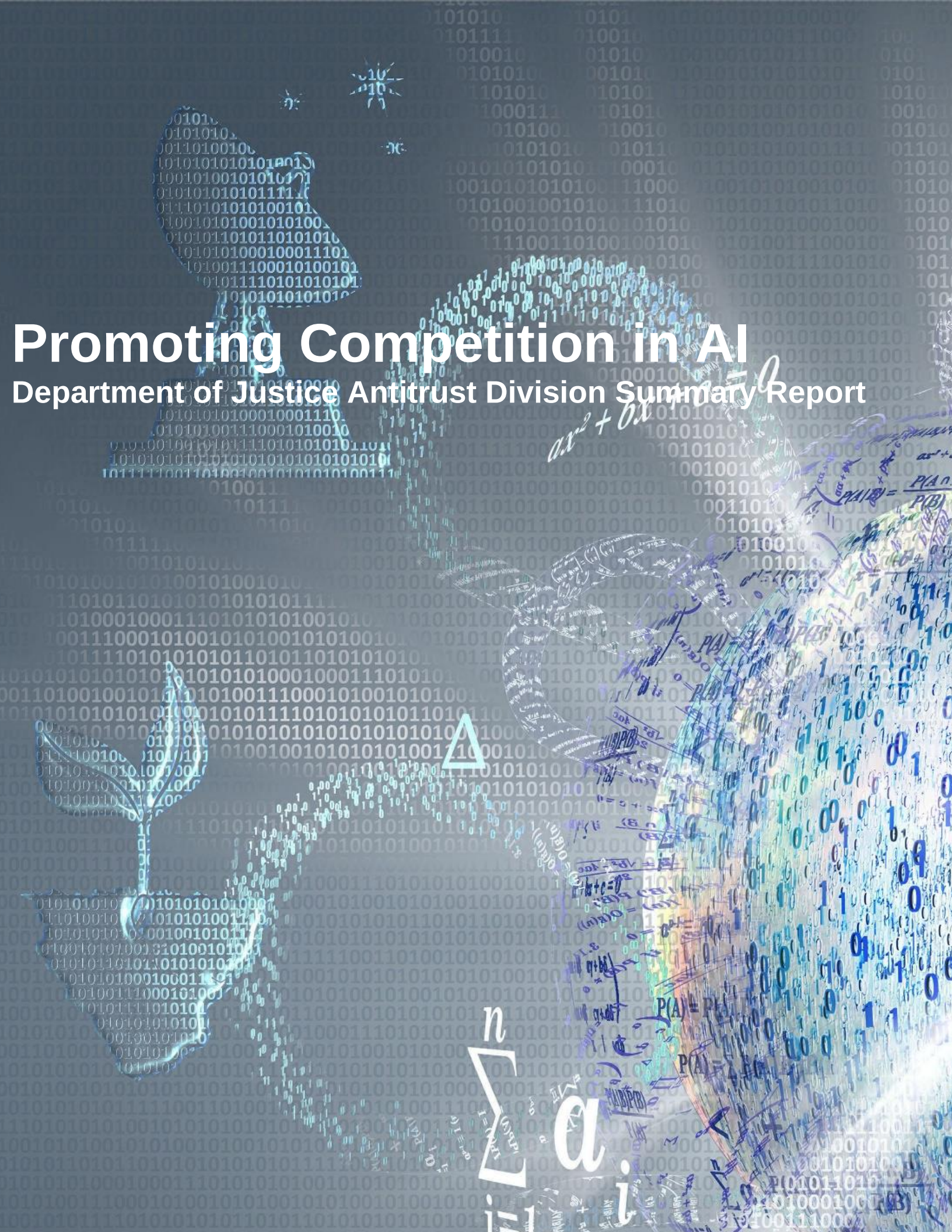


Promoting Competition in AI

Department of Justice Antitrust Division Summary Report

Contents

Introduction 1

The Competitive Implications of Foundation Models 2

Fireside Chat with Percy Liang: AI Infrastructure and Foundation Models 3

Fireside Chat with Andrew Ng: The AI application Ecosystem 3

Panel: Competition in Foundation Models and Beyond 5

Healthcare Spotlight: A Closer Look at Applying AI in the Healthcare Sector and Access to Data 9

Competition in AI Hardware and Chips 13

Fireside Chat with Victor Peng 13

Panel: Competition in AI Hardware and Chips 14

Balancing Access to Training Data and Creators' rights 19

Fireside Chat with Kathi Vidal: Balancing Creators' Rights and Competition 19

Panel: Balancing Creators' Rights and Competition 20

Promoting Procompetitive Regulation of AI Technologies 23

Dr. Condoleezza Rice and Senator Amy Klobuchar 23

Regulation Spotlight 26

International Perspectives 28

Conclusion 30

Video Statements on AI and Competition 31

Introduction

Artificial intelligence (AI) has groundbreaking potential, including by improving research outcomes, manufacturing processes, personal computing, entertainment options, and more. At the same time, there are risks of harms, including competitive harms, that may result from concentration in the market, which can threaten competition and innovation in AI-related markets. It is therefore important to understand the competitive landscape for the growth and development of AI technologies.

In May 2024, the Antitrust Division of the Department of Justice co-hosted a workshop with Stanford's Institute on Economic Policy Research (SIEPR) and Graduate School of Business examining competition in the AI sector.

The AI Workshop featured experts in different fields on a variety of topics, including AI infrastructure and foundation models; AI applications with a focus on healthcare; competition in AI hardware; protecting creators' rights; and regulating AI technologies. Panelists discussed topics such as the benefits of open foundation model weights to competition between foundation models and innovation in applications for foundation models; the lack of competition in hardware and the importance of access to AI chips; the need to balance access to training data and creators' rights; and the competitive implications of investment in "Little Tech," including collaborations between "Big Tech" and "Little Tech."

Following the workshop, individuals, advocacy groups, trade associations, and companies also submitted comments related to the topics of the workshop. Those comments are also available here.

This report summarizes the panelists' views on competition issues addressed at the AI Workshop: (1) the competitive implications of open foundation models versus closed systems and investment considerations in AI companies; (2) AI applications in healthcare markets, examining specific applications and competitive concerns over access to data; (3) competition in AI hardware and software that enables the hardware; (4) balancing access to training data and creators' rights; (5) how to foster procompetitive regulation that can promote entry and participation in the AI marketplace; and (6) international perspectives. Each section of the report concludes with questions for continued study.

The views of the workshop guests and panelists summarized in this report do not necessarily represent the views of the Antitrust Division of the Department of Justice.

