

ESEN YEL

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RESEARCH INTERESTS

The main objective of my research is to achieve safe, generalizable, and trustworthy autonomy for systems under uncertainty. My research uses concepts from reachability analysis, machine learning, verification, motion planning, and transfer learning to develop safe planning and runtime monitoring techniques.

EDUCATION

University of Virginia Charlottesville, VA
Ph.D., Systems Engineering 2021
Dissertation: *Online Predictive Monitoring and Proactive Planning for Safe Autonomous Robot Operations*

Bogazici University Istanbul, Turkey
M.S., Electrical and Electronics Engineering 2016
Thesis: *Appearance-based Self Localization and Navigation Using Place Memory*

B.S., Electrical and Electronics Engineering 2014

RESEARCH EXPERIENCE

Stanford University Stanford, CA
Position: Postdoctoral Scholar 2021 – Present
Affiliations: Stanford Intelligent Systems Lab (SISL), Stanford Center for AI Safety
Advisor: Mykel Kochenderfer

- Develop safety validation techniques for autonomous vehicles under uncertainties
- Develop probabilistically safe planning techniques for autonomous vehicles under uncertainties
- Manage industry-sponsored research projects

University of Virginia Charlottesville, VA
Position: Graduate Research Assistant 2016 – 2021
Affiliations: Autonomous Mobile Robots Lab, Link Lab
Advisor: Nicola Bezzo

- Developed assured runtime monitoring and replanning techniques for systems under disturbances
- Developed online replanning techniques for autonomous systems under unforeseen faults
- Developed self-triggered scheduling techniques to decrease sensing computation

Bogazici University Istanbul, Turkey
Position: Graduate Research Assistant 2014 – 2016
Affiliations: Intelligent Systems Lab (ISL)
Advisor: H. Işıl Bozma

- Researched appearance-based self-localization and navigation approaches for mobile ground robots

AWARDS

Rising Stars in Electrical Engineering and Computer Science 2022

Link Lab Outstanding Graduate Research Award 2021
Link Lab, University of Virginia
“This award was established as a way for faculty to recognize Link Lab students who have demonstrated excellence in research during the academic year.”

RSS Pioneers Workshop Participant <i>"RSS Pioneers brings together a cohort of the world's top early-career researchers."</i>	2021
Link Lab Student Seminar Award Link Lab, University of Virginia <i>"The Link Lab Graduate Seminar provides a prestigious honor and award for a PhD student to showcase the highest quality research happening at Link Lab conveying impact and relevance in the CPS field"</i>	2020
Travel Awards	
IEEE/RSJ International Conference on Intelligent Robots and Systems	2019
IEEE International Conference on Robotics and Automation PhD Forum	2018
Ruthie Oxford Memorial Award, Promising Graduate Student University of Virginia, Department of Systems and Information Engineering	2018
Dean's High Honor List Bogazici University, School of Engineering	2014

PROPOSAL PREPARATION

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| <ul style="list-style-type: none"> • Google (Awarded, \$195,000) PI: Mykel Kochenderfer
<i>Robust Out-of-Distribution Detection for Safety-Critical Systems</i>
Role: Leading author • Motional (Awarded, \$300,000) PI: Mykel Kochenderfer
<i>Online Safety Verification of Trajectory Planners</i>
Role: Leading author • National Science Foundation (Submitted, \$20,000,000)
PI: Mykel Kochenderfer, Co-PI: Russ Altman
<i>Trustworthy Intelligence for Critical Systems (TICS)</i>
Role: Primary contributor • Office of Naval Research (Awarded, \$25,000) PI: Mykel Kochenderfer
<i>Funding for Learning for Dynamics and Control (L4DC) Conference</i>
Role: Primary contributor • Air Force Office of Scientific Research (Awarded, \$10,000) PI: Mykel Kochenderfer
<i>Funding for Learning for Dynamics and Control (L4DC) Conference</i>
Role: Primary contributor | 2022
2022
2022
2022
2022 |
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PUBLICATIONS

