## **2025 CSAIL Alliances Annual Meeting** Key Takeaways



## Alliances 2025 CSAIL ALLIANCES

#### **Overview: CSAIL Alliances**

The CSAIL Alliances Annual Meeting, our flagship annual event, brings together member companies, CSAIL researchers, startups, and collaborators for three dynamic days on MIT's campus. This year's Annual Meeting offered a front-row seat to the groundbreaking work happening across CSAIL and the broader tech ecosystem.

CSAIL (MIT's Computer Science & Artificial Intelligence Lab) is MIT's largest lab with over 1700 people, 60+ research groups, 1000+ students and over 900 active projects. Alliances acts as a bridge between industry and CSAIL. Our member companies connect with the lab for insights into new innovative technologies, brilliant students, disruptive startups, and groundbreaking research. We offer opportunities for companies to connect with all CSAIL has to offer, from the near-term needs to the longer-term vision further out the innovation curve. As members you can receive monthly summaries of happenings in the lab, tune in to the CSAIL Alliances Podcast, and dive into our content-rich website which includes PI and student spotlights, member success case studies, a student profile book, video lab tours, and more! **At CSAIL Alliances, we help you turn world-class research into real-world impact.** All that comes together during the Annual Meeting, where we celebrate what our members and academic community have accomplished and look ahead to what comes next.

This document provides a high-level summary of the key sessions and themes from this year's event. For additional details, to follow up with a specific presenter or researcher, or to find out how you can engage more deeply with CSAIL and Alliances, please contact your <u>Client Relations Coordinator</u>.

We look forward to welcoming you back next year!



# Monday











## Workshop: Palimpzest Sam Madden: Professor, MIT EECS

- models, methods, and techniques coming out every day.

- rewriting and re-optimizing the program underneath.
- Learn more here: <u>https://dsg.csail.mit.edu/projects/palimpzest/</u>



Michael Cafarella: Principal Research Scientist, MIT CSAIL

• It's easy to waste a lot of time and money trying to optimize AI programs, especially with new

• <u>Palimpzest</u> is a system designed to help generate complex, AI-powered data processing tools easily, cheaply, and efficiently without having to manually optimize every aspect of the pipeline. • At a high level, Palimpzest lets users write declarative programs, meaning you describe what you want done (e.g., "find houses in a given area that meet a certain set of parameters") and the program automatically figures out how to do so in the most efficient and accurate way. • The name is a play on the word Palimpsest ("only zestier") because the system is constantly

## **DeepSeek Deciphered**

#### Yoon Kim: Assistant Professor, MIT EECS

- The creators of DeepSeek leveraged several innovations to cut down the cost of pretraining, including sparse mixture of experts and low-precision training.
- They also showed how to enable better math/coding reasoning in pretrained LLMs through simple reinforcement learning.
- The \$5.6M training cost is for a single training run and does not take into account the infrastructure needed to perform the necessary experiments to arrive at this final recipe.
- "My prediction is that the frontier LLM companies will leverage these efficiency innovations to train even better models, enabling new applications." ~ Professor Kim

"This workshop covered—and Professor Kim took copious questions on—an important and highly timely topic. The span of the talk from the basic elements of language models to some of the specific innovations of DeepSeek was undoubtedly of value for participants across the expertise spectrum. This kind of up-to-date briefing is the kind of thing we have learned to expect from CSAIL!" ~ Michael Stopa: Academic Manager, PlayStation