The Competitive Implications of Open Versus Closed Models

Fireside Chat with Percy Liang: AI Infrastructure and Foundation Models

- Definition of foundation models
- Explanation of open source and closed source
- The importance of open-source models for researchers or startups
- Risks of open-source models
- Explanation of platforms using open source like TogetherAI and how these platforms can help with entry into the AI ecosystem

Summary

Percy Liang, Associate Professor of Computer Science at Stanford University and the director of the Center for Research on Foundation Models (CRFM), spoke during a fireside chat with Susan Athey, then-Chief Economist at the Antitrust Division. They discussed the importance of transparency and collaboration in the development of foundation models. According to Liang, a foundation model is a single machine-learning system trained on a significant amount of data that can solve a large variety of tasks at scale.

Liang expressed concern over transparency in the development of foundational models. In the 2010s, researchers developing deep-learning models tended to develop open models—making their data, code, and performance metrics public, enabling researchers and startups to iterate rapidly and to develop novel applications. The open and collaborative nature of the process also enabled the research community to develop common benchmarks for testing model efficacy. These included, for instance, ImageNet, a public database of

images and labels, which long served as a benchmark for scoring the capabilities of AI models.

In recent years, foundational models have advanced substantially, but they have done so largely outside the public view. As a result, Liang said, "we have [a] hugely important technology which we don't understand" and is "guarded closely" by developers in the private sector.

The lack of transparency surrounding proprietary "closed" models (where model weights are not publicly available) and closed research labs has exacerbated the difficulty of identifying comprehensive evaluation metrics. Liang advocated that benchmarking and evaluation of today's foundation models should be multifaceted and incorporate metrics for accuracy, bias, fairness, robustness, and comprehension of uncertainty.

Liang sees a role for the academic community in creating and studying benchmarking methodologies. He called on developers to collaborate with researchers in "develop[ing] a stronger foundation" for testing and fine-tuning AI models to a specific task. Specifically, he called on developers to grant researchers greater access to their training sets and the computing power that could enable them to study model behavior at scale. He said that open collaboration would ultimately benefit developers by improving their products for consumers.

Fireside Chat with Andrew Ng: The AI Application Ecosystem

- Defining AI applications
- The importance of open models to applications
- Applications that researchers or startups can do well with their scale and infrastructure
- What government should be doing/or not be doing to facilitate the development of open models and applications

Summary

Professor Andrew Ng is a computer scientist and entrepreneur who cofounded and led Google Brain (Google's AI research team) and Coursera, which provides advanced online instruction on machine learning. Ng discussed the significance of regulation, open models, and competition in the AI ecosystem. He encouraged lawmakers to regulate applications for safety and security rather than regulate core models. Ng emphasized the importance of open source in preventing choke points in the AI technology stack, including the importance of preserving access to foundation models.

Ng described the AI technology "stack": semiconductors are at its base; then cloud computing services that power general-purpose foundational models like ChatGPT; then

the foundational models themselves; and finally, at the top, applications that utilize the foundation models for different purposes. Applications generate the revenue that pays for the technology layers underneath.

Ng stressed that the AI safety risks stem from specific applications rather than the technology itself. Ng compared foundation models to an electric motor, which can power blenders and dialysis machines but also guide bombs. Ng noted that, despite some of the electric motor's potentially dangerous uses, society regulates only its applications and not the underlying technology. Ng argued that the same is appropriate for AI: foundation models can also be built into a range of technologies, only some of which are dangerous. (Ng joked, "of course AI could be used to create bioweapons…. So can an Excel spreadsheet.") Regulating the foundation model instead of the application would hinder innovative and beneficial uses, according to Ng.

"Open source is one of our best tools for promoting innovation and preventing a new choke point from arising at [the] AI technology layer."

Andrew Ng

Ng discussed the benefits of open-source foundation models, which he said are more easily monitored and drive innovative use cases. He argued in favor of steps to protect open source as a critical component of the AI supply chain, including promoting open-source models through public procurement processes. Ng opined that "open source is one of our best tools for promoting innovation and preventing a new choke point from arising at [the] AI technology layer."

Ng underscored the importance of data access and fair use policies in addressing potential bottlenecks in AI implementations. He expressed concern that the economy could become beholden to a very small number of foundation model providers. He also expressed concern about data access. He described the fractured environments in fields like medicine and the cost of accessing proprietary data lakes (a collection of data) in others. He also observed that, while the "orchestration layer" of the stack (which facilitates system-building on

top of large-language models) is competitive today, several startups may be trying to become dominant.

Ng also discussed trends and ongoing innovation in AI technologies. He noted the emergence of agentic AI workflows, where AI systems iteratively improve outputs by interacting with users and other systems. Ng highlighted the potential of agentic AI in various domains, including code generation and multi-agent collaboration, and emphasized its dynamic and competitive nature.

Panel: Competition in Foundation Models and Beyond

- Models that companies are building now and how they benefit customers
- Where successful AI implementations are taking place and what types of firms (market leaders, challengers) are having the most success
- The benefits of open-source versus closed models
- Competition risks for foundation models
- Concerns about partnerships between large language models (LLM) providers and major public cloud providers announced over the last year

Panelists

- Dr. Karen Croxson, Chief Data, Technology and Insight Officer, United Kingdom Competition and Markets Authority (CMA)
- Jayesh Govindarajan, Senior Vice President of AI and Machine Learning (Salesforce)
- Venky Ganesan, Partner (Menlo Ventures)
- David George, General Partner (a16z)

Summary

Dr. Karen Croxson began the discussion by outlining the competitive risks that could undermine effective competition in foundation models. Croxson mentioned several concerns, including 1) "the risk that…powerful firms with control over critical inputs for model development may constrain or materially restrict access…in order to shield themselves from competition"; 2) that "powerful incumbents with powerful positions in downstream markets that are important for the deployment of…models could distort choice in those markets and undermine competition"; and 3) in the context of partnerships and investments involving key players, "players with power both upstream and downstream in these markets could inhibit fair effective competition."

One panelist, Jayesh Govindarajan, addressed these competitive risks with a specific example involving exclusive arrangements between hyperscalers (large cloud service providers) and LLM providers. He described how a foundation model available only on one hyperscaler could limit consumer choice and innovation, noting that foundation models are "low level building blocks that entire stacks are going to get built on" and if exclusive relationships are built between infrastructure providers and the first players on top of their infrastructure products, exclusive vertical stacks could form. Another panelist, David George, echoed the emphasis on cloud service providers, noting that "if you look at what the cloud companies are doing…it seems like they are trying to commoditize that layer. So they're actually using their competitive power to make sure that the economics are not too attractive at the foundation model side."

Panelists also discussed partnerships and investments between Big Tech firms and Little Tech firms. Dr. Croxson commented on vertical integration in foundation models through an "interconnected set of investments involving the biggest tech firms" (her team identified over 90 such investments) and said her team is looking at implications of the AI chips market for the foundation models ecosystem. Dr. Croxson further emphasized how partnership and investment arrangements "can sometimes be a little complex and opaque to understand" and therefore require active monitoring and consideration on the merits to ensure that competition is protected.