Under Review and Preprint

- A. Yildiz, E. Yel, A. Corso, K. Wray, S. Witwicki and M. Kochenderfer, "Experience Filter: Transferring Past Experiences to Unseen Tasks or Environments", 2022.
- M. Toyungyernsub, E. Yel, J. Li, and M. Kochenderfer, "Predicting Future Spatiotemporal Occupancy Grids with Semantics for Autonomous Driving", 2022.
- N. Rober, S. M. Katz, C. Sidrane, E. Yel, M. Everett, M. J. Kochenderfer, and J. P. How. "Backward reachability analysis of neural feedback loops: Techniques for linear and nonlinear systems", arXiv preprint arXiv:2209.14076, 2022

Refereed Journal and Magazine Articles

- E. Yel*, S. Gao*, N. Bezzo, “*Meta-Learning-based Proactive Online Planning for UAVs under Degraded Conditions*”, (*equal contribution), *Robotics and Automation Letters (RA-L)*, 2022, vol. 7, no. 4, pp. 10320–10327.
- E. Yel, T. X. Lin, N. Bezzo, “*Computation-Aware Adaptive Planning and Scheduling for Safe Unmanned Airborne Operations*”, *Journal of Intelligent and Robotic Systems*, 2020, vol. 100, no. 2, pp. 575–596.
- E. Yel, T. Carpenter, C. di Franco, R. Ivanov, Y. Kantaros, I. Lee, J. Weimer, N. Bezzo, “*Assured Runtime Monitoring and Planning: Towards Verification of Neural Networks for Safe Autonomous Operations*”, *Robotics and Automation Magazine, Special Issue on Deep Learning and Machine Learning in Robotics*, June 2020, vol. 27, no. 2, pp. 102–116.

Refereed Conference Papers

- M. Toyungyernsub, E. Yel, J. Li, M. Kochenderfer, “*Dynamics-Aware Spatiotemporal Occupancy Prediction in Urban Environments*”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2022* (in press).
- M. Cleaveland, E. Yel, Y. Kantaros, I. Lee, N. Bezzo, “*Learning Enabled Fast Planning and Control in Dynamic Environments with Intermittent Information*”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2022* (in press).
- L. Kruse, E. Yel, R. Senanayake, M. Kochenderfer, “*Uncertainty-Aware Online Merge Planning with Learned Driver Behavior*”, *IEEE International Conference on Intelligent Transportation Systems (ITSC)*, 2022.
- E. Yel, N. Bezzo, “*A Meta-Learning-based Trajectory Tracking Framework for UAVs under Degraded Conditions*”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS) 2021*, pp. 6884–6890.
- E. Yel, N. Bezzo, “*GP-based Runtime Planning, Learning, and Recovery for Safe UAV Operations under Unforeseen Disturbances*”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2020, pp. 2173–2180.
- E. Yel and N. Bezzo, “*Fast Run-time Monitoring, Replanning, and Recovery for Safe Autonomous System Operations*”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*, 2019, pp. 1661–1667.
- E. Yel, T. X. Lin and N. Bezzo, “*Self-triggered Adaptive Planning and Scheduling of UAV Operations*”, *IEEE International Conference on Robotics and Automation (ICRA)*, 2018, pp. 7518–7524.
- T. X. Lin, E. Yel and N. Bezzo, “*Energy-aware Persistent Control of Heterogeneous Robotic Systems*”, *Annual American Control Conference (ACC)*, 2018, pp. 2782–2787.
- E. Yel, T. X. Lin and N. Bezzo, “*Reachability-based self-triggered scheduling and replanning of UAV operations*”, *NASA/ESA Conference on Adaptive Hardware and Systems (AHS)*, 2017, pp. 221–228.

Refereed Workshop Papers

- E. Yel and N. Bezzo, “*Reachability-based Adaptive UAV Scheduling and Planning in Cluttered and Dynamic Environments*”, *ICRA Workshop on Informative Path Planning and Adaptive Sampling*, Brisbane, 2018.
- E. Yel and H.I. Bozma, “*Verifying the Recognized Place Through Localization*”, *IROS Workshop on Introspective Methods for Reliable Autonomy*, Vancouver 2017.

Other Papers

- G. Glaubit, K. Kleeman, N. Law, J. Thomas, S. Gao, R. Peddi, **E. Yel**, N. Bezzo “Fast, Safe, and Proactive Runtime Planning and Control of Autonomous Ground Vehicles in Changing Environments”, IEEE Systems and Information Engineering Design Symposium (SIEDS), 2021.
- **E. Yel**, T. X. Lin and N. Bezzo, “Reachability-based Self-triggered UAV Motion Planning”, International Symposium on Aerial Robotics, Philadelphia, PA, 2017.

