Bengier Ülgen Kılıç

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Education

- **Ph.D. in Applied Mathematics** 2023
  University at Buffalo, The State University of New York (SUNY), New York, USA

- **B.S. in Mathematics** 2017
  Boğaziçi University, Istanbul, Turkey

Work Experience

- **Postdoctoral Fellow** 2024 -Present
  Department of Psychiatry, Icahn School of Medicine at Mount Sinai, NY, USA

- **Postdoctoral Research Fellow** 2023 -2024
  Biomedical Engineering Department, Lerner Research Institute, Cleveland Clinic, OH, USA

- **Graduate Research Assistant** 2019 - 2023
  Department of Mathematics, University at Buffalo, SUNY, NY, USA

- **Graduate Teaching Assistant** 2017 - 2022
  Department of Mathematics, University at Buffalo, SUNY, NY, USA

- **Adjunct Instructor** 2019 - 2020
  Department of Mathematics, University at Buffalo, SUNY, NY, USA

Publications

- Moore, C., **Kilic, B. Ü.**, Masiero, F., Gherardini, M., Cipriani C., Marasco P. Comparative kinematic analysis of two kinesthetic interfaces from distinct recording methodologies, Myoelectric Controls Symposium, 2024.

- **Kilic, B. Ü.**, Muldoon, S.F. Skeleton coupling: a novel interlayer mapping of community evolution in temporal networks, Journal of Complex Networks, Volume 12, Issue 2, cnae011, 2024 https://doi.org/10.1093/comnet/cnae011.

- **Kilic, B. Ü.**, Taylor, D. Simplicial cascades are orchestrated by the multidimensional geometry of neuronal complexes. Communications Physics 5, 278, 2022, https://doi.org/10.1038/s42005-022-01062-3.

Talks & Poster Presentations

- Cleveland Clinic, Lerner Research Institute, Neuroscience Data on the Table (DOT) Seminar 2024
  (Seminar Talk) A coordinate-based meta-analytical approach to reveal core-periphery network structure for ownership

- Boston University, Dynamical Systems Seminar (BU-DSS) 2022
  (S.T.) Thresholding and multi-body interactions orient cascades in spatially embedded networks.

- Contagion on Complex Social Systems (CCSS) 2022
  (Contributed Talk) A simplicial threshold model for higher-order cascades.

- Network Science Society (Netsci2022) 2022
  (C. T.) Simplicial cascades are orchestrated by the multidimensional geometry of neuronal complexes.

- Northeastern Regional Conference on Complex Systems (NERCCS) 2022
  (C. T.) Geometrical signatures of spreading activity from a neuronal threshold model.

- Networks2021, A joint Sunbelt and NetSci conference 2021
  (C. T.) Higher-order flow channels of neuronal avalanches uncovered by topological data analysis of simplicial contagions.

- Northeastern Regional Conference on Complex Systems (NERCCS) 2021
  (C. T.) Characterization of communities in dynamic functional networks.
  (C. T.) Geometrical/topological data analyses reveal higher-order flow structures provide flow channels for neuronal avalanches.

- Northeastern Regional Conference on Complex Systems (NERCCS) 2019

  (**C. T.**) Biomedical image processing via persistent homology.

- Northeastern Regional Conference on Complex Systems (NERCCS) 2022

  (**Poster**) Skeleton coupling: novel method for choosing interlayer edges in temporal networks for dynamic community detection.

- Dynamics Days (DD) 2022

  (**P.**) Cascades over simplicial complexes preferably follow geometrically reinforced channels.

- Society for Neuroscience (SFN) 2019

  (**P.**) Cell detection and segmentation via persistent homology.