## Workshop: Getting the Most out of Alliances Lori Glover: Managing Director, MIT CSAIL Alliances

- CSAIL Alliances serves as the gateway for companies and institutions seeking meaningful collaboration with MIT's largest research lab.
- CSAIL's scale and excellence are unmatched, with 1700+ members, 130+ principal investigators, over 900 active projects, and students across 26 disciplines involved in 60 research groups.
- CSAIL Alliances provides **proactive and comprehensive** pathways for organizations to develop strong connections with the work, research, start-ups, and students of CSAIL. • Engagement happens across three main pillars:
- - **Research:** sponsored projects, working groups, expert connections, research initiatives, researcher spotlights, open source, visiting industry researchers, etc.
  - **Talent:** access to PhD, master's, and undergrad students, internships, job posts, in-person events, professional education, etc.
  - connections, etc.
- Membership directly supports impact, helping bridge federal funding gaps, enable faculty recruitment, support student participation at conferences, and fuel CSAIL-led innovation. • Value from engagement is both **tangible** and **intangible**, and can be measured through the MERIT framework: Measure, Exposure, Reach, Impact, and Tangible/Intangible benefits.

"All connections are available through CSAIL Alliances. No silos!" — Glover



• **Startups:** early-stage engagement, pitch sessions, VC connections, case studies, early



#### **Workshop: Mantis** Manolis Kellis: Professor, MIT EECS

- questions, resulting in reduced human creativity and ingenuity.
- exploration and discovery.
- knowledge itself.
- Learn more here: <u>https://home.withmantis.com/</u>

"The Mantis workshop truly stood out with its wow factor. Professor Kellis' masterful presentation skills made it both entertaining and informative. Although the one-hour session was too brief to cover every detail [of Mantis], it piqued my curiosity and left me eager to learn more. I found the concepts presented highly relevant to our research, and I am inspired to explore further and test their usefulness in our own work going forward." ~ Gustavo Sato dos Santos: VP Research, Vortexa



• Artificial intelligence is reshaping industry, but current chatbot frameworks are excluding humans from the creative process, underutilizing the extraordinary acuity of human visual cognition, hiding away necessary complexity, and providing over-confident and over-simplified answers to complex

• With <u>Mantis</u>, Professor Kellis's group introduces the idea of cognitive cartography, providing a new paradigm for human-AI collaboration that extends human conceptual reach, insight, and speed by blending natural language, structured data, and visual reasoning into an interactive canvas for

• At its core, Mantis constructs maps of meaning, latent landscapes representing ideas, documents, emails, collaborators, molecules, genes, or patients, laid out by their conceptual organization. • Mantis offers a new paradigm for how humans and machines think and create together, offering an interactive platform for seeing the invisible, reasoning through complexity, and navigating

#### Workshop: Essence of Software Design Daniel Jackson: Professor, MIT EECS

- Many software problems arise not from bugs or UI flaws but from poor conceptual design—the failure to define clear, coherent ideas that users can easily grasp.
- By basing software on well-defined, reusable concepts, developers can build systems that are more intuitive, robust, and maintainable.
- Concepts offer a way to achieve alignment across products, so that similar functions in different products are consistent, and between roles (especially bridging the gap between UX and engineering).
- For a deeper dive, read Professor Jackson's book The Essence of Software: Why Concepts Matter for Great Design: https://essenceofsoftware.com/

#### "There are a lot of fantastic classic ideas which have been underappreciated, and if we can repurpose them and focus them in the right way, they can be incredibly powerful." ~ Professor Jackson

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MEETING 2025





## Workshop: Julia, Reactant & Lux

#### Avik Pal: Graduate Student, MIT EECS

- Julia is a high-performance programming language designed for numerical and scientific computing. It combines the speed of low-level languages like C with the ease and expressiveness of higher-level languages like Python or MATLAB.
- <u>Reactant</u> is a next-generation runtime and optimization system for tensor operations in Julia. It automates many of the performance-critical aspects of the language.
- <u>Lux DL</u> is a deep learning framework in Julia tailored for scientific machine learning, with a particular emphasis on integrating neural networks into simulation and modeling tasks.
- Using Julia, Reactant, and Lux together provides a lightweight yet powerful toolchain for building and running AI models efficiently and doing so seamlessly across different kinds of hardware.
- Access the workshop toolkit here: <u>https://github.com/avik-pal/LuxReactantCSAILAlliances2025</u>