Venky Ganesan alluded to concerns for academic interests related to the AI chips market, questioning whether academics can conduct research in an unbiased manner given limited access to GPUs because they are "really expensive."

Other panelists expressed a concern about the potential for regulatory capture by larger tech firms and the need to avoid regulatory compliance burdens that could entrench Big Tech firms over smaller firms. Mr. Ganesan, for example, said that "the problem with regulatory regimes is just that you're going to be inundated with lobbyists from big tech because they have lots of money, they are successful businesses," and "we live in a democracy, [and] it's a political process." In expanding on this point, George recommended that Big Tech should not be allowed to "set the rules because those are likely to be self-interested"—warning in particular about efforts by Big Tech to steer regulatory conversations around "safety-ism or things like that." As George put it, such considerations can be "self-interested and…a blatant attempt in a lot of cases at regulatory capture."

With regard to compliance burdens, George noted that "every time we go down the path of" creating new agencies and compliance requirements, "it is competitively favoring Big Tech over Little [Tech] and it's likely to entrench them relative to startups who are trying to compete but don't have the resources to invest in a lot of compliance purposes."

"This is a genuinely complex ecosystem. The technology itself is complex…the value chain is still evolving. And we're continuing to see…that drumbeat of disruption of innovation and activity."

Karen Croxson

George also urged that it is important to allow the foundation model market to "evolve a little bit for the time being" before regulating models for safety and security. To him, "the more that technology ideally in open-source format is available to people building products, the more likely consumers are going to be able to benefit from them at large." He suggested that, for now, policymakers should "regulate how people use those models as opposed to regulating the models themselves."

Dr. Croxson emphasized the complexity of the AI ecosystem and the need for agencies to understand foundation models and the associated technology sufficiently. She also highlighted the importance of collaboration across agencies and encouraged policymakers to understand several key themes: the economics of the market; how technological change can shift those economics, the law, and business strategy; how to scan markets in a prioritized way; and the impacts of interventions already undertaken.

Panelists also discussed the importance of open model weights to competition between foundation models. George noted that "we don't actually know how many players in the foundation model space are going to be relevant.... There's going to be a major swing factor if we allow open source to flourish versus not." Furthermore, he noted, "it is absolutely critical that we invest aggressively behind open source" and that "open source allows other people to have access to this technology with transparency around what they're working with, which big tech close model things will not provide." Ganesan analogized the benefits of an open ecosystem to the early Internet, noting that "things like Section 230 did allow the Internet flourish," though "there were issues with it, and we will have to fix it, but making sure things were open in the beginning, I think that's a good job." Govindarajan cited benefits of open weights to the application layer on top of foundation models, saying, "I think it is a way for other people who don't have as much resources to be able to

build on top of something that someone with a lot of resources are able to build."

Panelists discussed the importance of transparency for foundation models. Dr. Croxson noted that, "with transparency, it's about really making sure that the risks and limitations of these models can be understood, including [transparency] to consumers who will need to make these decisions about their use." She linked the need for transparency to accountability "across the entire value chain." George suggested that transparency is an added benefit of open ecosystems. Mr. Ganesan proposed "self-reporting" as a framework for achieving transparency that could benefit regulators. He cited tools such as a "trust and safety plan" and asking firms to "print and document" what their safety procedures are as a "good way of building early warning signals."

Questions for Further Study

- What more can we learn about the competitive risks of exclusive vertical stacks between hyperscalers and LLM providers?
- What are the competitive implications of expensive AI chips that limit academics' ability to conduct research on and build foundation models in a way that is unbiased?
- What kinds of regulatory compliance burdens for foundation models would entrench large tech firms at the expense of smaller firms?
- What are the limitations of self-reporting approaches to foundation model transparency, and are there more effective alternatives or complementary approaches?

Healthcare Spotlight: A Closer Look at Applying AI in the Healthcare Sector and Access to Data

- State of competition for healthcare AI
- Barriers to competition/entry in healthcare, including access to data

Panelists

- Prof. Ben Handel, Associate Professor of Economics (University of California – Berkeley)
- Elena Viboch, Partner (General Catalyst)
- Allison Oelschlaeger, Chief Data Officer and Director of Enterprise Data and Analytics, Centers for Medicare & Medicaid Services (CMS)
- David Kizner, General Counsel and Chief Privacy Officer (Viz.ai)
- Prof. Ziad Obermeyer, Associate Professor and Blue Cross of California Distinguished Professor (University of California – Berkeley)

Summary

The Healthcare Spotlight provided an overview of the use of AI in the healthcare industry. It explored the dynamics of healthcare competition, including access to healthcare data and unique features of the U.S. healthcare system.

Potential Benefits of AI in Healthcare

Panelists explained the benefits of AI in healthcare on the clinical side, which includes the ability to treat patients quickly and accurately and to alleviate administrative burdens and lower costs. David Kizner of Viz.ai began the discussion by providing examples of how AI is used in clinical settings. He explained that AI can detect time-sensitive medical conditions, which allows clinicians to bypass time-consuming workflows and quickly coordinate care, ultimately improving patient outcomes and reducing costs. He also explained that generative AI can assist clinicians when responding to an overwhelming number of patient inquiries by drafting initial responses.

Elena Viboch, an investor focused on the life sciences, added that AI can alleviate administrative burdens. In addition to providing patient care, she raised that healthcare workers are also responsible for various administrative tasks, such as medical billing and coding and scheduling patients and staff. Given current healthcare workforce shortages, she explained that AI can relieve these administrative burdens, "which frees up money for research [and] frees up money for patient care."

Viboch also expanded on the different ways in which AI is used in the life sciences sector, because it is possible to "apply [AI] to every step in the value[] chain." She explained that, when developing drugs, researchers can use AI to better identify potential targets for drug discovery. By evaluating data from various sources, AI can aid in developing diagnostics that signal early warning systems to suggest early interventions. AI can even assist throughout each step of the research process by drafting grants and reports, identifying potential trial subjects, and aiding in data collection and analysis. She said, "[w]hether it's therapeutics, diagnostics, enablement for research…AI [can] solve a problem that couldn't be solved before, or help me do this better, faster, cheaper."

Insurers' Use of Healthcare Data

Ben Handel explained how insurers use data to gain a competitive advantage by developing proprietary datasets that span the entire healthcare supply chain. Handel said that insurers use this data to assess risk, apply policies across different insured groups, manage claims, design health insurance plans, and even identify potential acquisition targets, such as pharmacy benefit managers or provider groups.

Handel also mentioned how data at this scale affects mergers in the insurance industry. Handel opined that massive amounts of data can result in economies of scale and provide a major competitive advantage for insurers across horizontal and vertical markets. However, he said that when "data and data analytics" are "a central asset" of a merger, "it can lead to a number of asymmetries and a number of competitive advantages where at some point it's not obvious that these kind of increasing economies of scale are worth the trade-off with market power."

