Ali Zomorodi, David Hasan, Patrick J. Codd, Christopher J. Tralie, Timothy Dunn, Allan Friedman, Gerald Grant, Evan Calabrese, and Anoop Patel. 3d mri-based topological analysis with machine learning to predict skull base meningioma pathologic grade. *Journal of Neurological Surgery Part B: Skull Base*, 85:S160, 2024.

Christopher J Tralie. Modular virtual 3d cities assignment. ACM Special Interest Group on CS Education (SIGCSE) "Nifty Assignments" Track, Portland, Oregon, 2024.

Jose Perea and Christopher Tralie. Sliding windows and persistence. *The Journal of The Acoustical Society of America (JASA), Boston, MA*, 2017.

Christopher Tralie and Amanda Lazarus. A head of our times: Reimagining the heads in the brummer collection via real-time face mapping. *The Age of Sensing 5th International Conference on Remote Sensing in Archeaology, Durham, NC*, 2014.

Christopher J. Tralie, Goodwin S. Matthew, and Guillermo Sapiro. Automated detection of stereotypical motor movements in children with autism spectrum disorder using geometric feature fusion. *International Society for Autism Research (INSAR), Rotterdam, The Netherlands*, 2018.

Whitepapers / Not Peer Reviewed

Alexa Lewis(*) and Christopher J Tralie. Stipple tunes. In International Conference on Computational Intelligence in Music, Sound, Art and Design (Part of EvoStar): Late Breaking Demo Session. Springer, 2023.

Christopher J Tralie and Parker Fairchild(*). www.facejam.app: Facial expressions for musical expression. In 22nd International Society for Music Information Retrieval (ISMIR), Late Breaking Session, 2021.

Christopher J Tralie. Cover songs via sequences of local mfcc self-similarity matrices. In *Music Information Retrieval Evaluation Exchange (MIREX)*, 2015.

Christopher J Tralie. Cover song identification using similarity fusion of hpcps, mfccs, and mfcc ssms. In *Music Information Retrieval Evaluation Exchange (MIREX)*, 2017.

Christopher J Tralie. Graphditty: A software suite for geometric music structure visualization. In 19th International Society for Music Information Retrieval (ISMIR), Late Breaking Session, 2018.

Christopher J Tralie and John Harer. Moebius beats: The twisted spaces of sliding window audio novelty functions with rhythmic subdivisions. In *18th International Society for Music Information Retrieval (ISMIR), Late Breaking Session,* 2017.

Undergraduate Research Supervised

- 2024 Benjamin Douglas, Ian Utz, "Audio Watermarking" Spring 2024 Indpendent Study
- 2024 Kacey La, Jose Arbelo, "Visualizing Lucas's Hamiltonian Paths Through the Associahedron 1-Skeleton" Spring 2024 Indpendent Study
- 2023 Kacey La, "Maching Learning for Wireless-Based 3D Pose Identification," Ursinus Summer Fellows, Summer 2023 (joint with Bill Mongan)
- 2022 Sam Gregory, Kacey La. "Automated Identification of Bowhead Whales in Digital Images." Ursinus Summer Fellows, Summer 2022 (joint with Leslie New)
- 2022 Jose Arbelo, Tony Delgado, Charley Kirk (Juniata College), Zach Schlamowitz (Univeristy of Arizona). "Stable, Efficient, And Computable Metrics for Ordered Merge Trees." Ursinus MathCS NSF REU Summer 2022
- 2022 Will Gillette. "'A Data Driven Approach to Structure-Based Large Scale Audio Version Identification" Spring 2022 Indpendent Study
- 2022 Alexa Lewis. "Traveling Salesperson Tunes: A New Method for Image Musification" Spring 2022 Indpendent Study

