# Egemen Erbayat

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## PROFESSIONAL SUMMARY

PhD student in Electrical and Computer Engineering with a strong foundation in mathematics, machine learning, and communication theory. Experienced in finding, analyzing, and discovering insights, as well as formulating and implementing solutions for research problems. Throughout my career, I have gained diverse experience as both a software and machine learning engineer, working across a range of industries, from healthcare to market operations. Currently, my research focuses on AI applications and optimizations in communication systems, where I apply advanced machine learning techniques, computer vision, and optimization algorithms. My work has consistently demonstrated improvements in system accuracy and efficiency.

## WORK EXPERIENCE

**Machine Learning and Computer Vision Research Intern**                           June 2024 — August 2024
Siemens Healthineers                                                                                *Princeton, NJ*

- Developed an automated co-registration method for paired CTA and OCT/IVUS images using Python and advanced machine learning techniques, resulting in improved AI training accuracy with higher-quality ground truth data for coronary artery analysis.

- Applied advanced computational methods, including optimization algorithms and image processing techniques, to enhance medical image co-registration accuracy, achieving optimized alignment between different imaging modalities for more precise diagnostic analysis.

**Vision and Perception Developer**                                               February 2022 — May 2022
Delivers.ai                                                                                        *Istanbul, Turkey*

- Refined algorithm parameters and integrated advanced deep learning models, achieving an 87% improvement in landmark localization accuracy using Python and CNN frameworks.

- Enhanced the positional accuracy of delivery robots by 63 centimeters through the implementation of NetVLAD and ROS, utilizing OpenCV and PyTorch, resulting in more reliable navigation and a significant reduction in delivery errors.

**Image Processing Engineer Intern**                                          September 2022 — October 2022
Vispera                                                                                            *Istanbul, Turkey*

- Developed and implemented image stitching algorithms using Python and OpenCV, improving the accuracy of product shelf monitoring by 20% and reducing manual stock tracking time by 45%, leading to more efficient supermarket operations.

**Software Engineer**                                                             July 2020 — January 2021
Baykar Technologies                                                                                *Istanbul, Turkey*

- Developed formation flight algorithms for emerging technologies such as UAV swarms and designed simulation interfaces using C++ and C#, optimizing collaborative flight strategies and improving swarm coordination.

- Facilitated knowledge-sharing and problem-solving across interdisciplinary teams, enhancing collaboration and efficiency in UAV swarm projects through effective communication and teamwork.

## EDUCATION

**Doctor of Philosophy in Electrical and Computer Engineering**, George Washington University Aug. 2022 — May 2026

- **GPA: 4.00/4.00**; Advisor: Prof. Dr. Suresh Subramaniam

- **Relevant Coursework:** Design & Analysis of Algorithms, Machine Learning, Reinforcement Learning, Computer Vision, Applied Optimization Modeling, Machine Intelligence, Linear Optimization

**Bachelor of Science in Electrical and Electronics Engineering**, Bogazici University          September 2017 — June 2022

- **GPA: 3.72/4.00**; Graduated with High Honors

- **Relevant Coursework:** Image Processing, Computer Vision, Probability, Linear Algebra, Computer Networks

## PUBLICATIONS

**ACM MobiHoc 2024,** E. Erbayat, A. Maatouk, P. Zou, S. Subramaniam, Age of Information Optimization and State Error Analysis for Correlated Multi-Process Multi-Sensor Systems, October 2024

**Journal of Optical Communications and Networking,** S. Petale, A. Knapinska, E. Erbayat, P. Lechowicz, K. Walkowiak, S.-C. Lin, M. Matsuura, H. Hasegawa, S. Subramaniam, "PRODIGY+: A Robust Progressive Upgrade Approach For Elastic Optical Networks," July 2024.

**IEEE Cloud Summit 2024,** E. Erbayat, R. Zou, X. Wei, G. Venkataramani, S. Subramaniam, A Trade-off Analysis of Latency, Accuracy, and Energy in Task Offloading Strategies for UAVs, June 2024

**IEEE ICC 2024,** E. Erbayat, S. Petale, S. Lin, M. Matsuura, H. Hasegawa, S. Subramaniam, Fronthaul Network Architecture and Design For Optically Powered Passive Optical Networks, June 2024

**IEEE ANTS 2023,** S. Petale, E. Erbayat, S, Subramaniam, ULTRA: Machine Learning Optimized TRA For Enhanced Resource Allocation in MCF-based SDM-EONs, December 2023

## SELECTED PROJECTS

**Machine Learning Design for UAV Edge-Server IoT Systems** (Python, Tkinter, YOLO, SSD, UDP, RTP)

- Designed a novel UAV Edge-server system for analyzing the tradeoff between accuracy, latency, and power consumption by utilizing machine learning models to control object detection and video transmission.

- Implemented preprocessing techniques on the edge server using Python and OpenCV, reducing data transmission requirements by 40% while maintaining 95% object detection accuracy.

- Implemented a simulator featuring a user-friendly GUI that allows dynamic selection of deep learning models for object detection and real-time decision-making regarding data transmission between edge devices and servers.

**Fronthaul Network For Optically Powered Passive Optical Networks** (Python, Gurobi, Graph Algorithms)

- Conducted extensive research on fronthaul network architecture and design, with a particular emphasis on integrating power-over-fiber technology to enhance network resilience during power outages, especially in disaster-prone areas.

- Developed and implemented various algorithms, including integer linear programming and fast algorithms for splitter localization problems, to optimize network topology while considering both fiber and power costs.

- Engineered a network design algorithm 100x faster than ILP solutions, with only 3-5% cost increase for medium networks and greater efficiency for larger networks, demonstrating superior scalability and cost-effectiveness.

**Optimizing Multicast Flow Scheduling in Data Center Networks** (Algorithm Design, Mathematical Modeling)

- Designed an adaptive scheduling algorithm for multicast flows using Birkhoff-von Neumann decomposition, leveraging reconfigurable circuit switch capabilities to optimize flow times and throughput in data center networks.

**Age of Information** (Information Theory, Decision Making)

- Investigated multi-source, multi-channel IoT systems within the Age of Information framework, analyzing correlations between diverse information sources and their impact on decision-making processes, resulting in a comprehensive understanding of complex information dynamics in time-sensitive scenarios.

## AWARDS

- **National University Admission Exam:** Ranked $10^{th}$ in Mathematics and Science among 2.3 million candidates. (July 2017)

- **Turkish Governmental Outstanding Success Scholarship:** Awarded to undergraduate students who have been ranked in the top 100 in the National University Admission Exam. (Sep 2017 — Jun 2022)

- **Boğaziçi University Outstanding Success Scholarship:** Granted for achieving one of the top rankings among incoming students, recognizing outstanding academic excellence at Boğaziçi University. (Sep 2017 — Jun 2022)

- **International Basic Sciences Knowledge Contest:** Awarded Gold & Bronze Medals. (2013 — 2014)

- **Waterloo University, Gauss Math Contest & Kangaroo Math Contest:** Awarded Gold Medals. (2013)

- **National Math Contests:** Awarded 5 Gold, 1 Silver, and 3 Bronze Medals. (2012 — 2014)

## SKILLS

**Technical Skills:** C/C++, C#, Python, MATLAB, Unix/Linux, VHDL, ROS, Gurobi CPLEX, PyTorch, NumPy, Pandas
**Analytical Skills:** Problem formulation, Optimization, Algorithm design, Integer Linear Programming design