

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

Software Expertise

- Python (Numpy, scikit-learn, NetworkX, PyTorch, Tensorflow, PySpark, Pandas, matplotlib, Plotly, ReadTheDocs), SQL, Apache Spark, AWS-Sagemaker, Cython, Matlab, SLURM, L^AT_EX, 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.
- **Neural networks:** Deep Learning, Image Recognition (CNNs), Natural Language Processing (RNNs).
- **High performance computing:** Distributed computing, Parallel computing, Resilient distributed datasets (RDDs)

Work Experience

Postdoctoral Research Fellow – Lerner Research Institute, Cleveland Clinic (2023–)

- Performed clinical and computational research efforts in the Laboratory for Bionic Integration.

Graduate Research Assistant – University at Buffalo, SUNY (2019-2023)

- Published 2 first-author papers in top-tier journals, gave talks in major conferences and led discussions in journal club meetings.
- Conducted rigorous research on neuronal time-series (2p-microscopy) data utilizing ML (classification) & network analysis (community detection) frameworks, exploring up to 10 hyperparameter spaces & analyzing over 6 hours of data.
- Analyzed 500+ publicly available fMRI & DTI datasets with 200 brain regions, by applying statistical techniques such as anomaly detection, clustering and dimensional reduction leading to successful hypothesis testing & evaluation of models.
- Crafted data visualizations to communicate complex research results by increasing illustration effectiveness by 70%.

Graduate Teaching Assistant – Department of Mathematics, University at Buffalo, SUNY (2017-2022)

- Math 141, College Calculus I Fall'18
- Math 142, College Calculus II Spring'18/Spring'21/Fall'22
- Math 241, College Calculus III Fall'19/Fall'21/Spring'22/Fall'22/Spring'23
- Math 309, Linear Algebra Spring'20
- Math 417, Survey of Multivariable Calculus Spring'22/Spring'23

Adjunct Instructor – Department of Mathematics, University at Buffalo, SUNY (2019,2020)

- [Math 131, Mathematical Analysis for Management](#) Summer'19
- [Math 231, College Calculus III](#) Summer'20

Publications

- **Kilic, B. Ü.**, Muldoon, S., Skeleton coupling: a novel interlayer mapping of community evolution in temporal networks, <https://arxiv.org/abs/2301.10860>, 2023.
- **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>.

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%.

Talks & Poster Presentations

- Boston University, Dynamical Systems Seminar ([BU-DSS](#)) 2022
(**Seminar Talk**) 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.**) Simplicial cascades are orchestrated by the multidimensional geometry of neuronal complexes.
- [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
(**Poster**) Cascades over simplicial complexes preferably follow geometrically reinforced channels.
- Society for Neuroscience ([SFN](#)) 2019
(**Poster**) Cell detection and segmentation via persistent homology.

Certifications

- **Taming Big Data with Apache Spark and Python - Hands On**, Udemy 2023
- **Getting Started with AWS Machine Learning**, Coursera 2022
- **Python for Data Science and Machine Learning Bootcamp**, Udemy 2022
- **The Complete SQL Bootcamp 2022: Go from Zero to Hero**, Udemy 2022

Professional Development

- Neuromatch Academy Deep Learning summer workshop ([NMA-DL](#))** 2021
- Developed and debugged a deep learning framework (utilizing LSTMs, encoders/decoders etc.) for NLP (sentiment analysis from tweets), and gained experience cleaning and optimizing text data for analysis.
- Topological insights in Neuroscience ([MSRI](#))** 2021
- Participated in an interdisciplinary workshop.
- [TopoNets](#), Networks beyond pairwise interactions, Satellite @ Networks 2021** 2021
- Participated in a satellite workshop.
- Biology, Analysis, Geometry, Energies, Links ([bagel19](#)), IMA** 2019
- Participated in a two-week long workshop, presented posters.

Leadership and Organization

- Directed Reading Program - Turkey ([DRP-Turkey](#))** 2022-2023
- Organized a directed reading program across over 10 countries, pairing over 50 undergraduate students with young researchers to work on topics in mathematics.
 - Wrote grant proposals and reports, performed exploratory data analysis.

Awards, Honors and Scholarships

- Obtained travel and lodging grant from University of Colorado at Boulder (\$1000), [CCSS](#). 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 (\$750), [IMA](#). 2019
- Contributed to the project ‘Seizure control through state-specific manipulation of cell assemblies’ (NSF SMA-1734795).

Reviews of Journal Papers

- Frontiers in Physics
- Frontiers in Big Data

Volunteer activity

- 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

- **Sarah F. Muldoon** (Co-Advisor)
Associate Professor, Department of Mathematics, CDSE Program, Neuroscience Program, University at Buffalo, SUNY
(smuldoon@buffalo.edu)
- **Dane Taylor** (Co-Advisor)
Assistant Professor, Department of Mathematics, CDSE Program, University at Buffalo, SUNY
(danet@buffalo.edu)
- **Naoki Masuda** (Ph.D. Committee Member)
Professor, Department of Mathematics, CDSE Program, University at Buffalo, SUNY
(naokimas@buffalo.edu)