TEACHING EXPERIENCE/TRAINING

Pedagogical Training

Stanford Scientific Teaching Summer Institute

- Attended a 3-day workshop to explore the core tenets of Scientific Teaching – inclusion, active learning, assessment, and effective lesson planning.

Summer 2022

Stanford University

Guest Lecture

Advanced Topics in Sequential Decision Making

Stanford University

Winter 2022

Graduate Teaching Assistantship

System Dynamics and Control

Control Technology and Design

Introduction to Electrical Engineering

- Led discussion and lab sessions and graded homework and quizzes.

Bogazici University

Spring 2015, Spring 2016

Fall 2015

Fall 2015

Undergraduate Teaching Assistantship

System Dynamics and Control (Assisted discussion sessions)

Orientation to Electrical Engineering (Assisted lab sessions)

Bogazici University

Spring 2014

Fall 2013

MENTORSHIP EXPERIENCE

Mentor for Stanford Undergraduate Research Fellowship (SURF)

Research mentor for an 8-week program for students from communities underrepresented in engineering. I advised the student on her research topic, monitored her research progress, and advised research alongside a graduate student. Student: Michelle Ho.

Summer 2022

Mentor for Graduate Student Research

Dylan Asmar, Out-of-distribution detection

Chelsea Sidrane, Backwards reachability for nonlinear systems

Sydney Katz, Backwards reachability for nonlinear systems

Alexandros Tzikas, Trajectory verification for autonomous driving

Anil Yildiz, Transfer learning and validation for autonomous driving tasks

Liam Kruse, Safe planning for autonomous vehicles

Maneekwan Toyungyernsub, Occupancy grid prediction

Stanford University

Summer 2022 – Present

Winter 2022 – Present

Winter 2022 – Present

Winter 2022 – Present

Fall 2021 – Present

Fall 2021 – Present

Fall 2021 – Present

Mentor for Undergraduate Students Research

Ellie Talius, Trajectory verification for autonomous driving

Stanford University

Winter, Spring 2022

Mentor for Capstone Project

Co-advising four undergraduate students on a robot navigation project

University of Virginia

Spring 2021

Mentor for Society of Women Engineers

Graduate student mentor for undergraduate engineering students associated with the Society of Women Engineers. This mentorship program involved helping students navigate their engineering education and early career.

University of Virginia, Spring 2017

PRESENTATIONS

Stanford SystemX 2021 Fall Conference, Poster	2021
Stanford Intelligent Systems Lab, Talk	2021
UPenn GRASP Lab, Talk	2021
UVA Link Lab Student Seminars, Talk	2020
UVA Link Lab Student Flash Talks, Talk	2020
UVA ESE Graduate Symposium, Poster	2018, 2020
ICRA PhD Forum, Poster	2018
UVA ECE Student Research Session, Poster	2017

PROFESSIONAL SERVICE AND LEADERSHIP

Member, Stanford Center for AI Safety Working Group	2022
Co-chair, Learning for Dynamics & Control Conference (L4DC)	2022
Program Committee Member, RSS Pioneers Workshop	2022
Session Co-chair, IEEE/RSJ International Conference on Intelligent Robots (IROS)	2021
Panelist, UVA Link Lab Academic Writing Panel	2021
Co-organizer, UVA Systems Engineering Alumni Panel	2020
Session Chair, IEEE Systems and Information Engineering Design Symposium	2019

REVIEW ACTIVITIES

Journals:

IEEE Robotics and Automation Letters (RA-L)
Journal of Artificial Intelligence Research (JAIR)
Journal of Aerospace Information Systems
IEEE Computer Magazine

Conferences

IEEE International Conference on Robotics and Automation (ICRA)
IEEE/RSJ International Conference on Intelligent Robots (IROS)
Conference on Robot Learning (CoRL)
IEEE Conference on Decision and Control (CDC)
American Control Conference (ACC)
ACM/IEEE International Conference on Cyber-Physical Systems (ICCPS) (subreviewer)
International Conference on Runtime Verification (RV)
IEEE International Conference on Intelligent Transportation Systems (ITSC)