2023 MIT AI and Autonomy Conference

April 5, 2023 8:00 am - 6:30 pm

8:00 AM – 9:00 AM	Registration with Light Breakfast

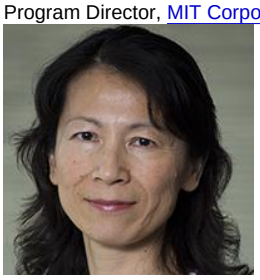
9:00 AM - 9:15 AM

Welcome Remarks:
John Roberts
Executive Director (Interim), MIT Corporate Relations

John Roberts
Executive Director (Interim)
MIT Corporate Relations

John Roberts has been Executive Director of MIT Corporate Relations (Interim) since February 2022. He obtained his Ph.D. in organic chemistry at MIT and returned to the university after a 20-year career in the pharmaceutical industry, joining the MIT Industrial Liaison Program (ILP) in 2013. Prior to his return, John worked at small, medium, and large companies, holding positions that allowed him to exploit his passions in synthetic chemistry, project leadership, and alliance management while growing his responsibilities for managing others, ultimately as a department head. As a program director at MIT, John built a portfolio of ILP member companies, mostly in the pharmaceutical industry and headquartered in Japan, connecting them to engagement opportunities in the MIT community. Soon after returning to MIT, John began to lead a group of program directors with a combined portfolio of 60-80 global companies. In his current role, John oversees MIT Corporate Relations which houses ILP and MIT Startup Exchange.

Hong Fan
Program Director, MIT Corporate Relations



Hong Fan
Program Director
MIT Corporate Relations

Hong Fan is a Program Director at the Office of Corporate Relations at MIT. She joined OCR in August 2016, brought with her 20+ years of international work experience across semiconductor, consumer electronics, telecom, and higher education.

Prior to joining OCR, Hong spent 12 years in the semiconductor industry with executive functions in strategic marketing, business development, corporate strategy, product management, and product marketing at Analog Devices and MediaTek. During those years, Hong played instrumental roles in identifying emerging business opportunities related to wireless communication networks, smartphones, wearable devices, Internet of Things (IoT), and medical devices and applications. She led cross-functional teams in defining and driving product and market strategy for businesses with annual revenue ranging from $30 million to $100 million.

Prior to joining the semiconductor industry, Hong spent 6 years in the telecommunications and electronics industry, leading engineering teams at companies such as Lucent Technologies and Watkins-Johnson Company for the development of digital signal processing, wireless communications, and micro-controller software.

Before coming to US, Hong was a strategic research staff at the President Office of Shanghai Jiao Tong University, one of the oldest universities in China. She was the first woman to hold this highly selective position.

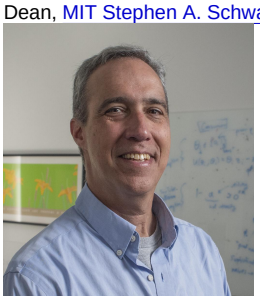
Hong has a B.S in Electronic Engineering from Shanghai Jiao Tong University, an M.S. in Electrical Engineering from University of Maryland at College Park, and an MBA from Sloan School of Management at MIT. She received numerous academic honors and awards including the McKinsey & Co. Scholarship, the NSF Graduate Research Fellowship, and the Shanghai Outstanding College Graduate Award.

View full bio

9:15 AM - 9:45 AM

Generative AI Heralds An Intellectual Revolution

Daniel Huttenlocher
Dean, MIT Stephen A. Schwarzman College of Computing



Daniel Huttenlocher
Dean
MIT Stephen A. Schwarzman College of Computing

Daniel Huttenlocher is the inaugural dean of the MIT Stephen A. Schwarzman College of Computing. He began his academic career at Cornell University in 1988, where he was a member of the computer science faculty. In 1998, he chaired the task force that led to the creation of Cornell's interdisciplinary Faculty of Computing and Information Science, later serving as its dean starting in 2009. In 2012, he became the founding dean of the new Cornell Tech campus in New York City.

Huttenlocher has extensive industry experience, having served as a scientist and lab director at Xerox's Palo Alto Research Center for 12 years before leaving to help establish a financial technology startup, Intelligent Markets, in 2000.

