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General Comment

See attached file(s)

Attachments

UAlbany Response to OSTP RFI for National AI RandD Strategic Plan



Accelerating America's AI Future: Development of a 2025 National Artificial Intelligence Research and Development Strategic Plan

University at Albany's Response to OSTP's RFI on the Development of an Artificial Intelligence (AI) Strategic Plan

Executive Summary

The University at Albany appreciates the opportunity to respond to the Office of Science and Technology Policy (OSTP), the Networking and Information Technology Research and Development (NITRD) National Coordination Office (NCO) request for input on how the previous administration's National Artificial Intelligence Research and Development Strategic Plan (2023 Update) can be updated so that the United States can secure its position as the unrivaled world leader in artificial intelligence.

We, the AI researchers at the University at Albany, view AI not as a single technology, but rather as an ecosystem of interconnected technologies and application domains comprising tightly-coupled components such as (i) scientific advances related to next-generation AI algorithms; (ii) the cutting-edge technologies for the computing, data storage, and computer communication infrastructures needed to support these powerful AI algorithms; (iii) AI deployment in various domains: health care and biotechnology, manufacturing, agriculture, managing critical infrastructure (such as electric grids, telecommunications, transportation), government operations, national security, and education. We strongly advocate that any policies adopted at the federal level recognize and support all components that inform this AI ecosystem. We also analyzed and identified the key factors differentiating the AI R&D investments pursued by the governments of America's chief competitors on the world stage.

Proceeding from this understanding, we recognize the need for a pragmatic strategy that extends America's global leadership in developing disruptive technologies by complementing private enterprise through the promotion of an expansive agenda of federally funded research defined by high-risk, high-reward initiatives whose ambitions and outcomes are not necessarily intended to be realized in the immediate future. And here, we take inspiration from AI itself in the form of the Long Short-Term Memory (LSTM)

model, a familiar one that captures the creative connections defined by long-term dependencies on sequential (or near-term) data.

We propose **Long Short-Term Investment in R&D for AI (LSTIRD)**, a strategy that balances two seemingly conflicting ambitions: (a) providing long-term support for ground-breaking technologies that take several decades to evolve while (b) facilitating near-term societal and commercial impact of these investments.

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Introduction

We, the AI researchers at the University at Albany, view AI not as a single technology, but rather as an ecosystem of interconnected technological advancements across multiple areas. These include algorithms that power deep learning models; computing infrastructure; high-speed communication technologies; data curation, archive, and storage; and memory architectures. Together, these components frame a transformative architecture that enables AI to be deployed across myriad fields (Figure 1). One significant element of this multifaceted understanding of AI lies in the fact that a disruptive innovation in any one component of this ecosystem is bound to trigger cascading consequences in the other connected components, leading to transformations in the development and deployment of AI that may not yet have been imagined.



Figure 1. AI Ecosystem and Its Plurality

AI Research & Development in A Global Context

Keeping this vision of AI in mind, we analyzed and identified the key factors differentiating the AI R&D investments pursued by the governments of America's chief competitors on the world stage as follows:

- *China* employs coordinated government-led investment across central and local levels, creating a "distributed centralization" model that ensures *nationwide AI development* while maintaining strategic alignment with a state-directed strategy designed to achieve global AI leadership and technological self-reliance by 2030.
- By contrast, *Europe* prioritizes developing AI systems that inherently comply with ethical standards and regulatory requirements, viewing this as a competitive differentiator rather than

a constraint. The European AI R&D investment strategy includes heavy reliance on mobilizing private capital (€150 billion of the €200 billion total) alongside coordinated public research funding through Horizon Europe and the Digital Europe Program.

- Unlike other global AI strategies focused on economic dominance, national security interests, or regulatory compliance, *India's* research priorities center on leveraging AI as a transformative tool for addressing pressing societal challenges while maintaining technological sovereignty through indigenous development capabilities that are inclusive of the multi-lingual nature of the Indian society.