Data Access Versus Privacy

Allison Oelschlaeger, Chief Data Officer and Director of Enterprise Data and Analytics (CMS) stated that "data is an asset," even more so now that companies are using AI in healthcare. Data is not shared not only because data provides value, but also because privacy plays a role in protecting patients, Oelschlaeger explained. She said,

"[t]hose are two things we have to balance as we start to think about how we can make data more available to promote competition in this space." Both CMS and National Institutes of Health make data available for research. CMS and the Office of the National Coordinator for Health Information Technology have also worked to give patients the ability to share their data with "whoever they want to share it with," including for the development of AI. Elena Viboch was optimistic about the government's efforts to standardize data and "make it more open to address the bottleneck in terms of data analysis."

Impediments to Competition

Panelists shared the sentiment that healthcare data is hard to access. They agreed that restricted access to healthcare data can impede competition by stalling the development of AI in the healthcare.

Ziad Obermeyer explained that algorithms are not competing on quality due to restrictions on data access. He pointed out that consumers are unable to compare AI algorithms or evaluate an algorithm's effectiveness because the algorithm cannot be tested on identical datasets. He further noted that gaining access to healthcare data is a time-consuming process that requires overcoming several hurdles, such as undergoing background checks and signing data-use agreements. By making data accessible, he said, "people aren't just competing on access to data but are competing on algorithm quality."

Another issue that David Kizner raised was access to annotated data when developing an AI algorithm and regulatory barriers. He explained that there is a need to annotate data in order to use it—i.e., to add more information to data to improve the usefulness and accuracy of data. However, annotating data is an expensive and time-consuming process. He also added that there are regulatory barriers to improving algorithms. He said, "currently FDA doesn't [] allow algorithms to improve in real-time."

Ben Handel explained that on the insurer side, data owners such as insurers are likely restricting competitors' access to data or otherwise disadvantaging rivals, hindering AI development in healthcare. Using UnitedHealth Group's acquisition of Change Healthcare as an example, Handel explained that the acquisition granted United access to rival insurers' data, giving them a competitive advantage to "assess and learn about the strategies of their rivals." He added that, if Change had remained an independent company, it could have developed analytic products purchased by other competing insurers. As with the data access issue on the clinical side, he flagged that there is a need to discuss whether the data should remain proprietary under private companies, be owned by other firms that are not using the data, or be regulated.

Elena Viboch suggested that to ensure robust competition, regulators must continue to grant pathways for innovative

players to access healthcare records held by large healthcare companies. Moreover, she recommended that regulators allow algorithms to be transferred with a patient at his or her request, similar to how patient data is portable. Viboch opined that standardizing data will help reduce the amount of data needed to build the next generation of AI models so that data access will be less of a bottleneck.

Labor and Technical Expertise

Panelists also commented on the importance of high-skilled labor, such as data analysts and data engineers, to compete effectively in the healthcare AI space. They said that data engineers and analysts who can develop AI tools and understand medical language are critical in developing healthcare AI tools. However, Handel noted, the "biggest companies get access to a lot of the best data engineers and data analysts." Obermeyer also commented that our education system is not good at generating labor with this kind of expertise.

Questions for Further Study

- What are ways to ensure patients exercise the ownership of their personal data so that they may choose to contribute their data to developing new AI tools?

- What can be done to improve data portability—such that a patient's data can be ported to other AI systems at the patient's request—in the healthcare sector?

Allison Oelschlaeger, Chief Data Officer and Director of Enterprise Data and Analytics for CMS, discusses the government's efforts to promote access to data for market participants.

Competition in AI Hardware and Chips

Fireside Chat with Victor Peng

Victor Peng, the president of the semiconductor company AMD, shared his perspectives about the market for AI chips, also known as AI accelerators.

Peng began with an overview of different types of computer chips. First, he described Central Processing Units, or CPUs, which he referred to as a "jack of all trades," running applications and software on consumer products such as laptops, web browsers, and video streaming. CPUs are also in servers in data centers running transaction processing or other kinds of more enterprise-level applications. These can be distinguished from Graphics Processing Units, or GPUs, which are better at running the processes involved in generative AI. GPUs serve a different function from CPUs and have historically been used for gaming graphics. A main distinction of CPUs and GPUs is how they process information. CPUs process tasks in a sequential manner, while GPUs excel in parallel processing, which is optimal for graphics rendering and explains why GPUs have their genesis in graphic-intensive applications. As Peng explained, "it turns out that graphics and AI from a workload perspective have similarities." Today, there are two different families of graphics chips—one that is primarily for graphics processing, gaming, and visualization, and another that is focused on extremely large-scale, high-performance computing, as required for generative AI. These "AI accelerators" are used to accelerate complex AI models and algorithms. Peng noted that there are other types of AI accelerators, such as Tensor Processing Units.

Next, Peng described the enormity and complexity of AI systems. AI systems require large data centers that can house thousands or millions of computer servers, each with multiple GPUs. Not only are the systems "massively huge"—"multiple Ikea-sized buildings large"—but the networking architecture is complex and requires many components to work together.

Peng emphasized that there is a significant amount of software and firmware needed to make the system work. Peng opined that a fully vertically integrated closed system "from the chip all the way up" could stunt innovation at every level. The innovation at every level "drives better delivery, lower cost, higher performance enabling, more powerful models enabling, and performance," and, thus, it is important to enable multiple players to compete. This is one reason AMD chooses open source for much of its own software, according to Peng. In areas where AMD employs its own proprietary elements, it aims to partner with other companies, thereby "enabling an ecosystem of multiple players" that promotes choice, said Peng.

On the role of government, Peng advocated for a "wait and see" approach. If competition is taking place on a fair and

level playing field, the best solution should win. If it becomes less of a level playing field, then there would be a role for government intervention. Peng said that this is no different from what the government has always done, though there are additional challenges due to the complexity of this space, as well as the rapid pace at which it is evolving. Peng further stressed the importance of weighing the marginal gain versus marginal risk. According to Peng, certain areas may pose safety risks that require more scrutiny or more guardrails, such as in medical applications. However, in "other areas," where the technology may not get a "movie preference just right," for example, there may be less of a need to regulate that too heavily.

Panel: Competition in AI Hardware and Chips

- State of competition in AI hardware
- Types of AI-related chips – who competes in this market?
- How software is integrated with AI hardware
- On-premise private and hybrid cloud alternatives that can reduce reliance on chips for some B2B firms
- Start-up perspectives: how access to chips affects investment and access to capital
- Lock in/network effects/data egress fees

Panelists

- Victor Peng, President (AMD)
- Chris Wolf, Global Head of AI and Advanced Services (VMware by Broadcom)
- Mazhar Memon, Founder and CEO (OSCI Labs)
- Alex Gaynor, Deputy Chief Technologist (FTC)
- Blanche Savary de Beauregard, General Counsel and Secretary of the Board (Mistral lawAI)

Summary

Each panelist began by providing general observations about AI's evolving place in the marketplace. First, Chris Wolf, Global Head of AI in Advanced Systems for VMware by Broadcom, discussed the role that open source played in his company's product strategy. Most notably, for Broadcom's internal AI services (e.g., using a chat service for product support), Wolf indicated that it would be difficult to "take a single bet on one vendor or technology provider." In order to quickly onboard new AI services at the speed of software, Broadcom relies on multiple models and has changed models as the technology improves. In addition, Wolf noted that, by using vitalization software solutions, the amount of compute necessary to run the model and respond to user queries is minimal. In fact,

according to Wolf, one of Broadcom's production applications can respond to a large volume of queries using only four GPUs.