Huttenlocher's research and scholarship in computer science is broad and interdisciplinary, spanning algorithms, social media, and computer vision. He has earned the Longuet-Higgins Award for Fundamental Advances in Computer Vision (2010), and various fellowships and awards from the National Science Foundation, the Association for Computing Machinery, IEEE, and Phi Beta Kappa.

He is a member of the boards of directors of Amazon and Corning, and of the John D. and Catherine T. MacArthur Foundation, where he has served as chair since 2018.

Huttenlocher earned a bachelor's degree from the University of Michigan in 1980, double-majoring in computer and communication sciences and experimental psychology. An MIT alumnus, he earned an SM in electrical engineering and computer science in 1984 and a PhD in computer science in 1988.

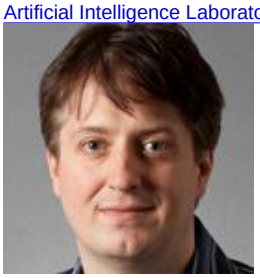
View full bio

Generative AI raises unparalleled questions. It may be tempting to see it as another in a long line of information and communication technologies, which have resulted in the profusion of human expression. However, generative AI operates in a very different manner than prior technologies, distilling human expression in order to synthesize human-like expression. The outcome of such a process, while not yet well understood, is qualitatively different from that of the human mind, creating gaps with human understanding. The essential challenges and opportunities of generative AI are thus cognitive at least as much as technological. Navigating this transformation successfully will require new concepts of human thought, not only new modes of human interaction with machines.

9:45 AM - 10:15 AM

Can Computers Beat Humans at Design?

Wojciech Matusik
Professor, Electrical Engineering and Computer Science , MIT Computer Science and Artificial Intelligence Laboratory



Wojciech Matusik
Professor, Electrical Engineering and Computer Science
MIT Computer Science and Artificial Intelligence Laboratory

Wojciech Matusik is a professor in MIT's Department of Electrical Engineering and Computer Science, and leads the Computational Fabrication Group at the Computer Science and Artificial Intelligence Laboratory. His research interests are in computer graphics, computational design and fabrication, computer vision, robotics and human-computer interaction. Before coming to MIT, he worked at Mitsubishi Electric Research Laboratories, Adobe Systems and Disney Research Zurich. He has received a Ruth and Joel Spira Award for Excellence in Teaching, a DARPA Young Faculty Award and a Sloan Foundation fellowship. He has been named one of the world's top 100 young innovators by MIT Technology Review and received a Significant New Researcher Award from ACM Siggraph. He earned a PhD in computer graphics at MIT.

View full bio

Design is everywhere: high-performance turbines, polymers with outstanding material properties, unmanned aerial vehicles, metamaterials, or computer algorithms. However, the best designs are a product of tremendous work of high-skilled domain experts. I will show that we are on the verge of a transition where computational methods start beating humans at design. I will describe a series of questions that need to be addressed to move the field of computational design forward: how to represent a design, how to represent design space, how to find designs with optimal performance, and how to bridge the gap between simulation and reality.

10:15 AM - 10:45 AM

Learning Control for Dexterous Robotic Manipulation
Russ Tedrake
Associate Professor of Computer Science and Engineering
Head, Robot Locomotion Group (CSAIL), MIT Department of Electrical Engineering and Computer Science

Russ Tedrake
Associate Professor of Computer Science and Engineering
Head, Robot Locomotion Group (CSAIL)
MIT Department of Electrical Engineering and Computer Science

Russ Tedrake is the Toyota Professor in MIT's Department of Electrical Engineering and Computer Science, and a member of the Computer Science and Artificial Intelligence Laboratory, where he leads the Center for Robotics. He is also vice president of robotics research at the Toyota Research Institute. His research focused on motor control systems in animals and machines that can execute dynamically dexterous tasks and interact with uncertain environments. Current projects include robust and efficient bipedal locomotion on flat terrain, multi-legged locomotion over extreme terrain, flapping-winged flight, and feedback control for fluid dynamics. He has received an NSF Career Award, an MIT Jerome Saltzer Award for undergraduate teaching, a DARPA Young Faculty Award, an MIT Spira teaching award, and a faculty fellowship at Microsoft Research. He earned a BSE from the University of Michigan, Ann Arbor, and a PhD from MIT.

