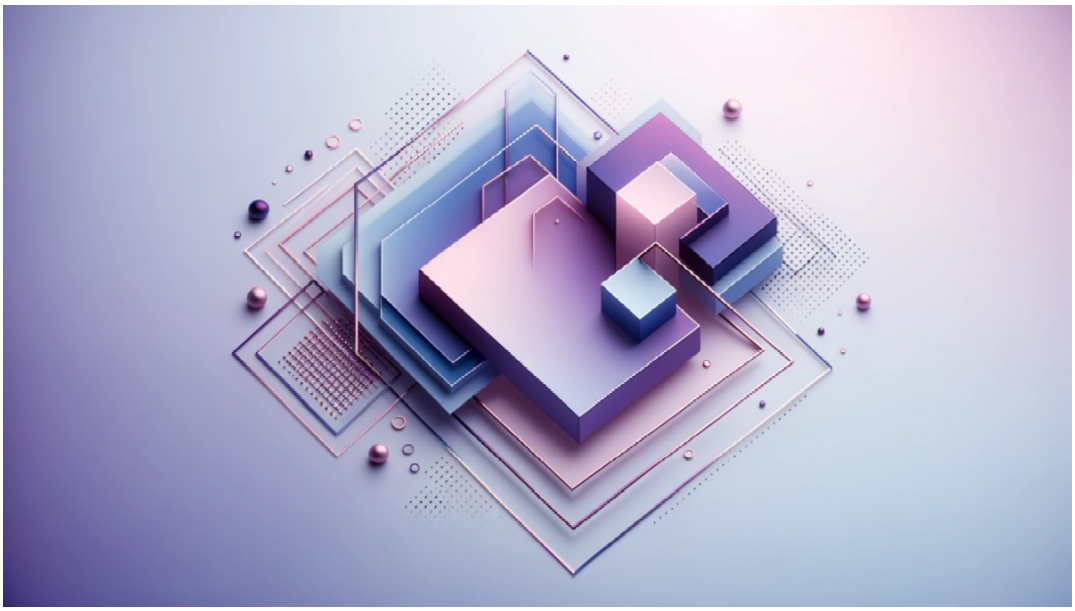
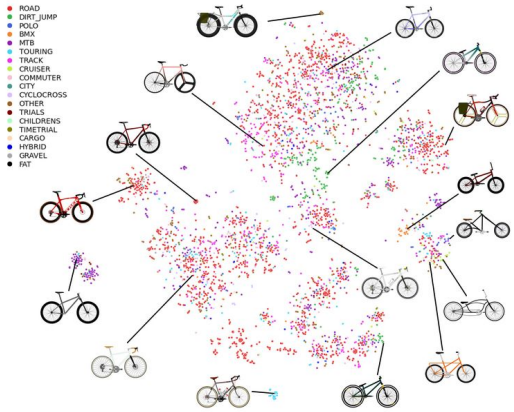
MIT-IBM Watson AI Lab



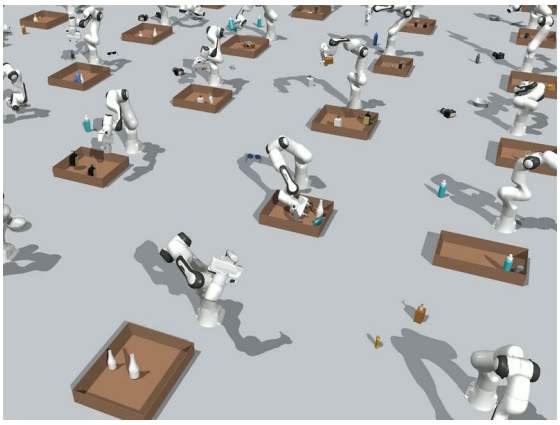
In the Lab



To excel at engineering design, generative AI must learn to innovate

[AI models that prioritize similarity falter when asked to design something completely new.]

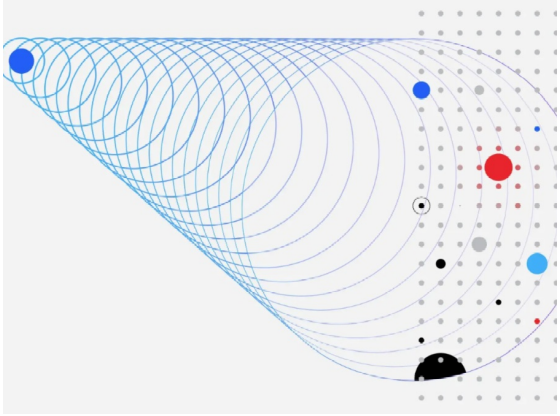
Lab researchers Faez Ahmed, Dan Gutfreund, Akash Srivastava, and their colleague examined how deep generative models could be trained to assist with mechanical engineering problems and, with the use of bikes, illustrated that the models need to focus on design requirements.



New technique helps robots pack objects into a tight space

[A family of generative AI models work together to solve multistep robot manipulation problems.]