- 2022 Seraiah Kutai. "Ursinus Smokestack 3D Annotation Interface in three.js." Spring 2022 Indpendent Study
- 2021-2022 Michael Tecce. "Augmented Reality for Counterpoint Education." Academic Year 2021 Independent Study.
 - 2021 Seraiah Kutai, Thomas Boccuto. "Amplification of Hidden Periodic Motions in 3D Videos." Fall 2021 Independent Study.
 - 2021 Seraiah Kutai, Thomas Boccuto, Samuel Kirk (Illinois State University), and Kristen Mosby (Spelman College). "Amplification of Hidden Periodic Motions in 3D Videos." Ursinus MathCS NSF REU Summer 2021
 - 2021 Seraiah Kutai. "Ursinus Smokestack 3D Annotation Interface in three.js." Spring 2021 Indpendent Study
 - 2021 Asberto (AJ) Alvero. "Web-Based Virtual Reality for Everyone." Spring 2021 Indpendent Study
 - 2020 Ronsard Malonda. "Statistical Machine Translation of Lingala Facile." Fall 2020 Indpendent Study
 - 2020 Michael Tecce. "Geometry Aided Sonification." Ursinus Summer Fellows, Summer 2020
 - 2020 Tom Mease. "Dimension Reduction with Eilenberg-MacClane Coordinates in Javascript." Spring 2020 Indpendent Study
 - 2020 Rachel Thornton. "Nonrigid Reconstruction of 3D Shapes." Spring 2020 Independent Study
 - 2019 Elizabeth Dempsey. "Parallel Dynamic Time Warping for Musical Audio Synchronization." Fall 2019 independent study.
 - 2019 Benjamin Klybor. "Self-Similarity Scattering Transforms for Large Scale Cover Song Identification." Fall 2019 independent study
 - 2019 Parker Fairchild. "A Javascript/WebGL Implementation of FaceJam." Fall 2019 independent study
- 2017-2018 Alice Antia (Math), Michael Lin (Math), Boyan Xu (Math). "Twisty takens: A geometric characterization of good observations on dense trajectories." Summer@ICERM research project (also journal paper).
- 2017-2018 Dev Dabke (CS/Math), Erin Taylor (CS/Math). "Geometric Approaches for Basketball Player Trajectory Analysis." Duke Math senior honors thesis / academic writing mentorship.
 - 2017 Biraj Pandey (Math), Tim Sudijno (Math). "Recurrence in Dynamic Networks." Summer@ICERM research project.
 - 2015 Marshall Ratliff (Math). "Introducing the Cover tree to Music Information Retrieval." Duke Math senior honors thesis.
 - 2014 Joy Patel (Math/CS). "Towards Automated Synapse Detection in Electron Microcopy Image." Semester long independent study
 - 2014 Julia Ni (Math), Joy Patel (Math/CS), Courtney Bennett Smith (Math), Roger Zou (Math). "Mitochondria Detection in 3D Brain Images." Duke Data Plus summer project.
 - 2014 Marshall Ratliff (Math), Derrick Nowak (Math). "Classifying Musical Genres: An Investigation into Sorting Music using Topology." Duke Data Plus summer project.

Teaching / Mentoring

2019-Present Mentor in WiMIR: Women in Music Information Retrieval

- 2024 CS 476: Computer Graphics (25 students). https://ursinusgraphics.github.io/ F2024/
- 2024 CS 271: Algorithms And Data Structures (20 students). https://ursinusdatastructures.github.io/F2024/
- 2024 CIE 100: Common Intellectual Experience (16 students). https:// ursinus-cie100j-f2024.github.io/CoursePage/
- 2023 CS 271: Algorithms And Data Structures (30 students). https:// ursinus-cs271-f2023.github.io/CoursePage
- 2023 CS 373: Theory of Computation (12 students). https://ursinus-cs373-f2023. github.io/CoursePage/
- 2023 CS 477: Artificial Intelligence And Machine Learning (22 students). https://ursinus-cs477-f2023.github.io/CoursePage/
- 2023 CS 174: Object Oriented Programming (21 students). https://ursinus-cs174-s2023. github.io/CoursePage/
- 2023 IDS 301: Problem Solving And Analysis with Python (3 students). https://ursinus-ids301-s2023.github.io/CoursePage/
- 2023 CS 372: Digital Music Processing (24 students). https://ursinus-cs372-s2023. github.io/CoursePage/
- 2022 CS 174: Object Oriented Programming (12 students). https://ursinus-cs174-f2022. github.io/CoursePage/
- 2022 CS 271: Algorithms And Data Structures (16 students). https:// ursinus-cs271-f2022.github.io/CoursePage
- 2022 CS 476: Computer Graphics (24 students), including a successful application for a linked inquiry with DGS-250: Game Design. https://ursinus-cs476-f2022.github.io/ CoursePage/
- 2022 CS 174: Object Oriented Programming (12 students). https://ursinus-cs174-s2022. github.io/CoursePage/
- 2022 CIE 200: Common Intellectual Experience (16 students). https://ursinus-cie200i-s2022.github.io/CoursePage/
- 2021 CS 371: Algorithms And Data Structures (24 students). https:// ursinus-cs371-s2022.github.io/CoursePage
- 2021 CS 373: Theory of Computation (16 students). https://ursinus-cs373-f2021. github.io/CoursePage
- 2021 CS 477: Machine Learning And Artificial Intelligence, including a successful application for an "obligations" designation for teaching a substantial ethics component (22 students). https://ursinus-cs477-f2021.github.io/CoursePage
- 2021 CS 371: Algorithms And Data Structures (26 students). https:// ursinus-cs371-s2021.github.io/CoursePage
- 2021 CS 472: Digital Music Processing, including a successful application for a recurring special topics course in Computer Science (15 students). https://ursinus-cs472a-s2021.github.io/CoursePage
- 2020 CS 174: Object Oriented Programming (19 students). https://ursinus-cs174-f2020. github.io/CoursePage/

