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 uncertainty
- Develop probabilistic techniques for autonomous vehicle safety under uncertainty
- 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 *2021*
"RSS Pioneers brings together a cohort of the world's top early-career researchers."

Link Lab Student Seminar Award *2020*
Link Lab, University of Virginia
"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"

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 *2018*
University of Virginia, Department of Systems and Information Engineering

Dean's High Honor List *2014*
Bogazici University, School of Engineering

PROPOSAL PREPARATION

- **Google** (Awarded, $195,000) PI: Mykel Kochenderfer *2022*
  Robust Out-of-Distribution Detection for Safety-Critical Systems
  Role: Leading author
- **Motional** (Awarded, $300,000) PI: Mykel Kochenderfer *2022*
  Online Safety Verification of Trajectory Planners
  Role: Leading author
- **Office of Naval Research** (Awarded, $25,000) PI: Mykel Kochenderfer *2022*
  Funding for Learning for Dynamics and Control (L4DC) Conference
  Role: Contributor
- **Air Force Office of Scientific Research** (Awarded, $10,000) PI: Mykel Kochenderfer *2022*
  Funding for Learning for Dynamics and Control (L4DC) Conference
  Role: Contributor

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 *Summer 2022*
Stanford Scientific Teaching Summer Institute Stanford University
- Attended a 3-day workshop to explore the core tenets of Scientific Teaching – inclusion, active learning, assessment, and effective lesson planning.

Guest Lecture Stanford University
Advanced Topics in Sequential Decision Making *Winter 2022*

Graduate Teaching Assistantship Bogazici University
System Dynamics and Control *Spring 2015, Spring 2016*
Control Technology and Design *Fall 2015*
Introduction to Electrical Engineering *Fall 2015*
- Led discussion and lab sessions and graded homework and quizzes.

Undergraduate Teaching Assistantship Bogazici University
System Dynamics and Control (Assisted discussion sessions) *Spring 2014*
Orientation to Electrical Engineering (Assisted lab sessions) *Fall 2013*

MENTORSHIP EXPERIENCE

Mentor for Stanford Undergraduate Research Fellowship (SURF) *Summer 2022*
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.

Mentor for Graduate Student Research Stanford University
Dylan Asmar, Out-of-distribution detection *Summer 2022 – Present*
Chelsea Sidrane, Backwards reachability for nonlinear systems *Winter 2022 – Present*
Sydney Katz, Backwards reachability for nonlinear systems *Winter 2022 – Present*
Alexandros Tzikas, Trajectory verification for autonomous driving *Winter 2022 – Present*
Anil Yildiz, Transfer learning and validation for autonomous driving tasks *Fall 2021 – Present*
Liam Kruse, Safe planning for autonomous vehicles *Fall 2021 – Present*
Maneekwan Toyungyernsub, Occupancy grid prediction *Fall 2021 – Present*

Mentor for Undergradute Students Research Stanford University
Ellie Talius, Trajectory verification for autonomous driving *Winter, Spring 2022*

Mentor for Capstone Project University of Virginia
Co-advising four undergraduate students on a robot navigation project *Spring 2021*

Mentor for Society of Women Engineers University of Virginia, *Spring 2017*
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.

PRESENTATIONS

Stanford SystemX 2021 Fall Conference, Poster *2021*
Stanford Intelligent Systems 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

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)