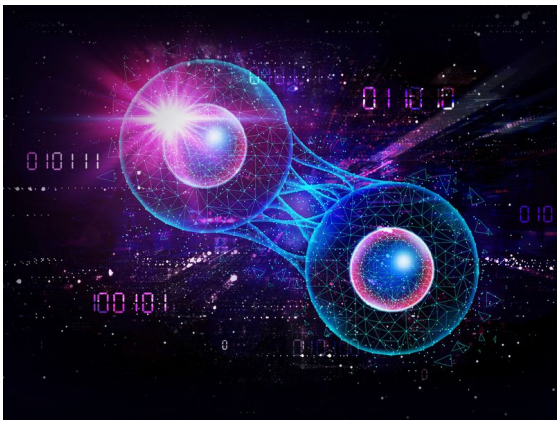
A team led by Lab researchers Joshua Tenenbaum, Tomas Lozano-Perez, and Leslie Kaelbling developed a suite of diffusion models that each represented a constraint and worked together to solve the problem faster and with more successful solutions



What is AI inferencing?

[The process of running live data through a trained AI model to make a prediction or solve a task]

IBM Research explains how inference can take up most of an AI model's time, which can come with significant costs. Ways to speed up inference therefore include faster hardware, smaller models, and removal of bottlenecks in middleware.



A more effective design for engineering a cell into a new state

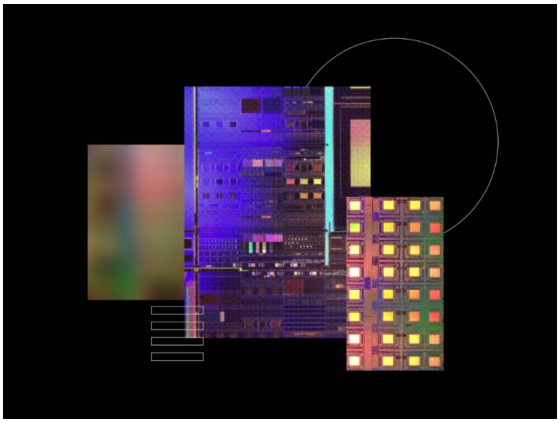
[Focusing on causal relationships in genome regulation]

A new AI method from Lab researcher Caroline Uhler's group could help scientists identify new immunotherapy techniques or regenerative therapies. The technique looks at cause-and-effect relationships to identify optimal genetic perturbations for an intervention.

An AI model for advanced pattern generation

[A new generative model PFGM++ outperforms diffusion models in image generation.]

Inspired by physics, researchers working with the Lab's Tommi Jaakkola unified diffusion models and Poisson Flow Generative Models (PFGM) for better pattern recognition. The work potentially has wide applicability, from antibody and RNA sequence generation to audio production and graph generation.



What are semiconductors?

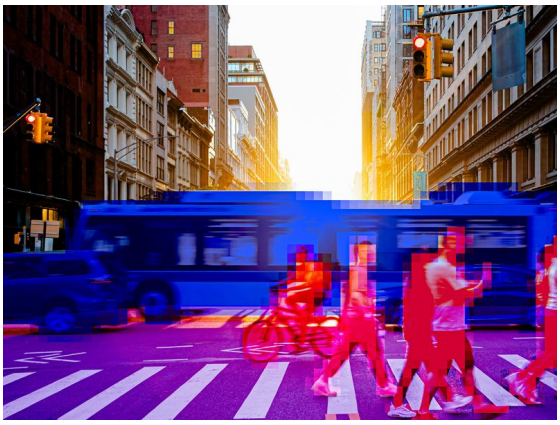
[Semiconductors power computer chips. But how are they made, and how do they work?]

Tiny transistors make up computer chips and are composed of material, that when charged or not, can create signals with a set of binary states. To create a chip, silicon, found in sand, is often chosen to undergo a process of heating, shaping, and EUV lithography.

Helping computer vision, language models understand what they see

[Synthetic data improves a model’s ability to grasp conceptual information]

A team led by Lab researchers Donghyun Kim, Rameswar Panda, Rogerio Feris, Leonid Karlinsky, and Lab co-director Aude Oliva created a new annotated synthetic dataset of images that depict a wide range of scenarios, which can be used to help machine-learning models understand the concepts in a scene. This could be used to enhance automatic captioning and question-answering systems.



AI model speeds up high-resolution computer vision

[The system could improve image quality in video or help autonomous vehicles identify road hazards in real-time.]

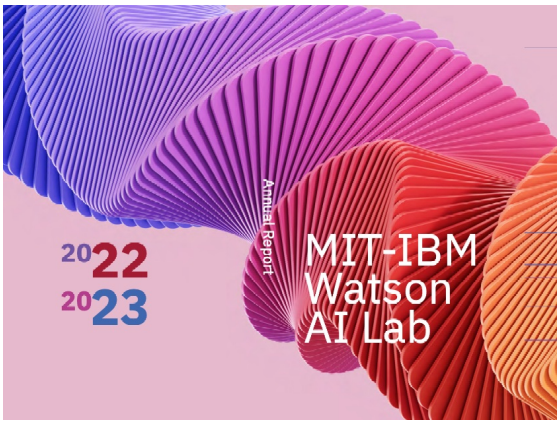
A new machine-learning model from the group of Lab researchers Song Han and Chuang Gan can perform semantic segmentation — categorizing every pixel — accurately in real-time on a device with limited hardware resources.