"I enjoyed that [the workshop] was in a collaborative format so I could follow along at my own pace and that there was a lot of cross-learning about it. In that sense it was a very good introduction crash course, MIT-style and I'm really glad that I attended." ~ CSAIL Alliances Member



# Tuesday









#### **Tuesday Keynote: The Neurosymbolic Future of AI for Programming** Armando Solar-Lezama: Professor, MIT EECS

- Despite widespread excitement about using generative AI for programming, there are still several open challenges, which Professor Solar-Lezama and his colleagues outline in the paper, "Challenges and Paths Towards AI for Software Engineering."
- There are emerging opportunities to leverage the strengths of AI with code generation. Some tools that have come out of his lab are:
  - OptCNF: a system that uses program synthesis (automated code generation) and machine learning to build custom translators from bit-vectors to CNF formulas, enabling automatic bug detection and program verification.
  - <u>VLMaterial</u>: a tool for generating editable procedural materials for 3D graphics.
  - <u>CRUXEval</u>: a benchmark that tests how well code language models can reason about and execute simple Python programs by asking them to predict either the output of a function or what input would produce a given output.
  - AbsInt-AI: a static analysis tool that uses language models to guide which parts of a JavaScript program should be abstracted, improving bug detection accuracy while guaranteeing that no real bugs are missed.
  - LINC: a neurosymbolic system that combines large language models with a first-order logic theorem prover to improve logical reasoning by translating natural language into formal logic and offloading inference to a symbolic solver.
- Read our PI spotlight of Professor Solar-Lezama's work here.

#### "Al for code generation has made enormous strides, but there's still plenty of scope for research before these tools can release us from the drudgery of coding." ~Professor Solar-Lezama



#### **Software Performance Engineering** Charles Leiserson: Professor, MIT EECS

- whatever software properties they value.
- With Moore's Law ending, consistent performance gains from hardware are no longer a guarantee. Therefore, it's time to consider the computing opportunities at the top of the stack, especially software performance engineering (SPE).
- DeepSeek's recent success can be heavily attributed to SPE, showing how much performance can be achieved with "educated people who can do SPE."
- Additionally, programmers with a background in SPE command a premium in the workplace comparable to those with a background in machine learning.
- <u>Fastcode.org</u> empowers SPE by bringing together a community of programmers, researchers, and educators to advance software performance engineering as a rigorous and principled scientific field.
- Read our PI spotlight of Professor Leiserson here.

"Performance is not an alternative to having better, smarter algorithms to LLMs or any kind of generative AI. It's one of the things you need to do to get there, to basically use your resources efficiently." ~ Professor Leiserson



• Performance can be thought of as "the currency of computing," allowing programmers to "buy"

#### **Programming Data Systems with Agentic Al** Sam Madden: Professor, MIT EECS

- LLMs and generative AI are fundamentally changing the way we build and work with data and systems. These tools allow users to treat all data as something that can be utilized and searched.
- Professor Madden's vision is to capture the succinctness of a programming language but applied to all of the world's data. ("How do we develop the analog of consistency and robustness of database systems with generative AI?")
- Palimpzest is an initial effort, a programming language which behaves like a relational database system, exploring hundreds of options to provide the best possible option for a given AI-related data task.
- Agentic AI is becoming increasingly central to AI development. Some open challenges in Agentic AI systems are:
  - Accurately assessing quality and cost.
  - Creating trustworthy and fully reliable systems.
  - Optimizing agent creation.
  - Debugging complex agent systems.
  - Building deterministic checks on inputs and outputs for automatic reasoning.
- Learn more about Palimpzest: <u>https://github.com/mitdbg/palimpzest</u>

