Sydney Katz

Co-founder and CTO – Valgo

I am co-founder and CTO of Valgo (Valgorithmic, Inc.), a company focused on building safety validation tooling to support autonomous systems development and certification. I have deep expertise in algorithmic safety validation through my doctoral and postdoctoral research in the Stanford Intelligent Systems Laboratory. I also wrote a textbook called Algorithms for Validation and teach a related course at Stanford.

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For more details, see full CV on my website.

EDUCATION

Stanford University

Aeronautics and Astronautics, MS/PhD

2018 – 2023 Stanford, CA

- **GPA**: 4.14 / 4.0
- **Thesis:** Safe Machine Learning-Based Perception via Closed-Loop Analysis

Washington University in St. Louis

Electrical and Systems Engineering, BS/BSAS

2014 – 2018 St. Louis, MO

- **GPA**: 4.0 / 4.0
- **Valedictorian**

RESEARCH EXPERIENCE

Stanford Intelligent Systems Laboratory

Researcher Fall 2018-Fall 2020 Stanford, CA

Topics and technologies: *safety-critical machine learning, perception, verification, validation, mechanistic interpretability, technical writing, Julia, Python, Pytorch, LaTeX, Git*

Postdoctoral Research

- Researching methods related to the **design and validation of safety-critical automated decision-making systems**
- **Algorithms for Validation:** authoring a textbook on algorithms for validating the performance of safety-critical decision-making systems using topics from optimization, probability theory, and formal methods <online version>
- **Mechanistic Interpretability:** exploring the ability to scale a traditional dictionary learning algorithm to disentangle high-dimensional embeddings from transformer models such as LLMs <paper> <code>
- **Uncertainty Quantification:** developing new techniques to quantify uncertainty in the pose estimation process for a vision-based landing system <paper> <code>
- **Mentoring** Master's and PhD students to set research goals, develop new ideas, and manage industry partnerships

PhD Research

- **Perception System Safety Requirements:** developed efficient approach for determining safety requirements for perception systems <paper> <video> <code>
- **Safe Design of Perception Systems:** designed safer perception systems using a risk-driven approach that accounts for closed-loop safety properties <paper> <video> <code>
- **Verified Neural Network Perception:** created a method to formally verify image-based neural network controllers that uses generative models to capture the set of plausible inputs <paper> <video> <code>
- **Probabilistic Safety Guarantees for Neural Networks:** developed a technique to analyze the safety of neural network controllers used in stochastic environments <paper> <video> <code>

WORK EXPERIENCE

Valgo

Co-founder and CTO Fall 2025-present San Mateo, CA

Topics and technologies: *safety validation, autonomy, risk estimation*

- Building tooling for algorithmic safety validation

Reliable Robotics

GNC Intern Summer 2022 Mountain View, CA

Topics and technologies: *aircraft automation, applied machine learning, safety-critical system, data collection, Pytorch*

- Led implementation and analysis of **machine learning techniques** to support development of automated cargo aircraft
- Designed data collection procedures and set up model training and validation pipeline in Pytorch

MIT Lincoln Laboratory

Research Intern Summer 2017/2018 Boston, MA

Topics and technologies: *aircraft collision avoidance, Markov decision process (MDP), safety-critical system, C++, Matlab*

- Supported testing of **Airborne Collision Avoidance System X (ACAS X)**
- Improved safety for aircraft coordinating horizontal collision avoidance maneuvers by modifying **Markov decision process (MDP)** formulation
- Integrated logic into C++/Matlab model for ACAS X simulations

Infoscitex, a DCS Company

Operations Analyst Intern | Spring 2017 | St. Louis, MO

Topics and technologies: *sensor models, mission-level simulation, AFSIM*

- Worked with Advanced Framework for Simulation, Integration, and Modeling (AFSIM) performing mission level analysis applicable to the United States Air Force

Johns Hopkins University Applied Physics Laboratory

NASA Intern | Summer 2016 | Laurel, MD

Topics and technologies: *GNC, satellite, Parker solar probe, simulation-based testing, Matlab, Simulink*

- Assisted with guidance and control for **NASA's Parker Solar Probe** mission (now in orbit around the sun)
- **Identified critical control system parameter change** to better manage arrays during momentum dumps

NASA Glenn Research Center

Summer Intern | Summer 2013-2015 | Cleveland, OH

Topics and technologies: *design team, spacecraft concepts, trajectory optimization*

- Worked on the Collaborative Modeling for Parametric Assessment of Space Systems (COMPASS) design team to perform rapid integrated vehicle systems analyses

TECHNICAL COMMUNICATION AND TEACHING

Validation of Safety-Critical Systems

Stanford University | Winter 2025 | Stanford, CA

- Developed and taught a new graduate-level course with over 60 students enrolled that covers algorithms that can be used to ensure the safe operation of decision-making systems used in high-stakes settings
- Lecture videos are publicly available online

Teaching Assistant

Stanford University | Stanford, CA

- **Designing Robust and Reliable AI Systems** (Summer 2023): Assisted with the development and execution of a week-long course with the Stanford Center for Professional Development
- **Decision Making Under Uncertainty** (Winter 2023): class of over 450 students, managed programming assignments
- **Engineering Design Optimization** (Spring 2021): managed programming assignments and held weekly office hours
- **Building Trust in Autonomy** (Winter 2021): designed assignments and curriculum for undergraduate seminar

AI4ALL Mentor

Stanford University | Summer 2021/2023 | Stanford, CA

- **Led the robotics group and developed curriculum** for a three-week summer camp to introduce high school students from underrepresented backgrounds to AI concepts and topics