Blanche Savary de Beauregard, General Counsel of Mistral, also opined on the competitive landscape. Mistral is a new developer of AI frontier models. Savary de Beauregard described Mistral's experience over its one year since being funded to illustrate how quickly the industry is evolving. Within that year, Mistral has built and launched several AI models, engaged in two rounds of funding, launched a platform, and entered several partnerships with leading technology companies. At 55 employees, Mistral is growing quickly, said Savary de Beauregard. This experience gives "a sense of what it is to be a startup in AI that has the ambition to compete against giants." As a non-integrated "pure player" with no connection to the pre-existing actors in the tech industry, Savary de Beauregard explained that it is critical for Mistral to create good relationships so they can get access to compute. Savary de Beauregard also stressed Mistral's commitment to open source. Like other panelists, she cautioned against regulators acting too quickly to regulate models including open-source options where "it's very difficult to anticipate the side effects of those actions and reactions."

Mazhar Memon, founder and CEO of OSCI Labs, said that "AI is not a differentiator and there's very little value capture from AI functionality, intelligence or machine learning or data science. Software is also not a differentiator. It's an expected outcome. The marginal cost of creating a new line of code is approaching zero. And the marginal cost of creating software that creates software is also approaching zero." Although his company uses AI, Memon does not view his company as an AI company. Instead, he views AI and software as tools that "accelerate our engineering, our testing, our robustness in our services." He also noted that code generators can speed up discovery, extracting value from the market. AI could accelerate the development of "deep tech," addressing issues such as a cleaner environment, increasing lifespans, improving healthcare, and food access. Solutions to all of these problems, according to Memon, could be accelerated with AI.

Next, Alex Gaynor, Deputy Chief Technologist at the Federal Trade Commission (FTC), explained that he frames the issue of competition in AI around three questions: 1) what are the competitive dynamics in companies building models themselves, particularly building foundational or frontier models?; 2) how does AI impact the competitive dynamics in markets, particularly in the supply chain for AI, the chips, cloud computing, orchestration tools, and all the other software and hardware needed to build and deploy these models?; and 3) how will AI impact competition in markets it is deployed in, such as healthcare or finance?

Distinguishing Features of AI

The panelists discussed how AI might be different from prior significant technological advancements. Memon noted the strong presence of a "feedback loop," where first-mover companies with the best model, hardware, or data can generate the next model faster than their competition, giving them a speed advantage that is usually characteristic of small, nimble companies. In addition, unlike many prior technological advancements, AI is different in that it is a general-purpose technology that can be applied across industries, "from healthcare to forecasting to entertainment to creativity, infrastructure, smart cities, autonomous driving," as "it is just so broad." Other differences discussed included the power given to algorithms because of the computing power available and the autonomy and flexibility of AI hardware, which allows for decoupling applications from hardware, compared to, for example, a mobile phone.

Access to Chips

One panelist distinguished between chips that are used for training an AI model and those used for inference or prediction. The training process is computationally complex and requires more powerful chips, which may be in short supply. Even having access to these chips is insufficient to train a model, as training requires access to a cloud provider that can assemble the chips. Not only are these very powerful chips rare, but the companies "that can assemble them and make them work in a way that is efficient for training are even more rare." Savary de Beauregard described this as a "massive bottleneck" that creates a queue for customers of the model that would like to do their own inference, reducing "the possibility of distribution on the side of customers to do on premises." Adding to the challenge is the fact that a "huge" number of chips, residing in the same place, are needed for training, which is all very expensive. Thus, as Savary de Beauregard put it, "if you don't have cash," you cannot train. "But if you don't have that, you also have problems convincing your investors to get your next fundraising because you have problems convincing them that you are a realistic actor for the future."

While not disagreeing with this characterization, Victor Peng added that a competing chip option was "coming to

your rescue," and "help is on the way" that would reduce scarcity.

Vertical Integration

The panelists next discussed the implications of vertical integration, stressing the importance of interoperability in promoting innovation. If a system is closed and proprietary, it is difficult for a firm operating at only one layer of the stack to interoperate. This becomes "a barrier for customer choice, for innovation, for driving down costs, for enabling value creation models." That is, modularity promotes competition for each component.

Memon gave an example of how a firm with a dominant AI capability could reduce choice, using the example of a healthcare AI startup that needed to be HIPAA-compliant. Only one cloud provider has this capability, and a startup may not have access to the GPUs used by that hyperscaler.

Role of Government

The panelists agreed that governments should proceed cautiously and not move too quickly toward safety regulation. Otherwise, they may run the risk of over-regulating. Chris Wolf expressed support the NIST AI Risk Management Framework, which provides voluntary guidance to improve the trustworthiness of AI products. He described the framework as "very effective guidelines for steering the safe and secure adoption of AI."

Savary de Beauregard noted that the European authorities have been actively studying AI, and "that's great because some days they will need to react," and to do so, they will need to have the necessary knowledge. However, she also expressed concern about the competition authorities studying AI partnerships, including Europe and the FTC through its 6(b) authority, noting that startups focusing on one layer of the AI stack need partnerships to exist. For example, a model developer needs to partner with hyperscalers for compute and for distribution. Regulators should consider potential side effects from actions they may take, as some actions could have the opposite effect of what competition laws aim to achieve. Given how quickly the industry is moving, however, Savary de Beauregard said this can be very difficult.

The panelists agreed that governments should encourage innovation by investing in AI, or "putting money on the table, creating the universities and schools…to ramp up this innovation [and] make sure that there is no one left behind in this adoption." Savary de Beauregard noted that France has been taking this approach. Another noted that the U.S. government has been good at promoting innovation but has not invested enough in incentivizing adoption of innovation, which is as important as incentivizing innovation itself.

Predictions for The Future

Some panelists agreed that, going forward, there will not only be large foundation models, but also smaller domain-

specific models that require less compute. Another panelist expressed reluctance to make predictions, admitting, “I don’t know. I don’t think anyone knows.”

Panelists also stressed the importance of open source in allowing for faster innovation going forward.

Questions for Further Study

- How can small AI companies offering foundation models and applications be ensured access to AI chips and computing power that will allow them to compete with established players in AI-related markets?
- How are collaborations between cloud providers and other chip suppliers affecting innovation, scale, and diversity in AI products and services?
- How will the market evolve to address the demand for AI chips?
- Will more on-premises and hybrid solutions create cost reductions on the hardware side?
- How are lock-in/network effects affecting innovation and new entrants in AI-related markets, including for on-premises solutions?

