Bariscan Kurtkaya

Research Interest

Exploring machine learning and neuroscience theory, with a focus on understanding memory components in both biological and artificial networks.

Education

University of California, Santa Barbara, PhD in Electrical and Computer Engineering, California, USA — Starting 2025
Prospective Principal Investigator: Prof. Nina Miolane

Koc University, MSc in Computer Science and Engineering, Istanbul, Turkey — 2023 - 2025
Awarded **KUIS AI Fellowship**. (1% Acceptance Rate) — GPA: 4.00/4.00
Thesis: Research on understanding dynamical phases of short-term mechanisms with Prof. Yucel Yemez & Dr. Fatih Dinc

Yildiz Technical University, BSc in Electronics and Communication Engineering, Istanbul, Turkey — 2017 - 2023
Graduated with **High Honors** by being **in the top 10 of 120** students. — GPA: 3.52/4.00
Thesis: Distorted ECG data classification by Masked Autoencoders with Prof. Nihan Kahraman

Publications & Preprints

[1] *Dynamical phases of short-term memory mechanisms in RNNs*, **ICML'25**, 2025, [Paper]
Bariscan Kurtkaya*, Fatih Dinc*, Mert Yuksekgonul, Marta Blanco-Pozo, Ege Cirakman, Mark J. Schnitzer, Yucel Yemez, Hidenori Tanaka†, Peng Yuan†, Nina Miolane†

[2] *A ghost mechanism: An analytical model of abrupt learning*, **Under review**, 2025, [Paper]
Fatih Dinc*, Ege Cirakman*, **Bariscan Kurtkaya**, Yiqi Jiang, Mert Yuksekgonul, Mark J. Schnitzer†, Hidenori Tanaka†

[3] *RAVE: Randomized Noise Shuffling for Fast and Consistent Video Editing with Diffusion Models*, **CVPR'24 Highlight**, 2024 [Paper] [Code] [Website]
Ozgur Kara*, **Bariscan Kurtkaya***, Hidir Yesiltepe, James M. Rehg, Pinar Yanardag

[4] *Deep learning-based driver assistance system*, **Electrica Journal** , 23(3), 607-618, 2023. [Paper] [Code]
Bariscan Kurtkaya, Arda Tezcan, Murat Taskiran

Research Experience

Stanford University, Schnitzer Group, Visiting Graduate Student Researcher — 2024 Fall - 2025 Winter
Supervised by Prof. Mark J. Schnitzer

- Investigating the role of hub neurons in memory tasks by employing recurrent neural networks to uncover underlying structures, contributing to a deeper understanding of neural connectivity and information processing with Dr. Fatih Dinc.
- Collaborating with lab members on neuron cell segmentation projects, developing and implementing machine learning architectures to accurately identify and analyze neuronal structures, thereby advancing the lab's research capabilities.

Wash. Uni & Koc Uni & PoliMi., McDonnell Center, Graduate Student Researcher — 2023 Spring - Present
Supervised by Prof. Tansu Daylan

- Conducting research to enhance exoplanet discovery through machine learning on observations from the James Webb Space Telescope. **(Manuscript in preparation.)**
- Developed a physics-informed, GPU-accelerated data augmentation technique, overcoming data scarcity by expanding the dataset from 1000 to 10^6 in 10 minutes thereby enhancing model training capacity.
- Investigating advanced machine learning architectures and explainability methods to improve interpretability and yield scientifically meaningful insights in exoplanet discovery.

Virginia Tech & Georgia Tech & Koc University, GemLab VT, Graduate Research Intern — 2023 Fall - 2024 Winter
Supervised by Prof. Pinar Yanardag

- Developed a novel, training-free, zero-shot video editing framework, leveraging pre-trained text-to-image diffusion models to enable efficient video editing without additional training requirements. **(CVPR'24 Highlight)**
- Achieved state-of-the-art performance in both qualitative and quantitative evaluations, demonstrating superior editing capabilities and addressing the shape morphing problem, a limitation of previous methods.
- Curated the largest dataset to date for video editing, designed to enhance comprehensive evaluations by including diverse motion types and editing prompts, providing a robust resource for the field.

University of Milan, AIS-Lab , Visiting Undergraduate Research Intern — 2022 Summer
Supervised by Prof. Alberto Borghese

- Researched the explainability of Capsule Networks, focusing on enhancing image feature representation by analyzing the 'dynamic routing' mechanism and comparing it with Convolutional Neural Networks (CNNs) and Vision Transformers for improved interpretability.

