



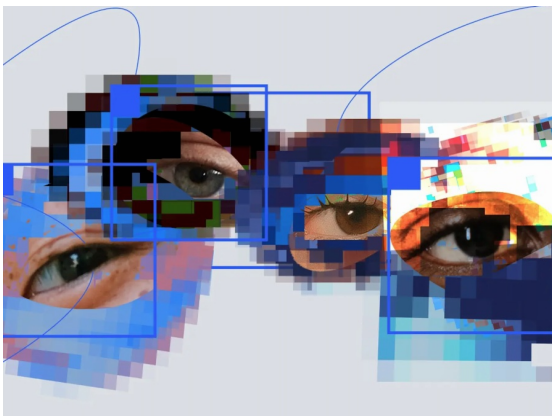
## In the Lab



### Daniel Huttenlocher

#### [Ushering in a new era of computing](#)

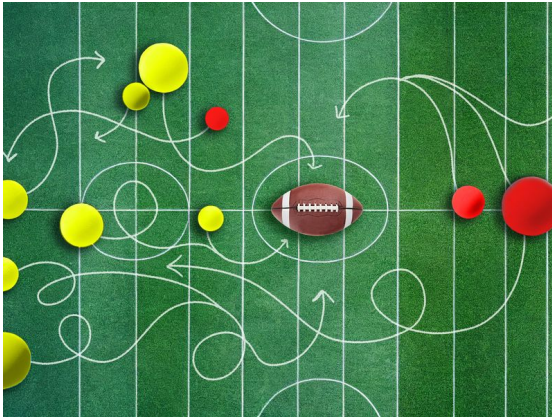
MIT Lab co-chair Dean Dan Huttenlocher is steering the MIT Schwarzman College of Computing in such a way that "...it explores ways to support but also to lead the technological changes that are reshaping the world. A bi-directional, interdisciplinary approach is key to the agenda, according to Huttenlocher. 'We want to harness the forefront of results in computing and infuse them with the other disciplines,' he says."



### Debugging foundation models for bias

#### [Reducing bias in large pre-trained AI models without expensive retraining](#)

Large, pre-trained AI models known as foundation models are attractive to companies for integrating AI into their operations; however the models can come with biases. At the high-profile conference NeurIPS, researchers from the Lab and IBM Research are demonstrating ways they've developed to mitigate bias.



## A far-sighted approach to machine learning

[AI system can teach cooperative or competitive AI agents to find an optimal long-term solution.](#)

Lab researchers working with the Jonathan How group have developed a machine-learning framework that enables AI agents to consider what other agents will do as time approaches infinity, not just over a few next steps. The agents can then adapt their behaviors accordingly to influence the others' future behaviors.

## The next wave

[IBM Quantum Summit 2022 keynote](#)

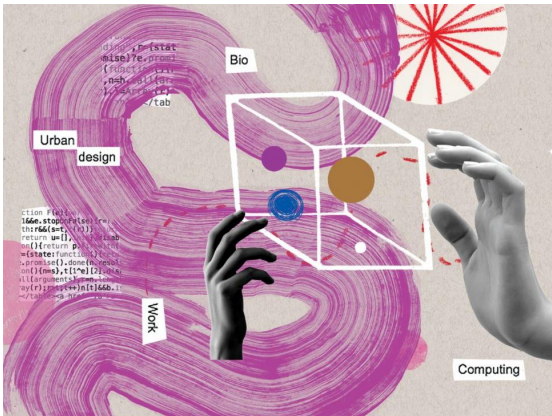
Dario Gil, Lab IBM chair, IBM senior VP and director of research, shared IBM's vision for tomorrow's computing architecture during the recent IBM Quantum Summit 2022 keynote. "It is about combining different disciplines to push the field of computing forward." He summarized it as a combination of bits, neurons, and qubits coming together in a hybrid cloud computing space.



## Design for anything and everything

[Researchers across MIT apply disciplined approach to form and function.](#)

Lab professor Faez Ahmed and his team are creating new AI-driven methods to generate novel designs for various products, from bicycles to aircrafts and ships. Beginning with a database of designs, they apply machine-learning algorithms and computer simulations to identify elements for improvement and accelerate discovery.



## Elsa Olivetti and Rafael Gomez-Bombarelli develop new recipes for new materials

[Pairing computational design techniques with machine learning to invent and improve materials](#)

The Lab's Elsa Olivetti and Rafael Gomez-Bombarelli are evaluating and rethinking materials over their lifespan, from the catalysts that drive chemical reactions to the cement used in buildings, to improve performance and sustainability.





## Ensuring AI works with the right dose of curiosity

[Balancing “exploration” versus “exploitation” of known pathways in reinforcement learning](#)

In reinforcement learning, AI systems receive rewards and punishments for good and unwanted behaviors to complete a task. Working with the Lab's Pulkit Agrawal group, researchers have developed an algorithm automatically increases an AI's curiosity when it's needed, and suppresses it if the agent gets enough supervision from the environment to know what to do.