Victor Peng discusses competition in AI-enabled chips and how this market operates.

Balancing Access to Training Data and Creators' Rights

Fireside Chat with Kathi Vidal: Balancing Creators' Rights and Competition

The U.S. Patent and Trademark Office has worked closely with the Antitrust Division in supporting a whole-of-government approach to promoting competition. Director Kidal discussed the interplay between the intellectual property system and fostering a competitive marketplace, both in general and in AI-related markets in particular. Director Vidal emphasized the importance of strong IP protections: "If we don't have a strong IP system, we don't have new market [entry]." Innovators "need the intellectual property in order to get funding and in order to compete," Director Vidal explained. She further stated that "when we think…about bringing more people into the economy…we need both IP and competition for that."

Director Vidal also discussed the PTO's role in promoting safe, secure, and trustworthy development of AI, including the PTO's recent inventorship guidance. Director Vidal said the guidance focuses on quality and the degree of human-centered contribution to a patented invention. She said that the PTO is working on patent eligibility guidance for AI-assisted inventions.

Director Vidal underscored the importance of access to AI for innovation and competition. She emphasized the need to ensure that "everyone has access and can use AI to innovate" in order to spur more market entry and invention.

Director Vidal further described the PTO's role in advising the Copyright Office on IP policy and AI, including working with the Copyright Office on its study of copyright law and AI. Addressing creators' rights, Director Vidal indicated that the government is seeking to strike a balance, including thinking about how to "create an ecosystem that doesn't disrupt the literary, the music

industry, productions, everything that really makes our country beautiful" and how to "allow for the innovation that you need based on the ingestion of data." The PTO is also engaging internationally on these issues, Director Vidal said.

Panel: Balancing Creators' Rights and Competition

- Respecting IP rights when training models
- Negotiation imbalance between Big Tech and creators
- Licensing solutions including PRO models
- The role of labor unions

Panelists

- Duncan Crabtree-Ireland, National Executive Director and Chief Negotiator (SAG-AFTRA)
- Prof. David Lowery, Senior Lecturer of Music Business (University of Georgia)
- Michael D. Fricklas, Chief Legal Officer and Corporate Secretary (Advance Publications)
- Prof. Jonathan Taplin, Director Emeritus at the Annenberg Innovation Lab (University of Southern California)

Summary

These panelists—who have worked for decades in the music, media, and entertainment industries—all expressed concern over the uncompensated use of copyrighted material in AI training data. They worried about the effects of under-compensation and debated possible solutions, including private licensing models or statutory licenses.

Michael Fricklas, a lawyer and long-time executive in the publishing and media industry, explained how spurring competition and adequately compensating creators are complementary aims. He pointed out that appropriately compensating creators for their works can spur competition among creators to have their content included in training data, but if "it's all free, then everybody has all of it and that form of competition disappears."

"AI progress actually requires that these rights be protected" in order to incentivize creativity and the creation of more human-generated content that may be made available for training, Fricklas said. "It's a little like clear-cutting a forest to make wood," Fricklas explained, "When the forest is gone, you're stuck."

Michael Fricklas said that the journalism industry is starting to see problems with uncompensated use. "Journalism [is] really expensive," and AI cannot replace real journalists and their content, said Fricklas. Yet, he said, "companies are claiming, using [copyright] fair use …that they have no obligation what[so]ever to compensate either for training or for output."

Jonathan Taplin, an author, academic, and former producer, agreed that Big Tech has had "a luxury" of using AI inputs for free. Taplin said this use benefits the tech companies and harms creators. "The illegal use of these works has allowed companies to become very big, and it hasn't offered compensation to [the] artists" for the work these companies are using for AI inputs, he explained.

Professor Taplin pointed out that "AI clones" made to sound or read like the original work detract from revenue to the real artists. David Lowery, a recording artist and academic, expressed similar concerns that artists' "own customers are being sold essentially music that's derived from their own music at a cheaper rate. So, their own music is being unfairly used to compete against them." He added that AI can be used to make advances in many fields such as science and medicine but "[y]ou don't need to vacuum up all the songs and literature in the world to develop that stuff."

Labor and Collective Bargaining

Dunan Crabtree-Ireland, head and chief negotiator of SAG-AFTRA—the union that represents professional performers, including actors, recording artists, broadcast journalists, and singers—discussed how labor unions can help promote creators' rights in AI markets.

He acknowledged that companies building foundation models and AI systems are "simply taking works that they have found to be publicly available and using them to train their models." Mr. Crabtree-Ireland said this circumstance is difficult for creators when works can "simply be taken and used to create a whole new business, a whole new concept, and then monetized without any consent or compensation."

Crabtree-Ireland said that "collective bargaining has proved to be a very effective tool in addressing AI." He

reported that, in less than a year, SAG-AFTRA was able to negotiate "pages of detailed contractual rules about the use of AI for digital replication of actors, including voice work, including generative AI provisions."

He further explained that SAG-AFTRA "has had more success in collectively bargaining on the output side than on the input side, because almost every company is scared to limit themselves on the input side, the training side, while the litigation is still going through the system about what fair use of copyright relates to training data."

Crabtree-Ireland also described how IP laws can level the playing field for companies training models. Training without negotiating fair compensation tends to benefit "the biggest and most advanced companies that have already staked out space in this area, or who just have huge economic resources."

Crabtree-Ireland further encouraged the U.S. government to engage internationally. He encouraged the United States and the European Union to pursue norm setting, especially on name, image, and likeness issues.

Licensing and Performance Rights

Panelists also discussed licensing solutions, including collective licensing using a performance rights model. David Lowery argued that AI use cases are different from other copyright uses because of the potential for "unfair competition." "When I license a song for a bar to play [in

David Lowery discusses licensing and performance rights in the AI context.

their establishment]," Lowery said, "they then don't go and create a derivative work and use that to compete against me." He added that the technology companies have been more aggressive in challenging collective licensing rates for digital music. Lowery also viewed voluntary collective licensing as better than compulsory or regulated licensing.

Michael Fricklas said he is "a big supporter of private collective licensing as a solution here." Fricklas viewed the following as efficiencies of collective licensing: "people who have rights that they want to license could license them in an organization, and there's huge efficiencies of having, especially for smaller newspapers and middle-size publications, to be able to go to one place." Collective licensing could be a solution especially if "tomorrow we may be talking about tens of thousands of refined models and tens of thousands of businesses that are interested in using AI." Fricklas noted that competition rules would have to be followed if parties were to engage in collective licensing.

Jonathan Taplin was skeptical that there would be many AI companies to license creative works in the future.

