

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 2021 — October 2021

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 10th 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