#### "It's a remarkable time to be a computer scientist." ~ Professor Madden





### FinTechAl@CSAIL Initiative Kickoff

Andrew W. Lo, Faculty Director: FinTechAI@CSAIL

- In his role as Faculty Director of the CSAIL Alliances Research Initiative FinTechAI@CSAIL, Professor Lo announced this new direction of FinTech@CSAIL which will focus more heavily on AI and how it impacts financial technology and the financial industry.
- The industry panel expressed excitement about applying AI to key challenges like:
  - Efficiency & productivity
  - Regulation compliance & governance
  - Personalization & customer experience
  - Democratization of gains & opportunities
  - Fraud detection & cybersecurity (e.g. the <u>SCRAM</u> platform for <u>securely measuring</u> <u>cyber risk</u>)
  - Data processing & utilization
- Responsible, transparent, and trustworthy AI will be central to deploying AI tools in finance. It will also be important to consider the AI pipeline and put controls in place for 3rd party risk, 4th party risk, etc.
- Customers and clients expect innovation, but banks aren't necessarily designed to be innovators. That's why it's critical to collaborate with creative entities like fintech startups and academic institutions.
- For more about Professor Lo, read his <u>CSAIL Alliances PI Spotlight</u> or listen to his <u>podcast episode</u>.







#### **Startup Feature: Liquid Al** Alexander Amini: Co-founder, Liquid AI

- limited.
- can be moved down from the cloud to small edge devices like cell phones.
- any kind of sequence data, and are extremely fast.
- rural areas which might lack stable internet connectivity.
- Learn more about the company here.

"For the first time we can do significantly more with significantly less compute." ~ Dr. Amini



• Most of today's AI technology is based on transformers, which revolutionized the field but are also energy intensive, lack interpretability, rely on cloud computing, and are modality

• Born in the lab of CSAIL Director Professor Daniela Rus, Liquid AI offers a new type of AI model that is extremely efficient, uses a fraction of the compute than transformers, and

• Liquid AI models can run anywhere, are always accessible, guarantee privacy, operate on

• This technology offers new opportunities for intelligence. For example: autonomous cars in

## **Startup Feature: Foundation EGI**

#### Mok Oh: Co-founder & CEO, Foundation EGI

- Despite the billions spent on "reading the internet," current AI models still fail at translating digital knowledge into real-world understanding.
- Modern manufacturing is also incredibly inefficient, with an estimated \$8T of annual economic waste due to inefficiencies in the pipeline.
- Foundation EGI introduces a new subset of AI technology called Engineering General Intelligence, offering domain-specific agentic AI for engineering.
- This system offers a win-win for engineers, who currently spend between 30-50% of their time on tedious documentation.
- See a <u>demo video</u> of their system in action, or learn more about the company on their website. CSAIL Alliances has also released an article about the company here.

#### "There's a perfect storm brewing with the potential to dramatically transform design and manufacturing industries." ~ Dr. Oh





#### **MIT Future of Data Initiative Update**

Moderator-Daniel Weitzner: Faculty Co-Director, MIT Future of Data Figen Ceceli: Fidelity Sam Hamilton: Visa Awah Teh: Capital One

- One of the major developments from the research initiative MIT Future of Data has been OTrace, a protocol for data traceability. OTrace will empower users in to answer three simple questions about personal data they share:
  - Who has my data?
  - What are they doing with it?
  - How do I change or revoke the consent under which the data is shared?
- Traceability is vital for a new class of modern privacy contexts. We all want to share data in order to get value from personal financial services, health and fitness information, location data, and many other types of sensitive data. Still, modern consumers are justifiably hesitant to share data without visibility into how their data is being used. OTrace can help build trust in all of these modern privacy contexts.
- The first OTrace use case developed with our partners Capital One, Fidelity Investments, and Visa will enable a future of open banking and empower customers with more control over their financial data.
- Banks and financial institutions like Future of Data members Visa, Capital One, and Fidelity want to use data to improve their models and systems and are heavily invested in doing so with maximum trust and transparency.
- The next step for OTrace work is to build larger pilot deployments with industry partners and build support for ecosystem-wide deployment and standardization.

#### "There is no higher power than full transparency, and that's why this data traceability initiative is so important."