Without advocating for or against a collective licensing solution, Crabtree-Ireland said that there can be many ways to structure a license, including statutory licensing models used for distributing digital performance royalties for sound recordings.

Questions for Further Study

- Can collective licensing solutions help to protect creators' rights, and what antitrust safeguards are needed?

Promoting Procompetitive Regulation of AI Technologies

Dr. Condoleezza Rice and Senator Amy Klobuchar

Both the remarks by Senator Amy Klobuchar and an interview with Dr. Condoleeza Rice touched on important issues related to access and safeguarding competition in AI and adjacent markets.

Access to Inputs

In her remarks, Senator Klobuchar touched on the themes of entry by small technology firms and consolidation. She noted that "many of the most prominent AI startups are partnering with big tech incumbents rather than competing with them" and that "we need to look out for anticompetitive behavior all the way down the AI supply chain." She noted that one barrier for startups is that

"development of AI models requires enormous amounts of computing power that often only large firms can provide."

In her interview, Dr. Rice said that "no university or combination of universities can do the kind of high-scale generative AI, large language models that we're seeing in the commercial sector." She questioned whether it makes sense for this innovation "only to be in the commercial

"I believe that the United States, with proper attention to its innovation ecosystem, has an academic element, has a private sector element, and of course then has government policy, that will give it the advantage." - Secretary Condoleezza Rice

sector" and said that people may be asking, "Can I do the kind of research that I want to do in a university, or do I have to go and do that in industry?"

Competition and Regulation

On regulation of AI and AI-adjacent markets, Senator Klobuchar expressed that governments should put "guardrails in place." She explained that regulation should come from a mindset "that says we love competition, we love capitalism" but that also "watches out for the unbridled power of the army of monopolies."

Dr. Rice also shared her views on competition and regulation in the technology sector. She observed that

"competition of capital…has driven our economy." Dr. Rice also highlighted that "technology is probably going to be the dominant factor in what country is most powerful," noting that "the other big competitor is China." Dr. Rice said that a regulatory approach should come from a place of caution, because "if you're trying to prefigure a regulation for something that is evolving this quickly, you're almost always going to make mistakes." She explained, "I worry that overregulation, particularly some of that I see from Europe, will actually stall our innovation and not allow us to outrace."

Dr. Rice expressed that one part of avoiding regulatory mishaps is to "penetrate the conversation…with people who are actually part of the innovation ecosystem." She recalled that as Secretary of State, she was hesitant to "send somebody who's working on something important" to rulemaking conferences. However, she discovered that those discussions can be influential, and she has now "reformed" her thinking.

Dr. Rice raised several other concerns that she believed regulators should be aware of. One concern was potential harm from other state actors who have the resources to target intelligence. In terms of addressing this issue, Dr. Rice mentioned that "one advantage with state actors is that they actually have things to lose." Dr. Rice also addressed concerns related to the "[broken] procurement and acquisition processes in the defense department." In her opinion, "there's so much in the private sector that could be helping us," and the government can do more to take advantage of it.

Regulation Spotlight

- Regulation through standard-setting bodies and voluntary standards (NIST)
- Use of private firms to self-regulate (Trustlab)
- How regulatory design should analyze the responsible parties in an accountability system
- Licensing or interoperability requirements as potential solutions
- Remedies/government solutions (e.g., CFPB, proposed legislation)

Panelists

- Elham Tabassi, Senior Scientist and the Associate Director for Emerging Technologies (NIST)
- Atur Desai, Deputy Chief Technologist for Law & Strategy (CFPB)
- Shankar Ponnekanti, Co-Founder and CTO (TrustLab)
- Prof. Ellen P. Goodman, Distinguished Professor of Law (Rutgers University)

Summary

The Regulation Spotlight panel focused on the strategies, principles, and challenges of regulating AI. The panelists noted that standards may come from various sources, including companies' self-regulation, standard-setting bodies, and governments. The panelists discussed the importance of including a diverse array of voices in considering regulatory solutions or in setting standards; the challenges of regulating safety and security of AI systems; and potential solutions to help mitigate concerns.

Importance of Diverse Voices

Panelists tended to agree that diverse voices should be considered in any standard-setting process. Professor Ellen Goodman pointed out that "people who are often not in the room are SMEs [subject-matter experts]…and also civil society folks." Elham Tabassi affirmed that "we want to reflect the needs and input from a diverse global set of stakeholders" and reiterated the need for scientific research as a "technical building block" for setting standards. Atur Desai mentioned that the CFPB has been "rounding [teams] out with technologists and other professionals" to help "identify potential violations of law …and design meaningful remedies" that can be understood and implemented by non-lawyers, such as technologists and data scientists.

Safety and Security

The panelists identified some of the challenges of regulating the safety and security of AI systems.

On the one hand, panelists explained that certain types of bad acts can be applied easily to AI. For example, Atur Desai explained, "there is no AI or complex technology exception" to federal consumer financial laws, so bright-line rules can be applied. Dr. Shankar Ponnekanti explained, "bigger companies have provided tools such as sophisticated hashing algorithms" to smaller platforms to address certain issues.

On the other hand, Dr. Ponnekanti pointed out, "once you get into things like hate speech or harassment, things get a little more gray area and companies tend to have somewhat different policies in that regard." Elham Tabassi expanded on this concern, describing abstract standards that call for AI systems to be "secure or non-discriminatory, but don't get to the level of explaining…what we mean." Goodman agreed that, "for a lot of the harms…with AI, we don't yet have that legal regime in place. And to some extent, we can't have it in place because we have First Amendment concerns." Professor Ellen Goodman further noted that "the threat of liability" without having legal certainty on these issues may deter the activity of some small businesses.

Potential Solutions

Despite the complexity of regulating the safety and security of AI, panelists provided some potential solutions for consideration. For example, Tabassi recommended "establishing terminology, taxonomies, specifications for trustworthiness characteristics, testing methodology, conformity assessments" as ways that standards can be made less abstract and used to support policies that "create a level playing field for innovations."

Panelists also discussed the option of encouraging interoperability in the industry, which could come from "putting data back into consumers hands [so they can] ask for their data to be shared with other institutions," as Desai suggested. Dr. Ponnekanti also proposed that it would be helpful to "benchmark[]" more "fine grain

capabilities," which could help avoid "having a single point of failure dependency on a single model and being able to work with different providers."

Panelists also discussed the possibility of professional licensing to mitigate some of the concerns with AI. Professor Ellen Goodman noted that there is a lot of unknown in this area and that attempts at standardizing have failed to provide "good measure[s] of risk or capability or threshold," not to mention "the competition concerns that licensing is a gatekeeping mechanism." Relatedly, Dr. Ponnekanti raised the question of whether government could play a role in helping to "bootstrap" collaboration efforts among smaller companies "where smaller companies don't have to be quite lacking the protections that a bigger company might put in place."

Tabassi explained that it could be helpful for "any AI actors…across this spectrum of the designer, developer, fine-tuners, deployers," to have "standards for transparency on actions being taken, tests being done, and standards [for a] way of reporting."

