Semanur Avsar

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Profile

MSc student in Electrical and Electronics Engineering at EPFL, focusing on Machine Learning and Artificial Intelligence. Strong academic foundation in Telecommunications and Signal Processing, complemented by practical projects.

Education

École Polytechnique Fédérale de Lausanne (EPFL) Lausanne, Vaud, Switzerland
Master of Science in Electrical and Electronics Engineering; GPA: 5.60/6.00 *2024 – Ongoing*

Middle East Technical University (METU) Ankara, Turkey
Bachelor of Science in Electrical and Electronics Engineering; GPA: 3.93/4.00 *2019 – 2024*

Universität Paderborn Paderborn, Germany
Erasmus exchange student at the Department of Electrical Engineering *09/2022 – 03/2023*

Research Experience

Graduate Researcher *Signal Processing Laboratory (LTS4)* **Lausanne, Switzerland** *09/2025 – 01/2026*

- Integrated phase-based functional connectivity (Phase-Locking Value, PLV) into a graph dictionary learning framework for EEG motor imagery decoding.
- Implemented and compared multiple PLV-based model variants, analyzing the effects of distance transformations, window length, frequency-band selection, scaling, and coefficient thresholding on learned graph atoms.
- Designed and ran extensive experiments on the EEGBCI dataset using group-aware cross-validation and multi-classifier evaluation.

Graduate Researcher *Telecommunications Circuits Laboratory (TCL)* **Lausanne, Switzerland** *02/2025 – 06/2025*

- Developed structured sparse parity-check matrices to improve belief propagation (BP) decoding of short LDPC codes.
- Developed an NSGA-II based multi-objective optimization framework to tune matrix parameters using block-wise genetic operations.
- Explored multiple objective formulations, including rank, 4-cycle count, and BER performance, to guide multi-objective search.

Summer Intern *Adaptive Systems Laboratory (ASL)* **Lausanne, Switzerland** *07/2023 – 09/2023*

- Selected for the E3: EPFL Excellence in Engineering summer research fellowship.
- Contributed to the development of Python codes for the simulations and visual data of the book Inference and Learning from Data Volume 1: Foundations.
- Created LaTeX-formatted Jupyter notebooks to support course-based learning from the book.

Undergraduate Researcher *Communication Networks Research Group (CNG)* **Ankara, Turkey** *07/2021 – 07/2022*

- Implemented and simulated AoI and QAoI minimization algorithms in MATLAB under i.i.d. and Markovian transmission delays.
- Evaluated algorithm performance across various delay distributions (exponential, lognormal, Pareto).
- Modeled correlated random variables and Markov chains to simulate realistic delay dynamics in queue-based systems.
- Contributed to a conference paper promoting QAoI as a metric for real-time system design.

Work Experience

Part-Time Engineer *Plan-S Satellite and Space Technologies* **Ankara, Turkey** *02/2024 – 07/2024*

- Worked on waveform design and testing in the Telecommunications Design Department.
- Conducted channel simulations and waveform analysis using MATLAB, GNU Radio, and Python.
- Developed complete GNU Radio blocks for LR-FHSS modulation using Python.

Summer Intern *Aselsan Military Electronics Industries* **Ankara, Turkey** *07/2022 – 08/2022*

- Worked in the Waveform Design Department, designed and evaluated Lateration and Min-Max algorithms for ad-hoc network localization in MATLAB, under static and mobile node conditions.
- Studied the impact of anchor placement, measurement count, and mobility; proposed enhancements like collinearity checks and iterative localization.

Publication

• M. E. Ildiz, S. Avşar, E. Uysal, "An Inequality for Query Age of Information and Age of Information," *30th Signal Processing and Communications Applications Conference (SIU)*, May 2022.

Selected Course Projects

Graph-based EEG Seizure Detection *Report* *Spring 2025*

- Modeled EEG signals as dynamic graphs and implemented various graph neural network (GNN) architectures (GCN, ChebNet, GAT, GraphSAGE) for seizure classification.
- Designed diverse preprocessing pipelines (STFT, wavelet, bandpower) and graph construction strategies (mutual information, inverse distance) to extract informative signal and relational features.
- Systematically tested combinations of preprocessing methods, graph construction techniques, and GNN models to identify the best-performing setup for seizure detection.

Multi-Task Learning for Implicit Hate Speech Detection *Report* *Spring 2025*

- Proposed and implemented a multi-task learning framework to enhance implicit hate speech detection and improve out-of-domain generalization capabilities
- Developed a BERT-based model integrating auxiliary tasks such as sarcasm detection, stereotypical bias identification, and fine-grained subtype classification to enrich contextual understanding
- Designed and executed comprehensive experiments, including an ablation study, to assess the contribution of each auxiliary task to overall performance

OFDM system to transmit and receive data using a loudspeaker and microphone *Report* *Fall 2024*

- Developed and implemented an OFDM system from scratch in MATLAB for data transmission and reception via a loudspeaker and microphone.
- Integrated key OFDM components, including modulation, IFFT/FFT, cyclic prefix handling, and channel equalization.
- Enhanced the system with additional features, such as Hamming error correction and scrambling.

Ad Hoc Communication Network System for Disaster Relief *Report* *Fall 2023 – Spring 2024*

- Designed a mobile multi-robot communication system for disaster environments, implementing an infrared-based ad hoc network with CRC-checked packets, directional scanning, and a lightweight protocol for reliable inter-robot coordination.
- Developed the robot decision-making and navigation logic, including tile-based mapping, localized search, collision avoidance, and coordinated task updates between mobile and base units.
- Built and tested a working prototype as part of a six-member team, integrating communication and control layers to demonstrate dynamic multi-agent collaboration in a simulated search-and-rescue scenario.

Basic Quality of Service (QoS) Network Implementation *Report* *Spring 2022*

- Designed and implemented a basic Quality of Service (QoS) network, obeying a predefined latency and reliability precedence requirement, on FPGA using Verilog. Displayed the process on a VGA screen.

Micro air conditioner *Report* *Fall 2021*

- Designed and implemented an analog micro air conditioner that employs heating and cooling operations by comparing the desired and ambient temperature levels.

Skills

- **Programming:** C, Python, Verilog HDL
- **Tools and Technical Skills:** MATLAB (including Simulink), GNU Radio, FPGA, NX 11.0, Keysight VEE, LTspice
- **Languages:** Turkish (Native), English (Proficient), German (Beginner), French (Beginner)

Honors and Awards

- E3: EPFL Excellence in Engineering summer fellowship. (2023)
- Bulent Kerim Altay (BKA) Award for 2021–2022 fall & spring semesters, given by METU EEE Department.
- Dean's High Honor List for the semesters in METU. (2019–2023)
- Was in the top 0.08% among 2.5 million people in the National University Entrance Exam. (2019)