- 2020 CS 476: Computer Graphics (12 students). https://ursinus-cs476-f2020.github. io/CoursePage/
- 2020 CS 173: Introduction To Computer Science (33 students). http://www.ctralie.com/ Teaching/CS173_S2020/
- 2020 IDS 301: Problem Solving And Analysis with Python (12 students). http://www.ctralie. com/Teaching/IDS301_S2020/index.html
- 2019 MATH 111: Calculus 1 (16 students). www.ctralie.com/Teaching/MATH111_F2019
- 2019 CS 476: Computer Graphics (11 students). www.ctralie.com/Teaching/CS476_F2019
- 2019 Invited to lead a workshop at WiMIR (Women in Music Information Retrieval) on "To What Extent Do Cyclic Inconsistencies Exist in Musical Preferences?" in Delft, The Netherlands
- 2018 Participant in the WiMIR: Women in Music Information Retrieval Workshop in Paris, France
- 2018 Co-Instructor At Summer School on Topological Data Analysis at Levico Terme, Italy. Labs found at http://github.com/ctralie/TDALabs
- 2018-Present STEAM-Center / CyberPatriot Mentor at Lakeland Elementary/Middle School in Baltimore, Maryland
 - 2017 Summer@ ICERM Topological Data Analysis Co-Instructor / Teaching Assistant
 - 2016 Summer School Teaching Assistant At Technical University of Munich, Germany on "Topological Time Series Analysis - Theory And Practice"
 - 2016 Instructor of Record of a new course I designed, CS/MATH 290: "Digital 3D Geometry," at Duke University. A ground up approach to 3D geometry with a statistics and signal processing focus. Assignments in Javascript/WebGL on sound modeling in virtual acoustic environments and modeling rotations. Assignments in numpy on 3D shape statistics, 3D shape alignment, and spectral mesh processing. http://www.ctralie.com/Teaching/COMPSCI290
 - 2016-2018 Guest Lecturer on Topological Data Analysis at Duke University (three lectures: two for Dr. John Harer and one for Dr. Francis Motta)
 - 2015 3D geometry and computer graphics independent study mentor to two high school students from North Carolina School for Science and Math
 - 2014 Guest lecture / lab design in "Data Expeditions" on "Topology + Music Audio Data" and "Musical Pitches And Chroma Features," sponsored by the Information Initiative at Duke
 - 2014 Mentor in 9 Week "Data and Brains" Undergraduate NSF Summer Research Program at Duke University sponsored by the math department
- 2013 2017 Member of Duke University Certificate in College Teaching (CCT) Program Participated in "College Teaching Practicum" spring 2013 and "Teaching Triangles" teaching evaluations spring 2016
- 2009 2011 Princeton University Engineering "Interactor" Assisted a faculty member and advised eight freshman engineering students with their courses

- 2008 2011 Princeton University Peer Math Tutor Tutored Undergraduate students one-on-one in Math 104: Calculus 2, Math 201: Multivariable Calculus, Math 203: Advanced Multivariable Calculus, and Math 202: Linear Algebra
 - 2010 Princeton University Math Study Hall Facilitator Selected to lead a pilot weekly study hall program sponsored by the math department

