

## Research Interests

- Topological Data Analysis, Dynamical Systems,
- High-Performance Computing, GPU-accelerated AI
- Machine Learning and Deep Learning Algorithms,
- Mathematical Finance, Time Series Analysis, Numerical Analysis

## Education

- 2018– 2023 Ph.D. in Mathematics Engineering  
Istanbul Technical University  
Thesis: Topological Data Analysis and Clustering Algorithms in Machine Learning  
Advisor: Prof. Dr. Atabey Kaygun  
Project: The Scientific Research Projects İTÜ : TDK-2020-42698
- 2014 – 2016 M.Sc. in Mathematics  
Dokuz Eylül University GPA: 3.88/4.00  
Thesis: On highest eigenvalues of Regular Sturm-Liouville Problems  
Advisor: Prof. Dr. Şennur Somali
- 2008 – 2014 B.Sc (Major) in Mathematics  
Dokuz Eylül University GPA: 3.81/4.00  
*magna cum laude*
- 2014 – 2015 Pedagogical Formation in Mathematics  
Dokuz Eylül University
- 2012 – 2015 B.Sc (Minor) in Statistics  
Dokuz Eylül University GPA: 3.29/4.00
- 2012 – 2013 Exchange Program in Denmark Aarhus University GPA: 3.66/4.00  
Project: Solving equations via Eigenvalues and Eigenvectors  
Advisor: Anders Nedergaard Jensen

## Work Experience

- 2024 – present Researcher and Lecturer, Actuarial Sciences, Institute of Applied Mathematics, METU  
Teaching IAM788-Topological Machine Learning in Time Series  
Research on time series and applications of topological data analysis
- 2023 – present Senior Researcher, TRUBA HPC Centre, Network Technologies Department,  
Turkish Academic Network and Information Center, TÜBİTAK ULAKBİM  
Experienced HPC User Support Specialist, skilled in managing CPU and GPU-based clusters, benchmarking HPC systems with HPL, HPCG and HPLMxP, and overseeing power usage. Proficient in facilitating multi-node, multi-GPU usage in Python and R for AI tasks including LLM, VLM, and image processing and etc. Development and Deployment AI Models on Multi node - GPU. Teaching GPU usage for AI in HPC and Feature Engineering in ML sections at the National Technology Initiative (Milli Teknoloji Hamlesi)-Artificial Intelligence Specialisation Programme
- 2021 – 2022 Visiting Researcher (12 months), Michigan State University via TÜBİTAK 2214-A  
with Prof. Dr. Elizabeth Munch
- 2018 – 2023 *Research and Teaching Assistant*, Istanbul Technical University  
Assisted courses: Mathematics I, II, Intro to Programming Languages C
- 2019 – 2022 *Quantitative Analyst*, Algotecht

2020 – 2022 *Lecturer of Machine and Deep Learning Courses*, UcuncuBinYil

2015 – 2018 *Mathematics Teacher*, BAYSEM, Bayraklı, İzmir

## Publications

### — Journal Papers - Mathematics

- 2023 Classification of stochastic processes with topological data analysis, *Concurrency and Computation: Practice and Experience* 2023.  
Güzel İ., Kaygun A.
- 2022 *Detecting bifurcations in dynamical systems with CROCKER plots*, *Chaos: An Interdisciplinary Journal of Nonlinear Science* 2022. *This article was selected as Featured Article.*  
Güzel İ., Munch E., Khasawneh F.
- 2022 Persistent Homology, Matroids and Cobordisms, *arXiv* 2022.  
Güzel İ., Kaygun A.
- 2022 *A new non-archimedean metric on persistent homology*, *Computational Statistics*, 2022.  
Güzel İ., Kaygun A.
- 2019 *Operator splitting methods for computation of eigenvalues of regular Sturm-Liouville problems*, *Surveys in Mathematics and its Applications*  
Güzel İ., Adıyaman M., Somali S.

### — Journal Papers - Interdisciplinary

- 2023 *Phenolic Constituents, Antioxidant and Antimicrobial Activity and Clustering Analysis of Propolis Samples Based on PCA from Different Regions of Anatolia*, *Molecules* 2023.  
Altuntaş Ü., Güzel İ., Özçelik B.
- 2022 *Attitudes and Behaviors of Turkish Consumers Regarding the Olive Oil Consumption*, *Erzincan University Journal of Science and Technology* 2022.  
Altuntaş Ü., Güzel İ., Yılmaz Ö., Uluata S., Özçelik B.

### — Conference Papers

- 2024 An Overall Equipment Efficiency Predictive Analysis of a Hydraulic Press System by Time Series Forecasting with Topological Features, (IDSSC 2024) International Data Science and Statistics Congress: Artificial Intelligence, October 2024.  
Anapa K., Güzel İ., Yozgatlıgil C.
- 2022 Classification of Stochastic Processes with Topological Data Analysis, BAŞARIM 2022 - 7th High-Performance Computing Conference, May 2022.  
Güzel İ., Kaygun A.
- 2022 A Case Study on Identifying Bifurcation and Chaos with CROCKER Plots, Proceedings of TDA at SDM (SIAM Data Mining), April 2022.  
Güzel İ., Munch E., Khasawneh F.