View full bio

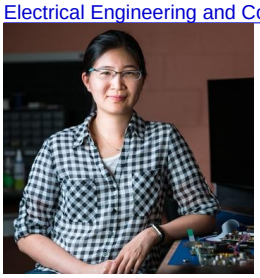
Advances in machine learning and control have enabled a new breed of dexterous robots that can leverage rich perceptual inputs and manipulate objects that would be difficult to model in a simulation. In this talk, I'll describe recent results in feedback control from pixels, intuitive physics, and control for dexterous manipulation. I'll describe some open theoretical challenges and show some fun experimental results.

10:45AM – 11:15AM

Efficient Computing for Autonomy and Navigation

Vivienne Sze

Associate Professor of Electrical Engineering and Computer Science, MIT Department of Electrical Engineering and Computer Science



Vivienne Sze
Associate Professor of Electrical Engineering and Computer Science
MIT Department of Electrical Engineering and Computer Science

Vivienne Sze is an Associate Professor in the Electrical Engineering and Computer Science Department at MIT. She works on computing systems that enable energy-efficient machine learning, computer vision, and video compression/processing for a wide range of applications, including autonomous navigation, digital health, and the internet of things. She is widely recognized for her leading work in these areas and has received many awards, including the AFOSR and DARPA Young Faculty Award, the Edgerton Faculty Award, several faculty awards from Google, Facebook, and Qualcomm, the 2018 Symposium on VLSI Circuits Best Student Paper Award, the 2017 CICC Outstanding Invited Paper Award, and the 2016 IEEE Micro Top Picks Award. As a member of the JCT-VC team, she received the Primetime Engineering Emmy Award for the development of the HEVC video compression standard. She is a co-editor of High Efficiency Video Coding (HEVC): Algorithms and Architectures (Springer, 2014) and co-author of Efficient Processing of Deep Neural Networks (Synthesis Lectures on Computer Architecture, Morgan Claypool, 2020). For more information about Prof. Sze's research, please visit http://sze.mit.edu.

View full bio

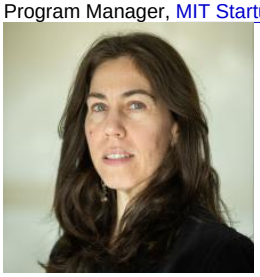
A broad range of next-generation applications will be enabled by low-energy autonomous vehicles including insect-size flapping wing robots that can help with search and rescue, chip-size satellites that can explore nearby stars, and blimps that can stay in the air for years to provide communication services in remote locations. Autonomy capabilities for these vehicles will be unlocked by building their computers from the ground up, and by co-designing the algorithms and hardware for autonomy and navigation. In this talk, I will present various methods, algorithms, and computing hardware that deliver significant improvements in energy consumption and processing speed for tasks such as visual-inertial navigation, depth estimation, motion planning, mutual-information-based exploration, and deep neural networks for robot perception. We will also discuss the importance of efficient computing to reduce carbon emissions for sustainable large-scale deployment of autonomous vehicles. Much of the work presented in this talk was developed in the Low-Energy Autonomy and Navigation (LEAN) interdisciplinary group at MIT (http://lean.mit.edu), which is co-directed by Vivienne Sze and Sertac Karaman.

11:15 AM - 11:45 AM

Networking Break

11:45 AM - 12:45 PM

MIT Startup Exchange Lightning Talks
Ariadna Rodenstein
Program Manager, MIT Startup Exchange



Ariadna Rodenstein
Program Manager
MIT Startup Exchange

Ariadna Rodenstein is a Program Manager at MIT Startup Exchange. She joined MIT Corporate Relations as an Events Leader in September 2019 and is responsible for designing and executing startup events, including content development, coaching and hosting, and logistics. Ms. Rodenstein works closely with the Industrial Liaison Program (ILP) in promoting collaboration and partnerships between MIT-connected startups and industry, as well as with other areas around the MIT innovation ecosystem and beyond.