## **CSAIL Forum Announcement**

Daniela Rus: Director, MIT CSAIL & Professor, MIT EECS

- We are in the midst of an extraordinary boom of technology, not just in AI but also in data, networking, cybersecurity, and more.
- In a field moving as quickly as computer science, it's not reasonable to convene and explore new ideas only once a year.
- CSAIL has launched a new venue for connection and ideation called the CSAIL Forum, where Professor Rus hosts a presentation and conversation with a cutting-edge CSAIL or MIT researcher every Tuesday from 12-1PM EST.
- These talks will be 40 minutes long with a 20 minute Fireside opportunity for Q&A and open discussion.
- More information, including access to past forums, can be found on this page.

"Advances in AI are happening every day—across academia, industry, and business. The CSAIL Forum was created to keep you connected to the excitement and innovation at CSAIL on a more frequent basis than just once a year." ~ Professor Rus





#### **CSAIL Alliances Startup Ecosystem** Christiana Kalfas: Senior Client Relations Coordinator, MIT CSAIL

Alliances

- Engaging with startups allows companies to tap into:
  - Cutting-edge research & talent
  - Cost-effective R&D
  - Open innovation & fresh perspectives
  - Early access to disruptive technology
  - De-risked innovation
  - Future-focused business lines and exploration of possibility
- Our Startup Success Journey offers many ways for enterprises to get involved:
  - Fireside Chats
  - Startup Office Hours
  - Corporate Interaction
  - ILP Legal Bootcamp
  - Non Dilutive Funding
  - Venture Capitalist Breakfasts
  - Anti Shark Tank Startup Success
  - The CSAIL Alliances Annual Meeting
- Reach out to your <u>Client Relations Coordinator</u> or <u>Christiana Kalfas</u> to get involved.

"Leverage our startups—not only will you be engaging more deeply with the lab, but you'll be supporting the next wave of innovation." ~ Kalfas



• In addition to offering access to top-notch CSAIL and MIT researchers, CSAIL Alliances also fosters an exciting ecosystem of innovation in our Startup Connect and Startup Connect Plus programs.

#### **Startup Feature: Systalyze**

Manya Ghobadi: Associate Professor (MIT CSAIL), CEO and Founder (Systalyze)

- The AI landscape has fundamentally changed over the past two years. Professor Ghobadi says, "In just two years, we've moved from an era where having some AI capabilities was itself a competitive advantage to one where AI deployment in production is becoming necessary across industries."
- This shift has created an urgent need for efficiency and accessibility, but AI is complex and expensive. The reality is that most organizations are often "chasing the dragon" without having a clear indication of performance problems, and in doing so, they end up wasting GPU cycles and incurring massive costs.
- <u>Systalyze</u>, founded by Professor Ghobadi, makes AI more efficient and easy to deploy by removing the barriers that prevent enterprises from realizing the full value of their AI investments.
- Systalyze has partnered with several CSAIL Alliance member companies and is helping them get more AI capabilities from their existing infrastructure investments.
- This technology leads to up to 90% cost savings, 14x faster performance, and 10x more accurate AI agents, empowering the creation of cost-effective and domain-specific applications with AI.

#### "At Systalyze, we're making AI more efficient, sustainable, and cost-effective so you can do more with less!" ~ Professor Ghobadi





#### Sponsored Research Spotlight: Itaú & Dr. Gupta Amar Gupta: MIT CSAIL Roberto Frossard: Itaú

- Itaú is the largest bank in Latin America and the southern hemisphere with a long history of technological innovation.
- As Itaú looks to the future, they are leveraging research, partnerships, development, and scholarships to accelerate the product lifecycle and scale the results to their customers and clients.
- Working with MIT researcher Dr. Amar Gupta, Itaú is exploring AI methods for detecting data abnormalities such as fraud.
- They appreciate Dr. Gupta's unusual technique of having multiple student groups working on the same problem at the same time, bringing a variety of novel ideas to the challenge and offering multiple creative techniques and solutions.
  - "It's been a real pleasure to work with Itaú." ~ Dr. Gupta
- Learn more about the collaboration between Itaú and Dr. Gupta in our CSAIL Alliances Case Study on Itaú.