Questions for Further Study

- Should treatment of small businesses differ from treatment of large businesses?
- How do we ensure standards and regulation support public sector innovation and competition?

International Perspectives

Remarks by Vice President Věra Jourová (European Commission)

Vice President Věra Jourová of the European Commission began by expressing gratitude and emphasizing the need for continued collaboration between the Department of Justice and the European Commission. She emphasized two main challenges posed by the increasing prevalence of AI: its impact on competition and its impact on democracy.

VP Jourová advocated an approach that aims to regulate technology in a way that upholds human rights and prevents exploitative data collection, citing past success with the General Data Protection Regulation (GDPR).

In considering the competitive landscape of AI and AI-adjacent markets, VP Jourová remarked, "We design laws to address risks for the people or to open markets that have been sealed by those who have become too big to compete against. This brings trust of the consumers and innovations through competition, predictability, and sufficient legal certainty. And where there is trust and healthy competition, there is investing from both public and private sources."

To address challenges, VP Jourová emphasized the importance of continued collaboration between the United States and the European Union. She also described the European Commission's efforts not only to enforce competition laws, but to regulate technologies themselves, as with the Digital Markets Act.

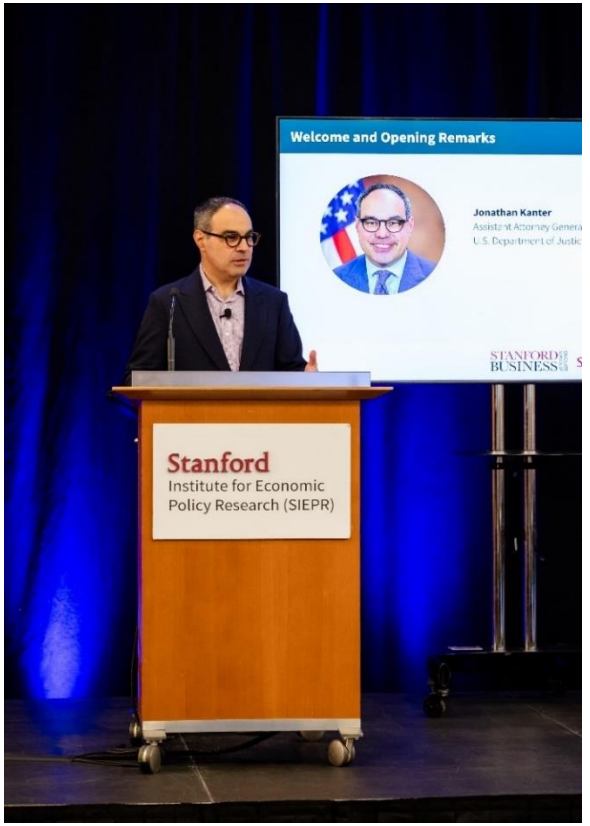
Panel remarks by Dr. Karen Croxson (UK CMA)

During the panel on Competition in Foundation Models and Beyond, Dr. Karen Croxson, the Chief Data, Technology and Insight Officer of the UK Competition and Markets Authority (CMA), discussed the work that the CMA has been doing at the intersection of competition and AI, including its latest reports on foundation models published in September 2023 and April 2024. Dr. Croxson's panel presentation is more fully summarized above.

Conclusion

The AI Workshop was an important step in better understanding the competitive landscape at each layer of the AI technology stack. We will continue to study competition in this ecosystem.

If you have any information on anticompetitive activity in the AI ecosystem, please contact the Antitrust Division's Complaint Center.



Assistant Attorney General Jonathan Kanter addresses those in attendance at the workshop.

Video Statements on AI and Competition

Link

AAG Jonathan Kanter

- Benefits of competition and the role of antitrust
- Mitigating threats to competition in AI-related markets
- Whole-of-government approach to competition policy

Link

PDAAG Doha Mekki

- Competition in labor markets
- AI's impact on creative expression
- Role of antitrust enforcers

Link

Dr. Susan Athey

- Economics of AI
- Defining the "AI Stack" and Identifying Potential Competition Concerns Across the Stack
- Role of Government Economists, Technologists, and Data Scientists

Link

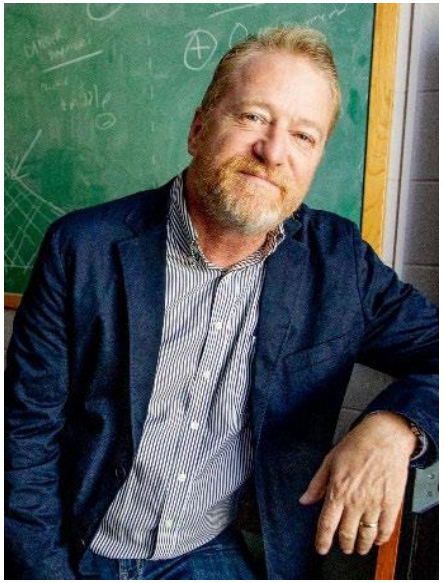
Andrew Ng

- Importance of Open-Source AI Models in Promoting Innovation
- Risks of Government Over-Regulation or Over-Enforcement of AI
- Importance of Start-ups in Promoting Competition

Link

Chris Wolf

- Growth of On-Premises and Hybrid AI Solutions
- AI-Hardware Ecosystem and Workload Mobility
- Government's Role in Promoting AI Adoption



Link

David Lowery

- AI's Effect on Competition in The Music Business
- Difficulties of Applying Current Collective Licensing Regimes to AI
- Role of Antitrust Division in Supporting Musicians

Link

Elena Viboch

- AI Applications in Life Sciences
- Venture Capitalist View of "Take Share" versus "Market Creation" Companies
- Data and Algorithm Portability and the Role of the Government

Link

Ellen P. Goodman

- NTIA Recommendations on Government's Role in AI Accountability
- Risks of Establishing a Federal AI Agency
- Need to Enable Participation in AI Standard Setting
- Appropriateness of Government Regulation and Lessons Learned

Link

Karen Croxson

- Role of the UK's Competition and Markets Authority in Promoting AI Competition and Consumer Protection
- Competition Risks Identified in CMA's Study of Foundational Models
- Developing Technical Expertise at the CMA

Link

Mazhar Memon

- Business Challenges for Startups
- Where Startups Can Compete in AI And How They Can Use Ai
- Role of USG in Promoting Innovation and Investment in AI Companies

Link

Victor Peng

- GPUs Versus CPUs And AMD's Fabless Model
- Chokepoints In Innovation and Competition – Importance of Interoperability

Link

Prof. Ziad Obermeyer

- How AI Relates to Experience in the Emergency Room
- Obstacles to Data Access and Effect on Development of AI Healthcare Tools
- Democratizing Access to Data
- Role Of USG in Health AI – Promoting Consumer Access to Information