Prior to working for MIT Corporate Relations, she worked for over a decade at Credit Suisse Group in New York and London, in a few different roles in event management and as Director of Client Strategy. Ms. Rodenstein has combined her experience in the private sector with work at non-profits as a Consultant and Development Director at New York Immigration Coalition, Immigrant Defense Project, and Americas Society/Council of the Americas. She also served as an Officer on the Board of Directors of the Riverside Clay Tennis Association in New York for several years. Additionally, she earned her B.A. in Political Science and Communications from New York University, with coursework at the Instituto Tecnológico y de Estudios Superiores de Monterrey in Mexico City, and her M.A. in Sociology from the City University of New York.

Cyrus Shaoul
Co-founder and CEO
Leela AI

Javier Ramos
Co-founder and EVP R&D
Inkbit

Sebastian Bauer
CEO
Ubicept

Matthew Cherewka
Director, Product Marketing and Strategy
Vecna Robotics

Sampriti Bhattacharyya
Co-founder and CEO
Navier

Lars Erik Matsson Fagernæs
Co-founder and CEO
Aviant

Hector Xu
Founder and CEO
Rotor

Ian Seiferling
Co-founder and CEO
AdaViv

Vinayak Ramesh
Co-founder and CEO
Ikigai Labs

Fadi Micaelian
CEO
Sparkdit

12:45 PM - 1:45 PM Lunch with Startup Exhibit

1:45 PM - 1:50 PM Industry Engagement at The Schwarzman College of Computing
Aude Oliva

Director of Strategic Industry Engagement, MIT Schwarzman College of Computing
MIT Director, MIT-IBM Watson AI Lab
Co-lead, MIT AI Hardware Program
Senior Research Scientist, CSAIL


Aude Oliva

Director of Strategic Industry Engagement, MIT Schwarzman College of Computing
MIT Director, MIT-IBM Watson AI Lab
Co-lead, MIT AI Hardware Program
Senior Research Scientist, CSAIL

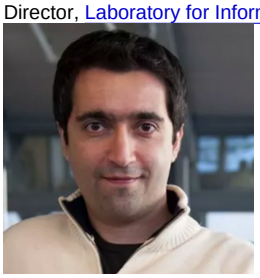
Aude Oliva, PhD is the MIT director in the MIT-IBM Watson AI Lab and director of strategic industry engagement in the MIT Schwarzman College of Computing, leading collaborations with industry to translate natural and artificial intelligence research into tools for the wider world. She is also a senior research scientist at the MIT Computer Science and Artificial Intelligence Laboratory (CSAIL), where she heads the Computational Perception and Cognition group.

Oliva has received an NSF Career Award in computational neuroscience, a Guggenheim fellowship in computer science and a Vannevar Bush Faculty Fellowship in cognitive neuroscience. She has served as an expert to the NSF Directorate of Computer and Information Science and Engineering on the topic of human and artificial intelligence. She is currently a member of the scientific advisory board for the Allen Institute for Artificial Intelligence. Her research is cross-disciplinary, spanning human perception and cognition, computer vision and cognitive neuroscience, and focuses on research questions at the intersection of all three domains. She earned a MS and PhD in cognitive science from the Institut National Polytechnique de Grenoble, France.

1:50 PM - 2:20 PM

Future of Aerial Vehicles Enabled by Agile Autonomy

Sertac Karaman
Associate Professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology
Director, Laboratory for Information and Decision Systems (LIDS)



Sertac Karaman
Associate Professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology
Director
Laboratory for Information and Decision Systems (LIDS)

Sertac Karaman is the director of the Laboratory for Information and Decision Systems, and an associate professor of Aeronautics and Astronautics at MIT. His research areas are robotics and control theory, particularly the applications of probability theory, stochastic processes, stochastic geometry, formal methods, and optimization for the design and analysis of high-performance cyber-physical systems. The applications of this research include driverless cars, unmanned aerial vehicles, distributed aerial surveillance systems, air traffic control, and certification and verification of control systems software. Karaman received a PhD in electrical engineering and computer science and an SM in mechanical engineering from MIT and BS degrees in mechanical engineering and in computer engineering from the Istanbul Technical University.