#### "Even if we paused AI evolution today, the abundance of intelligence available is still way too much, and we haven't reached half of the potential applications that can be built on top of it." ~ Frossard







### **Industry Panel: CSAIL Alliances Members**

Moderator—Lori Glover: Managing Director, MIT CSAIL Alliances Juan-Carlos Martinez: NTT Data Adnan Masood: UST Vishal Gossain: EY

- - intent-level prompts generate code in real time.
  - Al Agents, which are not just more competent assistants—they're autonomous, goal-driven digital coworkers capable of acting, reasoning, and executing complex tasks and offering continuous value loops and hyper-personalized value chains.
    - "This isn't a tech upgrade. It's a business transformation." ~ Martinez
  - **Democratization at scale** as engineering velocity now scales with linguistic clarity, not headcount. • Skills marketplaces inside companies dynamically match projects with newly certified AI talent,
  - slashing bench time.
- which technologies are ready for implementation.
- velocity over perfection-will see the most reward.
- As there is more to do, AI will allow people to do more.

"CSAIL has helped us not only in keeping up with innovation but also bringing the best technology to our clients." ~ Gossain



• All is reshaping the world, and companies need to stay abreast of the latest developments in this exciting technology as the focus moves **from digital enablement to digital autonomy**. Some trends in this area are: • **Vibe Coding**, or the shift from "write once, run anywhere" to "prompt once, remix everywhere," where

• To access the innovation pipeline, companies like NTT Data, UST, and EY are connecting with top research institutions like CSAIL. CSAIL Alliances helps them discover new ideas, find talented people, and assess

• It's not just about tools; implementing AI is also about leadership. Companies which prioritize AI upskilling, learn-by-doing policies, and institutionalize a spirit of fail-fast, learn-faster—rewarding hypothesis

• AI is unlikely to replace workers because, as the technology evolves, the number of tasks is "exploding."

# Wednesday









## Wednesday Keynote: Just Asking Questions, **Interaction & Autonomy in the Age of AI Assistants**

Jacob Andreas: Associate Professor, MIT EECS

- Machine Learning (ML) research is moving from building automated systems that can do a task to studying how to create systems that can infer human intentionality and operationalize those intentions. This means designing models that learn like humans do via observation, demonstration, and language.
- Some options being explored are:
  - Learning by Talking: Encouraging models to ask questions (not just answer them) leads to more effective, lower-effort supervision and can surface user needs that haven't explicitly been addressed.
    - <u>Eliciting Human Preferences with LMs</u>
    - <u>Bayesian Preference Elicitation with LMs</u>
  - Learning by Thinking: New techniques aim to let language models update their understanding by generating and reasoning over synthetic data derived from interactions.
    - Deductive Closure Training of Language Models for Coherence, Accuracy, and Updatability
- There's still major work to be done on better question generation (especially in applying AI toward education), new knowledge incorporation, interpretability, and getting models to admit what they don't know rather than hallucinate incorrect answers.
- To learn more about his research, check out Professor Andreas' podcast episode.

#### "We really are only starting to scratch the surface of the kinds of things we can do with language as a supervisory paradigm for models." ~ Professor Andreas







#### **Startup Feature: Delineate** *Emily Nieves: Co-founder & CEO, Delineate Inc*

- will be critically important to get useful drugs and small molecules to market.
- begins.
- 100x faster development of trial simulations and analysis tools.
- trial errors and bring more treatment options to patients who need them.