David Cox on foundation models

[IBM Research video shorts]

In a series of video shorts, Lab co-director David Cox covers a common misconception of foundation models, what's being done to limit risks of foundation models, and why smaller models have clout too.

Annual Report

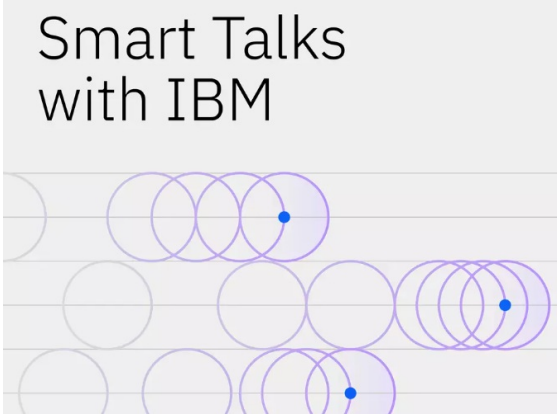


MIT-IBM Watson AI Lab

[2022-2023]

This annual report demonstrates the impacts the Lab has had over the last year on student development and education in AI, how the Lab has built value in industry with our corporate members, and the progress we've made to advance the field of AI and its influence on other sectors.

In the Media



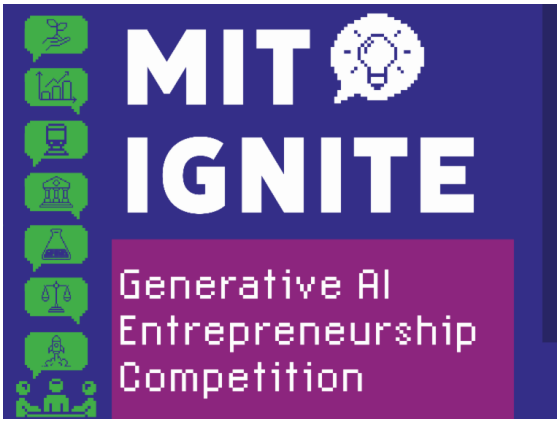
Transformations in AI: Why foundation models are the future

Major breakthroughs in AI research often reshape the design and utility of AI in both business and society. Lab co-director David Cox speaks with *Smart Talks with IBM* about the conceptual underpinnings of modern AI, foundation models, self-supervised machine learning, and the practical applications of AI and data platforms like watsonx in business and technology.

35 Innovators Under 35: Connor Coley

Each year, *MIT Technology Review* examines the "people driving the next wave of innovation," selecting 35 individuals across robotics, AI, climate and energy, biotechnology, and computing. Lab researcher Connor Coley is one of those people, developing generative AI for chemistry and identifying molecules to test for their properties and new applications.

Upcoming Events



MIT Ignite: Generative AI Entrepreneurship Competition

Fostering innovative projects within the realm of generative AI
October 30, 3-5:30 p.m. ET

The Martin Trust Center for MIT Entrepreneurship and the Lab are co-sponsoring this in-person event, during which teams of undergraduate students through postdocs will present to judges their transformative ideas and projects with generative AI that could significantly influence many industries and sectors. Register here.

Event Recordings

The Nano Summit
During the first annual flagship conference for MIT.nano, MIT experts — including Lab researchers William Oliver, Rafael Jaramillo, Frances Ross, and Jesús del Alamo — highlighted the astonishing research being done at MIT and look to the future of nanoscience and engineering.

Lab Highlights

The Lab had 29 papers accepted to the Conference and Workshop on Neural Information Processing Systems (NeurIPS), an annual machine learning and computational neuroscience conference.

The MIT Case Studies in Social and Ethical Responsibilities of Computing (SERC) aims to advance new efforts within and beyond the MIT Schwarzman College of Computing and regularly shares findings in its issues.

Lab researcher Elsa Olivetti appointed associate dean of engineering at MIT.

Lab researcher Regina Barzilay elected to the National Academy of Medicine for 2023, "for the development of machine learning tools that have been transformational for breast cancer screening and risk assessment, and for the development of molecular design tools broadly utilized for drug discovery."

Online Learning

Making AI Work: Machine Intelligence for Business and Society
A joint MIT Sloan & Schwarzman College of Computing Executive and Professional Course begins November 15.

Unsupervised Machine Learning: Unlocking the Potential of Data
A joint MIT Sloan & Schwarzman College of Computing Executive and Professional Course begins November 15.

Artificial Intelligence: Implications for Business Strategy
A joint MIT CSAIL and MIT Sloan School of Management Course begins November 22.

Machine Learning in Business
A joint MIT CSAIL and the MIT Sloan School of Management Course begins February 7, 2024.