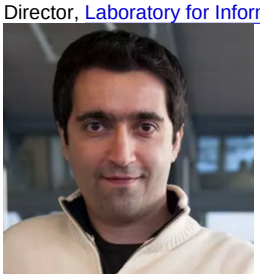
View full bio

Powered aerial vehicles have been around for more than a century. They have always been operated by a dedicated pilot, who has been on the vehicle for most of the century; remotely-piloted vehicles were introduced relatively recently, and still require, often multiple, vehicles. Today, the field of aerial vehicles is going through one of the most exciting breakthroughs in its hundred-year history. Autonomy-enabled vehicles will transform not only the aerospace industry but also consumer electronics, inspection and services, and more. In this talk, we discuss the future of autonomy-enabled aerial vehicles. We highlight key emerging technologies, including agile vehicles, miniature vehicles, vehicle teams and others.

2:20 PM - 3:00 PM

MIT and Industry Panel Discussion: The Present and Future of AI and Autonomy

Sertac Karaman
Associate Professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology
Director, Laboratory for Information and Decision Systems (LIDS)



Sertac Karaman
Associate Professor of Aeronautics and Astronautics at the Massachusetts Institute of Technology
Director
Laboratory for Information and Decision Systems (LIDS)

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View full bio

John Tylko
Chief Innovation Officer, Aurora Flight Sciences, A Boeing Company

John Tylko
Chief Innovation Officer
Aurora Flight Sciences, A Boeing Company

John Tylko serves as Aurora's Chief Innovation Officer, responsible for leading technology strategy and commercialization efforts. He oversaw Aurora's major new program and customer acquisition efforts, enabling Aurora's rapid growth which led to its acquisition by Boeing in 2017. He also developed the vision for Boeing's Aerospace and Autonomy Center.

His career has been focused on the development of innovative technologies and products, spanning both the aerospace and the electronics and computer industry. He received a Bachelor of Science in Aeronautics and Astronautics from the Massachusetts Institute of Technology in 1979 and began his engineering career at General Electric where he developed the first composite structural assemblies for aircraft engines. Tylko cofounded General Computer in 1981, which developed innovative electronics and personal computer products. He also cofounded VideoGuide, which developed the first interactive television program guide.

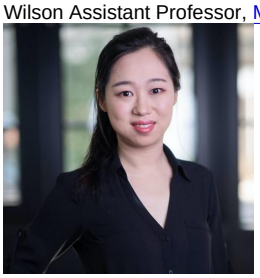
Tylko helped start Aurora Flight Sciences with John Langford in 1989 and was a member of Aurora's Board of Directors for nearly thirty years from 1989 to 2017. He led Aurora's Global Hawk program, built its state of-the-art composite structures manufacturing center, and established Aurora's aerostructures business sector. Tylko founded Aurora's Research and Development Center in Cambridge in 2005 and was the principle architect of Aurora's strategy for aerospace autonomy.

He has been a lecturer in MIT's Department of Aeronautics and Astronautics and is a recipient of MIT's Founders Award which recognizes innovation and entrepreneurship. Tylko was a Guggenheim Fellow at the National Air and Space Museum and is currently an Associate Fellow of the American Institute of Aeronautics and Astronautics, as well as a Fellow of the Royal Aeronautical Society. He is a Ph.D. candidate at MIT researching flight simulation technology.

David Doria
Director of Engineering – Automated Driving
Magna

3:00 PM - 3:30 PM

Building Dependable Large-Scale Autonomy Using Neural Certificates
Chuchu Fan
Wilson Assistant Professor, MIT Department of Aeronautics and Astronautics



Chuchu Fan
Wilson Assistant Professor
MIT Department of Aeronautics and Astronautics

Chuchu Fan is the Wilson Assistant Professor in the Department of Aeronautics and Astronautics at MIT, where she leads the Reliable Autonomous Systems Lab (REALM). Fan's research utilizes rigorous mathematics, including formal methods, machine learning, and control theory, for the design, analysis, and verification of safe autonomous systems. Her recent research focuses on certificate learning alongside learning-enabled robotics control systems to provide concise, data-driven proofs that guarantee safety and stability of a learned control system, and applying these tools to practical robotics problems. Fan received her PhD in computer engineering from the University of Illinois at Urbana-Champaign and BE in automation from Tsinghua University, China.