"We are focused on applying LLMs, specifically AI agents, to help pharma companies and biotechs design better clinical trials." ~ Dr. Nieves



• Bad trial design is a leading cause of failure in the development of new clinical treatments. While AI drug discovery will lead to many new options, choosing the right dose and patient population

• <u>Delineate</u> uses specialized AI agents to improve clinical trial design by optimizing the parameters and modeling outcomes to identify the best configurations before an expensive clinical trial even

• Their platform automates the conversion of unstructured data into structured datasets, enabling

• Collaborations with major pharma companies are already leading to impact via building AI-ready small molecule datasets, running large meta-analyses, and deploying AI copilots for scientists. • By blending pharmacology and data science, Delineate's AI-augmented tools can reduce costly



#### **Generative AI & Everest**

#### Tim Kraska: Associate Professor, MIT EECS

- Generative AI is transforming system interaction and industry at large, with examples like Klarna replacing major enterprise software and deploying AI agents at scale.
- The Everest Initiative has three main goals:
  - Develop new approaches for building AI-driven user experiences to process, query, and visualize data.
  - Reimagine the way we build large systems with AI.
  - Build better AI assistants for support/operations of complex software and systems.
- Einblick (which was spun out of the CSAIL research project Northstar) aims to empower data scientists with intuitive, prompt-based, visual tools for faster, iterative data exploration and analysis. The company recently integrated generative AI in its pipeline.
- There's a lot of hype around generative AI, but Professor Kraska thinks the excitement is real. "We are overestimating what GenAI can do over the next two years, but underestimating what it can do over the next eight."

#### "Generative AI is fundamentally changing the way we interact with systems. We are all probably not thinking big enough." ~ Professor Kraska





- Visual computing is a broad field that spans everything involving images as input or output. This includes biodiversity monitoring (see our podcast episode and PI spotlight on Assistant Professor Sara Beery) and clinical imaging (see our <u>PI spotlight</u> on Professor Polina Golland).
- Professor Durand is focused on high-performance visual systems, synthetic image generation, and computational photography. He has released open-source tools like <u>Halide</u> (a compiler for high performance visual computing) and <u>Slang D</u> (a tool for fast, easy differentiable rendering).
- Generative AI is transforming image and video creation, offering unprecedented capabilities, but still struggles with personalization, multiple identities, and fine-grained control.
- Professor Durand's group is working on solutions such as using segmentation and encoders to generate richer training data (addressing multiple identities) and using distillation for faster, casual video generation.
- He also discussed related work on therapeutics delivery using microneedles, which could encode an invisible record about a patient on the patient.
- A future frontier of this work includes generating 3D information from 2D data such as image or text.

"We haven't had anything this big since the invention of photography. Generative AI is really a new way for humans to create images and revolutionizing the field of computer graphics" ~ Professor Durand

**OpenAl S** 



## **Startup Feature: Nectry**

#### Adam Chlipala: Professor, MIT EECS

- CSAIL spinout <u>Nectry</u> bridges the gap between no-code tools and traditional software engineering by enabling the rapid development of trustworthy, production-grade applications without sacrificing control or visibility. Nectry can create robust applications using natural language prompts that are secure, reliable, and easily incorporated into enterprise systems.
- Their platform utilizes a hybrid approach where users can view either deterministic English-language descriptions or full backend code, supporting responsible deployment and transparent development.
- It builds apps with reusable, mathematically correct building blocks (like LEGOs) which offer both flexibility and full reliability.
- The foundational technology of Nectry comes from Professor Chlipala's background in compilers, verification, and his <u>Ur/Web</u> programming language.
- For more information, read our <u>CSAIL Alliances Case Study</u> on Nectry.

#### "The mission of Nectry is to dramatically streamline the development of custom enterprise software." ~ Professor Chlipala







#### **Al and Cybersecurity**

Una-May O'Reilly: Principal Research Scientist, MIT CSAIL

- Cybersecurity is an evolving arms race between intelligent attackers and defenders, with each side constantly adapting.
- Al accelerates this co-evolution, making both offense and defense more sophisticated and high-stakes.
  - Language models enhance attackers' capabilities in automating sophisticated fraud and orchestrating complex campaigns.
  - Conversely, defenders can leverage AI for monitoring, forensic analysis, and deploying deceptive strategies like honeypots to study attacker behavior.
- Her group developed BRON, a graph database that integrates diverse cybersecurity data sources, enabling AI models to reason about threats and defenses.
- She explored what an LLM-supported cyber agent might look like and how such a program could model the behavior of both attackers ("red team") and defenders ("blue team").
  - LLMs Killed the Script Kiddie
- To gain a long-term security advantage, we need secure-by-design systems and collaborative intelligence sharing.