Outreach Videos

Stanford University | Stanford, CA

- **Stanford Intelligent Systems Laboratory:** producer for a documentary detailing the first ten years of the lab
- **Neural Network Verification:** created an introductory video on neural network verification
- **Markov Chain Monte Carlo:** intuitive explanation of Markov chain Monte Carlo in 10 minutes

FELLOWSHIP HIGHLIGHTS

2020-2023 **National Science Foundation Graduate Research Fellow**
Three years of funding and support for graduate research

2018-2020 ***Stanford Graduate Research Fellow***
Initial funding and support during Master's degree

2014-2018 ***Langsdorf Fellow***
Full-tuition merit scholarship to attend Washington University in St. Louis

AWARD HIGHLIGHTS

2025 ***Stanford AIAA Excellence in Teaching Award***
For outstanding contributions in teaching (selected by students)

2021 ***Third Place in Student Research Competition***
Digital Avionics Systems Conference (DASC)

2021 **Best Paper of Session**
Digital Avionics Systems Conference (DASC)

INVITED TALK HIGHLIGHTS

2025 **Validation of Complex Decision-Making Systems**
Horasis Visionary Circle (Stanford, CA)

2025 **Verification and Validation of Safety-Critical Decision-Making Systems**
University of Auckland Space Institute Seminar (Auckland, NZ)

2025 **Building a Safety Case for AI in Aviation**
IEEE International Conference on Robotics and Automation Workshop (Atlanta, GA)

2024 **Validation of AI Systems for Use in High-Stakes Settings**
Amazon Lab126 (Sunnyvale, CA)

2024 **Safe Machine Learning-Based Perception and Open Problems in Scaling Formal Methods**
Dagstuhl Seminar 24361 (Wadern, Germany)

2024 **Algorithms for Validation**
Stanford Center for AI Safety Annual Meeting (Stanford, CA)

2024 **Building a Safety Case for AI in Aviation**
GenAI x Aerospace Hackathon (Hillsborough, CA)

2023 **Efficient Determination of Safety Requirements for Perception Systems**
Digital Avionics Systems Conference (Barcelona, Spain)

2023 **Safe Machine Learning-Based Perception via Closed-Loop Analysis**
Airbus Acubed (Sunnyvale, CA)

2022 **Verification and Validation of Safety-Critical Autonomous Systems**
Recent Advances in AI for National Security Conference (MIT Lincoln Laboratory, Boston, MA)

2022 **Verification and Validation of Safety-Critical Autonomous Systems**
Trustworthy Autonomous Systems Governance Node (Edinburgh, Scotland)

PUBLICATION HIGHLIGHTS

- Kochenderfer, M. J., **Katz**, **S. M.**, Corso, A. L., and Moss, R. J. *Algorithms for Validation*. MIT Press, 2026. URL: https://algorithmsbook.com/validation/files/val.pdf.
- Delecki, H., **Katz**, **S. M.**, and Kochenderfer, M. J. "Failure Probability Estimation for Black-Box Autonomous Systems using State-Dependent Importance Sampling Proposals". In: *International Conference on Control, Decision and Information Technologies (CODIT)*. 2025. URL: https://arxiv.org/abs/2412.02154.
- Valentin, R., **Katz**, **S. M.**, Vanhoucke, V., and Kochenderfer, M. J. "DB-KSVD: Scalable Alternating Optimization for Disentangling High-Dimensional Embedding Spaces". In: *ArXiv* 2505.18441 (2025). URL: https://arxiv.org/abs/2505.18441.
- Valentin, R., **Katz**, **S. M.**, Lee, J., Arief, M., Sorgenfrei, M., Walker, D., and Kochenderfer, M. J. "Uncertainty aware pose estimation and calibration from image features". In: *Digital Avionics Systems Conference (DASC)*. 2024.
- **Katz**, **S. M.** "Safe machine learning-based perception via closed-loop analysis". PhD thesis. Stanford University, 2023. URL: https://searchworks.stanford.edu/view/14781481.
- Rober, N., **Katz**, **S. M.**, Sidrane, C., Yel, E., Everett, M., Kochenderfer, M. J., and How, J. P. "Backward reachability analysis of neural feedback loops: Techniques for linear and nonlinear systems". In: *IEEE Open Journal of Control Systems* (2023), pp. 1–18. DOI: 10.1109/OJCSYS.2023.3265901.
- Smyers, E. Q., **Katz**, **S. M.**, Corso, A., and Kochenderfer, M. J. "AVOIDDS: Aircraft vision-based intruder detection dataset and simulator". In: *Advances in Neural Information Processing Systems (NeurIPS)*. 2023.
- Corso, A. L., **Katz**, **S. M.**, Innes, C. A., Du, X., Ramamoorthy, S., and Kochenderfer, M. J. "Risk-driven design of perception systems". In: *Advances in Neural Information Processing Systems (NeurIPS)*. 2022. URL: https://arxiv.org/pdf/2205.10677.pdf.
- **Katz**, **S. M.**, Corso, A. L., Strong, C. A., and Kochenderfer, M. J. "Verification of image-based neural network controllers using generative models". In: *Journal of Aerospace Information Systems* (2022). DOI: 10.2514/1.I011071. URL: https://arxiv.org/abs/2105.07091.
- **Katz**, **S. M.**, Julian, K. D., Strong, C. A., and Kochenderfer, M. J. "Generating probabilistic safety guarantees for neural network controllers". In: *Machine Learning* 2103.01203 (2021). DOI: 10.1007/s10994-021-06065-9. URL: https://arxiv.org/abs/2103.01203.