- Presented findings on Capsule Networks to faculty members and Ph.D. students at the University of Milan, contributing to knowledge exchange and discussion on advanced neural network architectures.

Yildiz Technical University, MeDaLab , Undergraduate Research Assistant 2021 Fall - 2022 Spring
Supervised by Prof. Murat Taskiran

- Secured funding from the Scientific and Technological Research Council of Turkey (TUBITAK) for this project, recognizing its potential to improve driving safety under challenging lighting conditions.
- Led research on a Driver Assistance System by addressing biases in state-of-the-art object detection methods for daytime images. Developed a high-speed, real-time day-night classifier that achieved 99.92% accuracy on 10^5 real-world images. **(Electrica Journal 2023)**
- Curated and enhanced the Oxford RobotCar Dataset for object detection tasks, manually labeling images to support robust model training for diverse lighting conditions. Fine-tuned YoloV3 and YoloV4 models for night-time object detection, achieving approximately 0.92 IOU with YoloV3 and 0.95 IOU with YoloV4.

SCHOLARSHIPS

- **Funded** by Prof. Jay McClelland through the Feldman-McClelland Open-a-Door fund. 2024 Fall
- **Impact Scholar**, awarded a fellowship from the Bridge to Turkiye Fund. 2024 Fall
- **KUIS AI Fellowship**, awarded fellowship from Koc University AI Center 2023-2025
- **2209 TUBITAK Research Project Grant Holder**, awarded from TUBITAK. 2022

ACHIEVEMENTS

- **Awarded 1st, and 3rd place** as in the US-based MateRov Semi-autonomous Underwater Systems competition organized under the sponsorship of NSF, in consecutive years.
- **Awarded 4th place** in the Undersecretariat of Defense Industry award in the Underwater Systems category.
- **Awarded 3rd place** in the Teknofest Turkiye award in the Underwater Systems category.
- **Hugging Face Ambassador**
- **Microsoft Ambassador**
- **High Honors from Yildiz Technical University**
- **Top 0.25% among 150 thousand** - Turkish National Postgraduate Entrance Exam and Academics
- **Top 1% among 2 million** - Turkish National University Entrance Exam

TEACHING EXPERIENCE

COMP 410/510 - Computer Graphics - Koc University - Graduate Teaching Assistant 2024,2025 Spring

- Delivered a lecture on 3D reconstruction using Neural Radiance Fields, introducing key concepts and applications to the class.
- Provided support during office hours, addressing student questions, and assessed student performance through grading course homeworks.

COMP 106 - Discrete Mathematics for CSE - Koc University - Graduate Teaching Assistant 2023 Fall

- Led problem solving sessions, presenting example problems to the class on the RSA public-key cryptosystem to enhance understanding.
- Provided support during office hours, addressing student questions, and assessed student performance through grading midterm and final exams.

TALKS

Voxel51 CVPR2024 Meetup - Speaker 2024 Summer

- Presented our CVPR work *RAVE: Randomized Noise Shuffling for Fast and Consistent Video Editing with Diffusion Models* at Voxel51's CVPR meetup.

Akbank MultiGroup - Women in AI - Speaker 2023 Spring

- Delivered an advanced-level seminar on deep learning-based object detection models to underrepresented groups at the Akbank MultiGroup MoreThan101 series. (Presentation Link)

Tech Istanbul - Istanbul Metropolitan Municipality - Speaker 2022 Fall

- Volunteered to teach a lecture on advanced deep learning algorithms to individuals from underrepresented, low-income backgrounds, aiming to provide them with industry-relevant skills and enhance their career opportunities.

University of Milan - Visiting Research Intern 2022 Summer

- Presented a seminar on Capsule Networks to faculty and graduate students in the Computer Science Department at the University of Milan. (Presentation Link)

INDUSTRY EXPERIENCE

Ollang Media Technologies, AI Research and Development Engineer 2021-2022

- Conducted research on Ollang's Text-To-Speech and Transformer-based machine translation technology.
- Represented the Ollang AI department to **Microsoft Turkey GM, CTO, and Customer Success Lead**.

A Group R&D, Software Engineer Intern 2020 Summer

- Developed the unmasked people detection project due to the Covid-19 spread. Developed the project with **YOLO** algorithm core to get real-time results.

Yıldız Technical University IEEE CAS Team, Software Team Member 2018 - 2019

- Contributed to the development of a Semi-Autonomous Underwater Robot, creating software to solve complex computer vision tasks such as text recognition and object localization from real-time video streams.