#### "You have to remember that AI is a double-edged sword: if you can use it on one side, you can also use it on the other side." ~ Dr. O'Reilly







## **The Nexus of Gaming and AI: Alliances Member-Led IAP Class**

Michael Stopa: Academic Manager, PlayStation

- because of the 1-2 year head start it gives those involved in the research.
- Collaborating with academia brings significant benefits including:
  - to commercialization, lower R&D costs, and access to visionary ideas.
- even led to the publication of a research paper.
- Read more in our <u>case study of their IAP course</u>.

#### "We cannot invent the whole future of our technology. We really have to collaborate with the best minds." ~ Dr. Stopa



• PlayStation is deeply invested in using AI innovation to create cutting-edge game technology for immersive environments, low-latency cloud systems, more realistic non-player characters, and more. • Dr. Stopa emphasized that companies gain enormous benefit by taking part in open innovation

• **Internally**: opportunities to level up members of an organization, leading to agility, a quicker path

• **Externally**: association with top-tier research centers and a reputational presence in the field of AI. • To leverage the CSAIL student community, Sony hosted an Independent Activities Period (IAP) course at MIT titled "The Nexus of Games and AI" which consisted of 9 lectures, had high interest and engagement, and culminated in student projects which have gone on to impact company strategy and



### **Physical AI and Humanoids** Daniela Rus: Director, MIT CSAIL & Professor, MIT EECS

- transformer-based models.
- smaller, more energy-efficient, and better at handling time-series data.
- safely, intelligently, and interactively.

"What's changing now is not just how robots move. What's changing now is how the robots think, how they perceive, and how they interact." ~ Professor Rus



• Humanoid robots are evolving from science fiction to commercial reality, but true progress will require integrating the body (hardware) and brain (software) via perception, action, and language. • Language will act as a key bridge between abstract reasoning and embodied intelligence, allowing robots not just to act but explain and learn from humans, turning AI into physical partners. • The future of robotics demands AI that can operate on-device and adapt to its environment. This means rethinking how we train, design, and embed intelligence into physical machines beyond

• Liquid Neural Networks offer a breakthrough alternative to today's large models: they are

• Professor Rus's lab is building next-gen tools, including text-to-robot and image-to-robot design pipelines, generative robotic design systems, and human-to-robot learning methods.

• The broader vision: AI-empowered robots that amplify human ability will support healthcare,

manufacturing, and everyday life not by replacing people but by extending what we can do more

In an era defined by rapid AI advancement and constant technological disruption, industry collaboration with academia is more vital than ever. The 2025 CSAIL Alliances Annual Meeting showcased how bridging the gap between MIT researchers and industry leaders enables business leaders to stay ahead of the curve, whether by co-developing trustworthy AI agents, accelerating product design, anticipating cybersecurity threats, or exploring new frontiers like generative video, physical AI, and next-gen clinical trials.

Companies who spoke, attended, or participated in panels illustrated the tangible ROI of academic engagement: early access to emerging technologies, talent pipelines, strategic insight, and faster paths to innovation. But they also emphasized the importance of giving back through open innovation, education, and shared experimentation.

Collaboration is not just a resource but a mindset. By staying open to new ideas, thinking beyond short-term gains, and working with academia to shape the future of computing in ways that are ethical, scalable, and humancentered, together we can bring about a better world through technology.

"Let's be creative and think about ways to work together!" ~ Lori Glover, CSAIL Alliances



## Learn how to connect with CSAIL through Alliances.

<u>cap.csail.mit.edu</u>



