Haldun Balim

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Research interests

My research interest falls at intersection between control and machine learning. My goal is to design data-driven and provably correct solutions for control of complex dynamical systems. I am particularly interested in verification of learning-based control algorithms.

Education

2021–2023	**Robotics, Systems and Control M.Sc.**, *ETH Zürich*, *GPA − 5.73*.
	Highlighted Courses: *Model Predictive Control, System Identification, Machine Perception, Probabilistic Artificial Intelligence*
2015–2021	**Mechanical Engineering B.Sc.**, *Koç University*, *GPA − 4.0*.
	Summa Cum Laude, Graduated as 2nd in department
2015–2021	**Computer Science B.Sc.**, *Koç University*, *GPA − 4.0*.
	Highlighted Courses: *Nonconvex Optimization for Explainable ML & DL, Machine learning, Reinforcement Learning*
2020–2020	**Exchange Student**, *University of British Columbia*.
	Highlighted Courses: *Advanced Machine Learning, Dynamic Systems Modelling (Advanced), Computer Vision*

Master's Thesis

Title	*Multi-step Predictors for Model Predictive Control*
Supervisors	Johannes Köhler, Andrea Carron, Prof. Melanie Zeilinger
Description	This thesis explored the idea of incorporating multi-step predictors in predictive control schemes

Experience

Sep 2022 Feb 2023	**Visiting Scholar**, University of Michigan, Ann Arbor.
	Engaged in research on backward reachability for nonlinear systems through learned models. Developed a method to construct model approximation error robust backward reachable sets and to synthesize safe controllers.
	Additionally, worked on transformer-based neural network architectures and in-context learning for filtering and control problems.

Mar 2021	**Machine Learning Engineer**, Dcipher Analytics.
Sep 2021	Developed and implemented a state-of-the-art convolutional neural network-based solution for the detection of highly biodiverse regions from satellite imagery in collaboration with Sweden's Ecogain.
	Additionally, designed and executed a cutting-edge neural network-based solution for the diagnosis of acute otitis media disease from otoscopy videos as part of a research project at the University of Pennsylvania School of Medicine.
Apr 2020	**Research Assistant**, University of British Columbia.
Oct 2020	Implemented recurrent neural network-based user intention estimation frameworks for power-assisted manual wheelchair users.
Feb 2017	**Research Assistant**, Koç University.
May 2018	Conducted in vitro analysis of a mechanical heart assist device for Fontan patients. Designed and executed experiments to assess the performance of left-ventricular assist devices developed.

Teaching

Mar 2023	**Machine Perception**, ETH Zürich.
Jun 2023	I was a teaching assistant for the course, which entailed facilitating problem-solving sessions to supplement the lecture material covered and answering questions asked by students over moodle platform.
Sep 2018	**Statics and Mechanics of Materials**, Koç University.
Dec 2018	Took role as a teaching assistant in the course. My responsibilities included: holding office hours for students and giving problem sessions.

Publications

Journal publications

[J2] Koopman-Inspired Implicit Backward Reachable Sets for Unknown Nonlinear Systems
H. Balim, A. Aspeel, Z. Liu, N. Ozay.
IEEE Control Systems Letters, vol. 7, pp. 2245-2250, 2023

[J1] In vitro validation of a self-driving aortic-turbine venous-assist device for Fontan patients
K. Pekkan, I.B. Aka, E. Tutsak, E. Ermek, **H. Balim**, I. Lazoglu, R. Turkoz.
The Journal of thoracic and cardiovascular surgery, vol. 156, no. 1, pp. 292-301.e7, Jul. 2018

Workshop papers

[W1] EFE: End-to-end Frame-to-Gaze Estimation
H. Balim, S. Park, X. Wang, X. Zhan, O. Hilliges.
Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition Workshops pp. 2687–2696, 2023

Abstracts

[A2] Automated Diagnosis of Keratoconus from Corneal Topography
A.Y. Tas, M. Hasanreisoglu, **H. Balim**, M. Gönen, A. Sahin.
The Association for Research in Vision and Ophthalmology, vol. 62, no. 8, pp. 2021–2021, Jun. 2021

[A1] Recurrent Neural Network-Based Intention Estimation Frameworks for Power-Assisted Manual Wheelchair Users: A Feasibility Study
H. Balim, M. Khalili., C. Kuo, H.F.M. Van der Loos, J.F. Borisoff.
IEEE International Symposium on Robot and Human Interactive Communication Workshops

In Review

[R1] Can Transformers Learn Optimal Filtering for Unknown Systems?
H. Balim*, Z. Du*, S. Oymak, N. Ozay.
In review for: *American Control Conference*