### — Posters

- 2021 *Bifurcation Analysis with CROCKER plots*, CMSE Student Research Symposium at Michigan State University, Nov 2021.  
Güzel, İ., Munch. E., Khasawneh F.
- 2021 *Hierarchical Clustering and Zeroth Persistent Homology*, Institute for Mathematical and Statistical Innovation (MSI), May 2021.  
Güzel, İ., Kaygun, A.

## Scientific Activities

### — Seminar and Conference Talks

- 2024 Artificial Intelligence and High Performance Computing Ecosystem, BAŞARIM2024, May 2024.
- 2022 Classification of Stochastic Processes with Topological Data Analysis, BAŞARIM2022, May 2022.
- 2022 A Case Study on Identifying Bifurcation and Chaos with CROCKER Plots, Proceedings of TDA: Applications of Topological Data Analysis to Data Science, Artificial Intelligence, and Machine Learning Workshop at SDM 2022.

- 2021 A Guided Tour of Data Science Ecosystem for Asset Managers Seminar at Quant Workshop: Developing an intraday trading strategy using order book data, machine learning, and optimization, Chartered Financial Analyst (CFA) Istanbul Society in June 3-15, 2021
- 2016 *Computing Eigenvalues of Regular Sturm-Liouville Problems*, The 3rd Workshop of Association for Turkish Women in Maths. May, 27-29 Izmir, Turkey. (Joint with Ş. Somalı)

#### — Attended and Selected Workshops, Courses

- 2024 Multi-GPU Deep Learning, HLRS, University of Stuttgart, Stuttgart, Germany, July 02-05, 2024.
- 2023 Güncel Yapay Zeka ve Matematiksel Temelleri, Bilimler Köyü, Foça, İzmir, July 24-30, 2023
- 2023 ACM Europe Summer School on HPC Computer Architectures for AI and Dedicated Applications, Barcelona Supercomputing Center, Barcelona, Spain, July 02-07, 2023
- 2022 Topological Data Visualization Workshop University of Iowa, May 16-20, 2022
- 2021 Computational Persistence ComPerWorkshop Purdue University, Nov 1-5, 2021
- 2021 Summer School: Theory and Practice of Deep Learning Gene Golub SIAM Summer School, July 19-30, 2021
- 2021 Quantum Information for Mathematics, Economics, and Statistics, Institute for Mathematical and Statistical Innovation (IMSI), May 24-28, 2021
- 2020 İMO2020 – Machine Learning in İstanbul (14 hours theoretical, 14 hours implementation), Mimar Sinan Fine Arts University, Feb 2020, Prof. Dr. Ş. İlker BİRBİL

### Computer Skills

- CAS Mathematica, SageMath
- Computation Python, R, Julia, Matlab
- Miscellaneous High-Performance Computing, Bash, Linux, Troubleshooting, L<sup>A</sup>T<sub>E</sub>X, Inkspace, Mathcha, IBM SPSS Statistics

### Certificate of Competency

- Data Parallelism: How to Train Deep Learning Models on Multiple GPUs, NVIDIA
- Applications of AI for Anomaly Detection, NVIDIA
- Fundamentals of Accelerated Computing with CUDA Python, NVIDIA
- Fundamentals of Deep Learning, NVIDIA
- High Performance Data Analysis with R, IT4Innovations National Supercomputing Center

### Scholarships

- 2017 – 2021 The Scientific and Technological Research Council of Türkiye, Grant 2211-A
- 2014 – 2016 Republic of Türkiye, State Scholarship (for masters education)
- 2011 – 2014 Zorlu Foundation Fellowship

### Honors-Awards

- 2014 Graduate ranking first in Science Faculty, Dokuz Eylül University
- 2011 –2014 Certificate of high honor by Science Faculty Dean, Dokuz Eylül University

### References

- o Dr. Atabey Kaygun - [kaygun@itu.edu.tr](mailto:kaygun@itu.edu.tr)
- o Dr. Elizabeth Munch - [muncheli@msu.edu](mailto:muncheli@msu.edu)
- o Dr. Selçuk Bilmiş - [selcukbilmis@gmail.com](mailto:selcukbilmis@gmail.com)
- o Dr. Ayhan Yüksel, CFA, FRM, PRM - [ayhan.yuksel1@boun.edu.tr](mailto:ayhan.yuksel1@boun.edu.tr)
- o Dr. Burak Saltoğlu - [burak.saltoglu@boun.edu.tr](mailto:burak.saltoglu@boun.edu.tr)