Advising/Service

2020-Present Faculty adviser to the Ursinus Maker Club (formerly ACM Club)

- 2022-Present Leader of Ursinus MathCS Affordable Laptop Loaner Program
 - 2023 Served on a search committee for a visiting position in Computer Science
 - 2022 Participated in the at-risk student working group with the Ursinus Institute for Student Success
 - 2021 Served on a search committee for a tenure track position in Computer Science
 - 2021-2023 Member of the Ursinus Diversity Committee
 - 2020-2021 Academic Adviser To \approx 25 Computer Science majors
 - 2021 Served on a search committee for a tenure track position in Mathematics
 - 2021 Served on a search committee for a tenure track position in Statistics
 - 2020 Computer Science representative for the Digital Liberal Arts (DLA) Working Group At Ursinus College
 - 2020 Member of "STEM and racial injustice" group summer 2020 at Ursinus College Summer Fellows
 - 2020 Member of reading group on "Campus Counterspaces: Black and Latinx Students' Search for Community at Historically White Universities" by Micere Keels, Summer 2020 At Ursinus
 - 2020 Served on a search committee for a visiting position in Computer Science
 - 2020 Served on the panel "AMS Panel Discussion: Mental Health in the Mathematics Profession" at the Joint Mathematics Meeting Conference
 - 2019 Served on a search committee for a visiting position in Mathematics

Grants

- 2020 Applied as co-PI for CSSI: Collaborative Research: Elements NSF Grant on "DREiMac, A Software Suite for Dimensionality Reduction with Eilenberg-MacLane Coordinates"
- 2017 Helped write the Air Force Office of Scientific Research (AFOSR) grant "Geometric And Topological Methods for Multi-Modal Data Analysis And Fusion," which was successfully funded (joint with Paul Bendich and John Harer)
- 2014 Wrote the technical overview for the NSF Big Data Grant "Topological Data Analysis and Machine-Learning with Community-Accepted Features" (Award No. 1447491), which was successfully funded (joint with Paul Bendich and John Harer)

Invited Talks

- 2024 "Structure Analysis And Visualization in Digital Music Audio." IIT Kanpur IEEE SPS Branch
- 2024 "The Concatenator: A Bayesian Approach To Real Time Concatenative Musaicing." Encanti Music Academy
- 2024 "Topological Signal Processing with Applications in Multimedia Data." University of South Carolina
- 2023 "The Tech And Ethics Behind Automatic Audio Version Identification." Guest Lecture in Rosa Abrahams's "What Is Music" Class.
- 2023 "Topological Time Series Analysis/Synthesis in Multimedia Data." Northeastern University
- 2023 "The DOPE Metric is SIC: A Stable, Informative, And Computable Metric for Time Series And Ordered Merge Trees." Joint Math Meetings (JMM)
- 2022 "Embodied Learning in Music Theory through Augmented Reality." University of Oslo Embodied Al Workshop (Joint with Rosa Abrahams).
- 2022 "Discovering And Perfecting Periodicity in Video Using Topological Autoencoders." Union College Mathematics Conference.
- 2021 "What Are These Shapes?? A Small Liberal Arts College Approach To Applied Geometry in Computer Science." Urinus College Summer Fellows Symposium.
- 2021 "p53 And Dynamic Networks: Applications of Topological (Quasi) Periodicity Quantification." SIAM Data Science Special Session on Topological Signal Processing.
- 2021 "Topological Signal Processing with Applications in Multimedia Data." University of South Carolina
- 2020 "Audio Version Identification in The 20s." Tutorial At The International Society for Information Retrieval (ISMIR) 2020. Joint with Joan Serrà and Furkan Yesiler
- 2020 "The Graph Laplacian And Some Applications in Multimedia Data Processing." Ursinus College AMS Group
- 2020 "What Are These Shapes?? A Small Liberal Arts College Approach To Applied Geometry in Computer Science." Duke University Data Dialogue
- 2020 "TDALabs: (Some of) TDA's Greatest Hits in Interactive Python." Florida Atlantic University Department of Mathematics
- 2020 "TDALabs: (Some of) TDA's Greatest Hits in Interactive Python." Applied Algebraic Topology Research Network Talk Series (AATRN)
- 2020 "Topology-Guided Analysis And Synthesis of (Quasi)Periodic Phenomena in Multimedia Data." University of Florida Applied Topology Seminar.
- 2019 "Designer Takens: A Tale of Twisted Time Series." Union College Mathematics Conference.
- 2019 "2-Torus And Beyond: (Spatio)Temporal Takens with A Twist." Workshop on Topology: Identifying Order in Complex Systems, University of Pennsylvania.
- 2019 "Audio Cover Song Identification: Beyond The Notes." Bryn Mawr College Computer Science Colloquium
- 2019 "Audio Cover Song Identification: Beyond The Notes." Northeast Music Information Special Interest Group (NEMISIG) Meeting, Brooklyn College
- 2019 "Topological Periodicity Analysis in Multimedia Time Series": Joint Math Meeting (JMM) Baltimore, MD