View full bio

Learning-enabled data-driven methods have demonstrated impressive empirical performance on challenging autonomous systems. But this performance comes at the cost of reduced transparency and lack of guarantees on the safety or stability of the systems. In this talk, I will present several of our recent efforts that combine machine learning with formal methods and control theory to enable the design of dependable and safe autonomous systems. The approach we took, called neural certificates, provides supervision during training by allowing safety and stability requirements to influence the training process. As a result, the learned policies can achieve a much-improved performance on safety and stability, especially on complex autonomous systems with a large number of agents, following nonlinear and nonholonomic dynamics and needing to satisfy high-level specifications.

3:30 PM - 4:00 PM

Networking Break

4:00 PM - 4:30 PM

Doing for Our Robots What Nature Did for Us
Leslie Kaelbling
Scientific Advisor, MIT Quest
Panasonic Professor of Computer Science and Engineering, Department of Electrical Engineering and Computer Science

Leslie Kaelbling
Scientific Advisor, MIT Quest
Panasonic Professor of Computer Science and Engineering
Department of Electrical Engineering and Computer Science

Leslie Kaelbling is a Professor at MIT. She has an undergraduate degree in Philosophy and a PhD in Computer Science from Stanford, and was previously on the faculty at Brown University. She was the founding editor-in-chief of the Journal of Machine Learning Research. Her research agenda is to make intelligent robots using methods including estimation, learning, planning, and reasoning. She is not a robot.

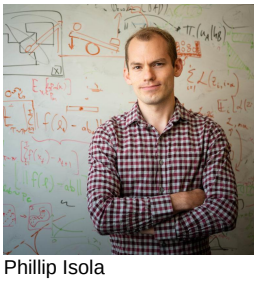
View full bio

We, as robot engineers, have to think hard about our role in the design of robots and how it interacts with learning, both in "the factory" (that is, at engineering time) and in "the wild" (that is, when the robot is delivered to a customer). I will share some general thoughts about the strategies for robot design and then talk in detail about some work I have been involved in, both in the design of an overall architecture for an intelligent robot and in strategies for learning to integrate new skills into the repertoire of an already competent robot.

4:30 PM - 5:00 PM

When Faking Your Data Actually Helps — Learning Vision From Gans, Nerfs, and Noise
Phillip Isola

Associate Professor, Department of Electrical Engineering and Computer Science



Phillip Isola

Associate Professor, Department of Electrical Engineering and Computer Science

Phillip Isola is an Associate Professor in MIT's Department of Electrical Engineering and Computer Science and an investigator in the Computer Science and Artificial Intelligence Laboratory. His work focuses on why we represent the world the way we do and how we can replicate these abilities in machines. Before coming to MIT, he was a visiting research scientist at OpenAI. He earned a PhD in brain and cognitive sciences at MIT and spent two years as a postdoc at the University of California, Berkeley.
Perhaps the most crucial factor in the performance of modern AI systems is the scale and quality of their training data. It is well known that the bigger the data, the better the performance. This talk asks: rather than just building bigger data, can we design better data? For this purpose I will turn to synthetic data, and explore three kinds: images sampled from generative models (GANs), images synthesized by radiance fields (NeRFs), and procedural images generated by simple scripts ("noise"). I will show how these data sources support new approaches to model training, and I will argue that data of these kinds is not just a cheap substitute for "real data", it can in fact be better than the real thing.

5:00 PM - 5:30 PM

Towards Human-Derived Frameworks for Intelligent Sensorimotor Control

Nidhi Seethapathi
Assistant Professor, Department of Electrical Engineering and Computer Science (EECS)
Assistant Professor
Department of Brain and Cognitive Sciences

The best current robots still fall short of the versatility, efficiency, stability, and robustness to uncertainty achieved by the human sensorimotor control system. One way to understand how such remarkable performance is achieved is to develop theoretical frameworks and computational models that capture empirical evidence of how humans select, execute, and learn movements. In this talk, I will summarize the findings of our past and ongoing work seeking to uncover the computational principles underlying efficient locomotor control in natural environments, the strategies underlying robust locomotion in the presence of intrinsic and extrinsic perturbations, and the seamless integration of sensorimotor control with higher-level cognition across different timescales. These principles can provide a blueprint for engineers seeking to develop autonomous and robot-aided systems that exhibit intelligence comparable to biological sensorimotor control.

5:30PM - 6:30 PM

Adjournment with Networking Reception