Professional Development

- Mathematical Approaches for Connectome Analysis workshop, (IPAM, UCLA) 2024
- Neuromatch Academy Deep Learning summer workshop (NMA-DL) 2021
- Topological insights in Neuroscience (MSRI) 2021
- TopoNets, Networks beyond pairwise interactions, Satellite @ Networks 2021 2021
- Biology, Analysis, Geometry, Energies, Links (bagel19), IMA 2019

Awards and Honors

- Obtained lodging funding from IPAM, UCLA. ($1500) 2024
- Secured a funding from CIMPA-AESIM for the organization of DRP-Turkey. ($4000) 2023
- Obtained travel and lodging grant from University of Colorado at Boulder, CCSS. ($1000) 2022
- Rewarded by honorable mention of the best poster award, NERCCS. 2022
- Obtained travel and lodging grant from The Institute for Mathematics and Its Applications, IMA. ($750) 2019
- Contributed to the project 'Seizure control through state-specific manipulation of cell assemblies' (NSF SMA-1734795).

Reviews of Journal Papers

- Frontiers in Computational Neuroscience (Review Editor)
- Frontiers in Physics
- Frontiers in Big Data
- Chaos: An Interdisciplinary Journal of Nonlinear Science

Projects

Donu-TDA: Unsupervised software for Donut-like Object segmeNtation Utilizing Topological Data Analysis

- Built a novel computer vision pipeline employing topological data analysis, raising accuracy by 5% and achieving highest score among 1,500 entries in KAGGLE's 2018 Data Science Bowl Cell Segmentation competition.
- Integrated a graphical user interface (GUI) for laboratory workflow using tkinter library in Python to correlate analysis results & automation processes, streamlining workflow by 15%.

Temporal network analysis: A novel interlayer mapping of community evolution in temporal networks

- Enhanced scalability and accuracy of dynamic community detection through developing an algorithm, 'skeleton coupling' which utilizes data-driven interlayer edge selection, resulting in 20% enhancement of graph clustering accuracy.
- Compiled an open-source application programming interface (API) using ReadtheDocs library in Python for 5 dynamic community detection algorithms utilizing skeleton coupling algorithm improving user experience by 25%.

Neuronal cascades: Computational framework for modeling neuronal dynamics on coupled network systems

- Developed an agent-based model on spatially embedded networks of over 1000 nodes, simulating 100s of diffusion processes via computational methods to replicate real-world events, validating accuracy with 97% correlation rate.
- Provided an open-source codebase in Cython based on provided model to facilitate quantitative research with a well-documented API enabling 40% faster runtime and simplifying code access process by 50%.

Software Expertise

- Python (Numpy, scikit-learn, NetworkX, PyTorch, Tensorflow, PySpark, Pandas, matplotlib, Plotly, ReadTheDocs, Nilearn), SQL, Cython, Matlab (Brainstorm), SLURM, LaTeX, Illustrator, MS Office, Github.

Skills

- **Machine learning:** Regression, Clustering, Decision trees, Classification, Dynamic community detection, Dimensional reduction, Network analysis, Time-series analysis, Topological data analysis, Signal-frequency analysis.
- **Neural networks:** Deep Learning, Image Recognition (CNNs), Natural Language Processing (RNNs).
- **High performance computing:** through Ohio Supercomputer Center and Wyoming Supercomputing Center.

Leadership and Organization

- Organizer of Directed Reading Program - Turkey (DRP-Turkey)   2022 - 2023

Volunteer activity

- Project mentor for '*Critical Thresholds for Epidemics on Networks*' – (Directed Reading Program, Turkey)   2023
- Project mentor for '*Mathematics of deep learning*' – (Directed Reading Program, Turkey)   2022
- Project mentor for '*Network analysis for real-world applications*' – (UB, Directed Reading Program)   2022
- Project mentor for '*Graph theoretical analysis of brain networks*' – (Directed Reading Program, Turkey)   2021

Languages

- Turkish (Native)   • English (Fluent)   • Greek (Elementary)

References

- **Dane Taylor** (PhD Co-Advisor, dane.taylor@uwyo.edu)

  Assistant Professor, School of Computing, Department of Mathematics and Statistics, University of Wyoming

- **Sarah Muldoon** (PhD Co-Advisor, smuldoon@buffalo.edu)

  Associate Professor, Department of Mathematics, Computational and Data-Enabled Sciences and Engineering Program and Neuroscience Program, University at Buffalo, SUNY