## Synthetic data can offer real performance improvements

[Making models more accurate and eliminating some privacy, copyright, and ethical concerns](#)

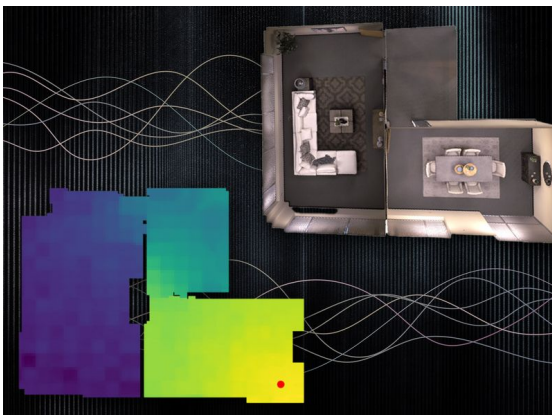
Lab researchers working with Rogerio Feris and Lab co-director Aude Oliva have built a synthetic dataset of video clips showing a wide range of human actions, which they used to train machine-learning models for computer vision. They found that models trained with synthetic data could outperform the same ones trained on real data.



## Ways to use synthetic data to improve AI models

[Protecting sensitive data, improving accuracy, finding and mitigating bias and more](#)

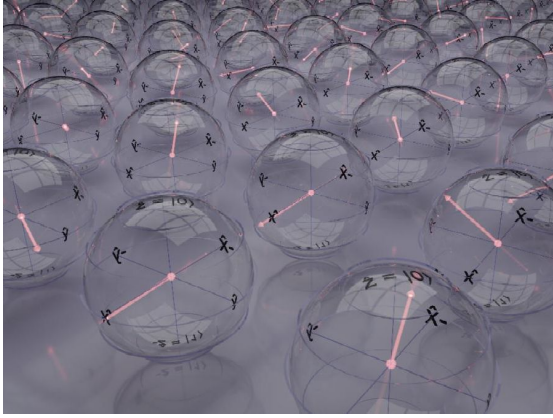
Researchers from the Lab and IBM Research are using synthetic data, for instance, to generate a made-up language to help AI systems on less dominant languages, design machines that move via linkage mechanisms, "hallucinate" images to improve machine translation, probe stock prediction models, and de-bias language classification models.



## Using sound to model the world

[New system can simulate how a listener would hear a sound from any point in a room.](#)

Lab researchers, working with the Joshua Tenenbaum and Antonio Torralba groups, have developed a machine-learning technique that accurately captures and models the underlying acoustics of a scene from only a limited number of sound recordings.

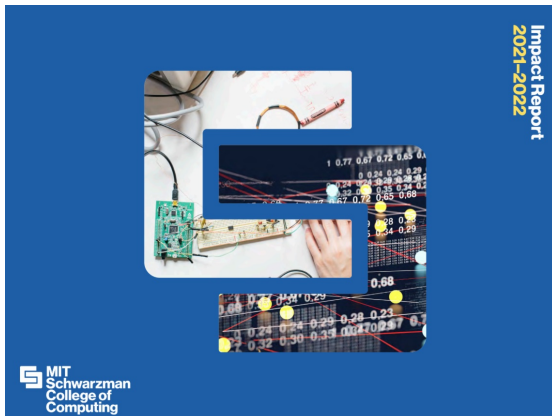


## Explainer: error suppression, error mitigation, and error correction

[Error handling in quantum computing requires fixing at every step of system design.](#)

Quantum bit errors are more complex than classical bit errors. Not only can the qubit's zero or one value change, but qubits also come with a phase — kind of like a direction that they point. Thus, three methods have been developed to handle issues that arise, each with their own research and development considerations.

## Annual Report

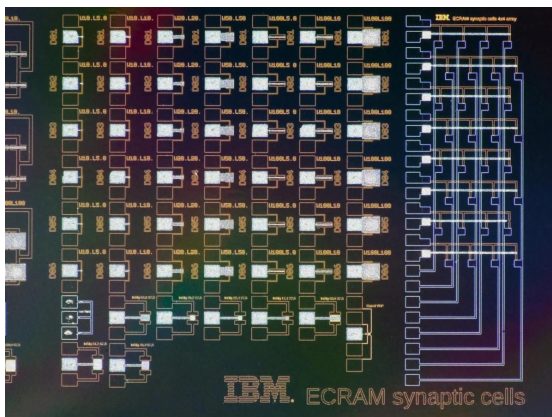


### MIT Schwarzman College of Computing Impact Report

[2021-2022](#)

The MIT Schwarzman College of Computing's Impact report offers a high-level view of its progress and impact on computing, education, and research at MIT and beyond, including notable contributions from Lab research and members.