- 2018 "Geometric Audiovisual Signal Processing (GASP!): Video And Music Processing with A Twist": Telecom Paristech
- 2018 "Audio Cover Songs: Analysis And Synthesis": Duke University Data Dialogue Seminar
- 2017 "From Musical Rhythms To Vibrating Vocal Folds: Geometric (Quasi)Periodicity Quantification in Multimedia Time Series." NC State Department of Mathematics
- 2017 "Topological Rhythm Hierarchy Quantification in Musical Audio." SIAM Conference on Applied Algebraic Geometry, Georgia Tech.
- 2016 "Geometry Aided Music Structure Analysis And Cover Song Identification" (SAS)
- 2015 "Intro to the Duke Cluster and Data Hacks" (Duke University)
- 2014 "The Geometry and Topology of Musical Audio Data" (Duke University)
- 2014 "A Head of Our Times: Reimagining the Heads in the Brummer Collection via Real-Time Face Mapping" with Amanda Lazarus at "The Age of Sensing 5th International Conference on Remote Sensing in Archeaology"

Conference / Journal Reviewing

- 2024 24th International Society for Music Information Retrieval Conference (ISMIR)
- 2024 Transactions on Applied And Computational Topology (JACT) Journal
- 2024 IEEE Transactions on Audio, Speech, And Language Processing (TASLP) Journal
- 2023 Program chair for EVOMusart
- 2023 ACM SIGCSE Student Research Competition
- 2023 SIAM Transactions on Mathematical Data Science Journal
- 2023 IEEE Transactions on Audio, Speech, And Language Processing (TASLP) Journal
- 2022 IEEE Pattern Analysis And Machine Intelligence (PAMI) Journal
- 2021 Research in Computational Topology Journal
- 2020 21st International Society for Music Information Retrieval Conference (ISMIR)
- 2019 20th International Society for Music Information Retrieval Conference (ISMIR)
- 2019 Annals of Applied Statistics
- 2019 35th International Symposium on Computational Geometry (SOCG)
- 2018 19th International Society for Music Information Retrieval Conference (ISMIR)
- 2018 Journal of Information Fusion (INFUS)
- 2018 34th International Symposium on Computational Geometry (SOCG)
- 2016 EURASIP Journal on Audio, Speech, and Music Processing
- 2015 Iberoamerican Congress on Pattern Recognition (CIARP)

Other Scholarly Activity

2013 - Member of "Information Initiative at Duke" (IID)

Present

- 2015-2017 MIREX Music Benchmarking Competition Task Captain in "Cover Song Identification"
 - 2015 US Air Force Research Labs (AFRL) Visiting Faculty Research Program

Industry Experience

2008 Lockheed Martin Summer Internship in Software Development

Wrote an R&D project management plugin for the Eclipse IDE (contributed over 17k Lines of Code)

	Programming Languages and Lab Experience
Programming Languages	C, C++, Java, Python, Javascript, Matlab, HTML, OpenGL/WebGL, Linux Tools, Java Applet Development, ROS robot operating system
Master's Project in Radar Signal Processing (2012)	Created a 2D positioner robot from scratch to move a K-band horn antenna in front of a $4'x4'x4'$ anechoic box, and used this apparatus to create SAR images
Undergraduate EE Core Lab (2010)	"Carlab" ELE 302 Junior Electrical Engineering Design Project. Replaced radio control systems on an RC-sized car with our own autonomous control circuits Programmed a DSP56800 series microprocessor to implement PID cruise control, PWM steering control, and line following using a C2 camera and the NTSC video standard

Spoken Languages

Native English Proficient French