ECEM ŞİMŞEK

M.Sc. Student at Bilkent University, Electrical and Electronics department

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RESEARCH INTERESTS

Graph Signal Processing, Graph Neural Networks, Visibility Graphs, Hypergraphs, Deep Learning
Natural Language Processing, Signal Processing

EDUCATION

I.D.F. Bilkent High School (IB Program)　　　　　*September 2014 – June 2018*
IB Diploma Grade: 37/45; High School Diploma Grade: 94.43

Bilkent University　　　　　*September 2018 – June 2023*
B.Sc. in Electrical and Electronics Engineering, CGPA: 3.20
Research Intern at UMRAM: July 2020 – April 2021
Undergraduate Researcher at KocLab, UMRAM: June 2022 – August 2023

Graduate Studies, Bilkent University　　　　　*August 2023 – Present*
M.Sc. in Electrical and Electronics Engineering, CGPA: 3.67
(Advisor: Asst. Prof. Aykut Koç)

PUBLICATIONS

E. Şimşek, H. M. Özaktaş and A. Koç, "Fractional-Fourier Guided Visibility Graphs," to be submitted to *IEEE Signal Processing Letters*

E. Şimşek, A. Topcu, E. Koç, E. Ü. Sarıtaş and A. Koç, "Emotion Classification with Visibility Graphs," *IEEE Signal Processing Letters*, vol. 32, 2025. DOI: 10.1109/LSP.2025.3567033.

E. Şimşek, E. Koç and A. Koç, "EpiGraphNet: Epilepsy Recognition Architecture with Graph-Based EEG Analysis," in *Proc. 33rd IEEE Signal Processing and Communications Applications Conf. (SIU)*, 2025. DOI: DOI: 10.1109/LSP.2025.3567033.

E. Koç, İ. Şanlı, **E. Şimşek**, H. Özekin and A. Koç, "Automatic Detection of Basic Level Categories," in *Proc. 33rd IEEE Signal Processing and Communications Applications Conf. (SIU)*, 2025. DOI: 10.1109/SIU66497.2025.11112453.

E. Şimşek, A. Güngör, Ö. Karavelioglu, M. T. Yerli and N. G. Kuyumcuoğlu, "Wind Power Prediction Using Machine Learning and Deep Learning Algorithms," in *Proc. 31st IEEE Signal Processing and Communications Applications Conf. (SIU)*, 2023. DOI: 10.1109/SIU59756.2023.10223936.

AWARDS & HONORS

- Graduated third from I.D.F. Bilkent Middle School and awarded a full academic scholarship covering all four years of high school education at I.D.F. Bilkent High School.

- Granted a scholarship from UMRAM under the Student Work Program as an Electrical and Electronics Engineering research intern.

- Awarded a Master's scholarship under the Information and Communication Technologies Authority of Turkey (BTK), as a part of 5G and Beyond Joint Graduate Support Program (funded by Türk Telekom company).

- Awarded first place in the 5-Minute Thesis (5MT) Competition (Master's category) at the 33rd IEEE SIU Conference at Işık University (June 25–28, 2025).

- Selected as a Principal Candidate for the 2026–2027 Fulbright Ph.D. scholarship.

PRESENTATIONS & CONFERENCE EXPERIENCES

- Delivered an oral presentation at the 31st IEEE Signal Processing and Communications Applications (SIU) Conference at Istanbul Technical University (July 5–8, 2023).

- Presented a poster at the 34th Graduate Research Conference (GRC) hosted by Bilkent University on January 25, 2024, and served as the GRC Vice Chair.

- Delivered an oral presentation at the 35th GRC hosted by Bilkent University on January 23, 2025, and served as a session chair.

- Delivered an oral presentation at the 33rd IEEE SIU Conference at Işık University (June 25–28, 2025).

TEACHING EXPERIENCE

- Served as a laboratory assistant for CS115 – Introduction to Python Programming at Bilkent University (October 2020 – January 2021 and June – August 2022).

- Served as a laboratory assistant for EEE342 – Feedback Control Systems at Bilkent University (September – December 2022 and February – August 2023).

- Working as a graduate teaching assistant for the EEE493/494 – Industrial Design Project courses at Bilkent University (September 2023 – May 2024, September 2024 – May 2025, and September 2025 - Present).

INTERNSHIP EXPERIENCES

UMRAM Summer Internship Project – VHDL Coding for High-Speed ADC Conversion with DMA

In the summer of 2020, this project was initiated at National Magnetic Resonance Center (UMRAM) under the guidance of Prof. Ergin Atalar. The project focused on converting two analog signals at the maximum sampling rate, storing the data on a VC707 FPGA board via Direct Memory Access (DMA), and displaying the digital signals on a computer.

ASELSAN Summer Internship Project – Small-Scale Camera System Design with Analog and Digital Lenses

At ASELSAN's UGES division, this project involved designing and testing a small-scale camera system. The work began with researching key components and features of camera systems, followed by acquiring images and live video streams from both analog and digital lenses. The captured images were optimized for enhanced performance, a motor driver board was integrated with the digital camera lens, and several Python programs were developed to manage the zoom and focus functions.

OTHER NOTABLE PROJECTS

KocLab Research Project – Text Classification with Graph Neural Networks

This project employed Python to represent text clusters as graph structures. The goal was to accurately predict class labels and surpass state-of-the-art results in a supervised learning framework.

EEE493/494 Final Year Research Project – Machine Learning for Solar and Wind Energy Forecasting
Conducted with a team under the supervision of Prof. Süleyman Serdar Kozat and DataBoss Analytics & Security, this project developed an algorithmic system to forecast solar and wind energy production. Five machine learning methods were evaluated, and a Python-based graphical user interface was designed to display the results.

EEE473 Final Project – Fan-Beam Computed Tomography Simulator
Developed in MATLAB, this project created a fan-beam computed tomography simulator. The simulator was tested on real and synthetic datasets, analyzing the impact of noise, distance, fan size, and filter parameters on reconstruction quality.

EEE485 Final Project – Epileptic Seizure Classification from EEG Signals
In this project, Python-based algorithms were developed from scratch to classify healthy versus epileptic EEG signals using three machine learning models. Comparative analysis identified the most effective approach.

EEE414 Final Project – SRAM Design using Cadence Virtuoso
In this project, an 8x4 SRAM array was designed. The system processed 2-bit inputs to write and read data, operating at a 100 MHz clock, with a dual-structured design to optimize area efficiency.

EEE522 Final Project – Time Series Classification Using Visibility Graphs and Fractional Fourier Transform
This project proposed two novel methods that integrate fractional Fourier transform-based edge weights with natural and vector visibility graphs. Both approaches achieved superior classification performance on EEG time series data compared to conventional techniques.

CS550 Final Project – Visibility Hypergraphs for Text Classification
In this project, a novel architecture for text classification named *visibility hypergraphs* was developed. Consisting of two novel hyperedges constructed on vector visibility graphs, this architecture yielded a classification performance that is close to the results presented by state-of-the-art methods.

TECHNICAL SKILLS

Core Skills	Machine Learning, Signal Processing, Graph Signal Processing, Deep Learning, Natural Language Processing, Graph Neural Networks, Time Series Analysis
Programming	Python, HTML, VHDL, Vivado, Arduino, MATLAB, LTSpice, Assembly, Cadence Virtuoso, PyTorch, Pytorch-Geometric, TensorFlow, Streamlit
Tools	Microsoft Word, Microsoft Office, Microsoft PowerPoint, LaTeX
Languages	English, French (Beginner), Spanish (Beginner)