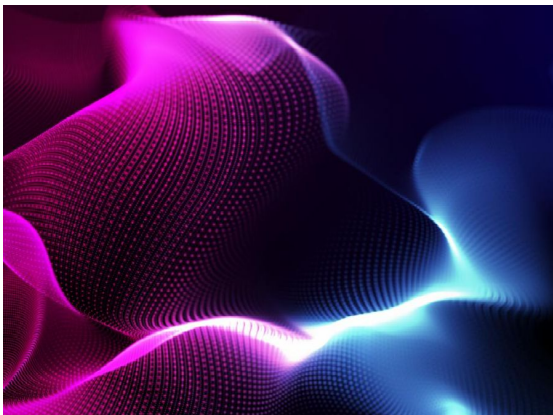
## In the Media



### Computing with chemicals makes faster, leaner AI

[Battery-inspired artificial synapses are advancing at unprecedented speeds](#)

Researchers from the Lab and elsewhere see promise in a new type of device, electrochemical RAM (ECRAM), for analog AI that can run at unprecedented speeds, *reports IEEE Spectrum*. Recent work out of the Lab identifies new ways to make the technology even faster and more efficient, and scalable.



### This AI can harness sound to reveal the structure of unseen spaces

[Modeling sound propagation through space](#)

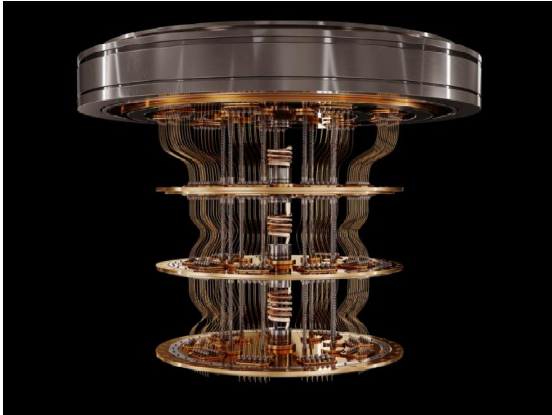
Researchers from the Lab are modeling spatial acoustics, with a focus on reverberations, *Popular Science* reports. Two significant applications involve uses with virtual reality and enhancing sensors and devices underwater or in low light.



## AI that sees with sound

[Neural acoustic field model can depict how a sound changes with location.](#)

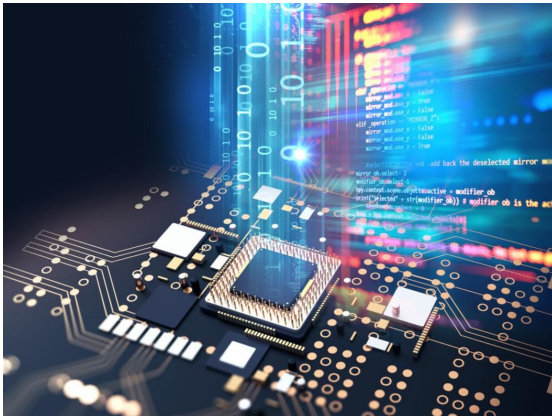
"The researchers say the tech could be applied to virtual and augmented reality software or robots that have to navigate complex environments. In the future, they plan to enhance the system so that it can generalize to new and larger scenes, such as entire buildings or even whole towns and cities," reports *TechCrunch*.



## IBM: 'America must invest in a new model of innovation'

[Dario Gil on the future of the tech sector](#)

In *Fortune*, Lab IBM chair Dario Gil sees a change coming, not only in the technology but the innovation ecosystem: "...we need to remember that the future of America's tech sector will be built on both the software and the hardware it runs on, a model where innovation is undertaken by researchers at labs and workers in manufacturing facilities—not just programmers in office buildings."



## MIT boffins cram machine learning training into microcontrollers

[Squeezing machine learning into 256KB of RAM](#)

*The Register* details how researchers from the Lab have developed a way to enable deep learning on edge devices, improving efficiency and reducing memory requirements. Using a software-hardware co-design, the team working with Lab researcher Song Han has demonstrated that they can perform on-device training in computer vision, with less than 256KB of memory.

## Event Recording

[Lab research in 60 seconds](#)

Two Lab researchers, Soumya Ghosh and Mikhail Yurochkin, describe their work to mitigate bias in AI foundation models, presented at NeurIPS, and introduce the first open-source library for individual fairness.

## Lab Highlights

The Lab is currently [accepting applications for summer 2023 interns](#) who will work on cutting-edge research in areas such as AI, machine learning, quantum computing, security and more.

Lab researcher Connor Coley honored as part of the first cohort of Schmidt Futures' [AI2050 Early Career Fellows](#) to "work on the hard problems we must solve in order for AI to benefit society."

Peng Qian, a former Lab-supported graduate student, completed his thesis on ["Cause, Composition, and Structure in Language."](#)