None of these models comport with America's ambitions for artificial intelligence in their entirety. We recognize the fact that the major technology disruptions in the world arose from the USA through startups such as Microsoft, Google, and Meta, and that Google has its origins in support provided by the US federal government through the National Science Foundation. Going back in time even further, the world owes the modern-day Internet and the ubiquitous email to the federal government's investment in the ARPANET (Advanced Research Projects Agency Network) in the 1960s. The evolution of the Internet from ARPANET is one of the classic examples where a fundamentally disruptive technology takes several decades to evolve with no immediate commercial returns. However, in the long term, these federal investments become a game changer to the extent of the entire world being dependent on the technology, such as the Internet. Rather than instrumentalizing research to serve immediate cultural, political, or commercial interests, America has long challenged its most talented researchers to imagine what is *possible* and invested in their research with the unmatched support of the federal government.

Long Short-Term Investment in R&D for AI (LSTIRD)

With this understanding in mind, we recognize the need for a pragmatic strategy that extends America's global leadership in developing disruptive technologies by complementing private enterprise through the promotion of an expansive agenda of federally funded research defined by high-risk, high-reward initiatives whose ambitions and outcomes are not necessarily intended to be realized in the immediate future. Here, we take inspiration from AI itself in the form of the Long Short-Term Memory (LSTM) model, a familiar one that captures the creative connections defined by long-term dependencies on sequential (or near-term) data.

We propose **LSTIRD**, a strategy that needs to balance two seemingly conflicting ambitions: (a) providing long-term support for ground-breaking technologies that take several decades to evolve while (b) facilitating near-term societal and commercial impact of these investments.

LSTIRD Long Term Strategy

Disruptive innovations require basic scientific advancements, yet the areas of research in which such disruptions may occur are inherently unpredictable. As such, we advocate coordinated federal investments across the full scope of research areas comprising the AI ecosystem. AI policy should not pick "winners;" rather, it should promote and accelerate the conditions under which disruptive technologies emerge organically. For instance, we cannot currently anticipate when Quantum Computers will be ready for widespread use, nor can we determine whether bio-inspired computing architectures and neuromorphic computing will replace current "traditional" deep algorithms.

With this rationale in mind, LSTIRD’s long-term strategy aims to foster multiple foundational research projects spanning the entire spectrum of the AI ecosystem that might take decades to evolve into impactful and actionable technology with stable and predictable funding mechanisms that allow researchers to plan and execute their vision over a long period:

- *Quantum Leap*: According to Scott Aaronson, “the world that allows quantum computers will be fundamentally different from a world that doesn’t.” A world that “allows” quantum computers isn’t just one with faster computers; it’s one in which formerly unsolvable problems become solvable, cryptographic foundations may need rebuilding from scratch, and scientific progress could leap forward in ways we can’t fully predict today. The ability to harness quantum phenomena changes the very rules of information processing and thus reshapes core aspects of technology, commerce, security, and scientific exploration.
- *NeuroAI*: Despite the rapid advance in large language models (LLMs), the foundation of intelligence is not language (which is only around 100,000-250,000 years old) but the sensorimotor knowledge acquired by the neocortex through the much longer period of evolution in mammalian brains. How to computationally model the brain’s ability to achieve goals is a fundamental challenge facing both the AI and neuroscience communities. NeuroAI, at the intersection of these two well-established fields, is expected to be the most fruitful area for growth in science, according to Norbert Wiener.
- *Reversible and Zero Energy Computing*: Advances in reversible and zero energy computing hold the promise of minimizing the expansive energy needs of computing in general, and AI in particular. However, these new computing approaches might imply rethinking the way foundational AI algorithms as well as their applications are programmed and deployed.
- *Advanced Communication Infrastructure*: Be it quantum or neural computing architectures, the underlying mechanism for moving data and computation around needs ultra-high-speed networking technologies that maximize the communication bandwidth and minimize the delay predictably. These technologies not only support the wide area Internet, but also serve as the backbone for supercomputing infrastructure in large data centers.
- *Data Ecosystem for supporting the AI Ecosystem*: The performance of AI models is tightly linked with the quality of the data that is used for training the foundational algorithms. In fact, one can even say that the countries that use the highest quality data are most likely to have the AI technologies that dominate the world. The AI investment strategies followed by China, Europe, and India recognize and address the importance of data. Federal investment should prioritize a holistic, long-term view of the diversity of the data ecosystem by funding initiatives for multi-modal (text, audio, vision, gesture, olfaction, etc.) data sets from multiple domains (such as manufacturing, health care, etc). Our proposed LSTIRD strategy also emphasizes the need for multilingual datasets for US AI technologies to sustain and grow their superiority.
- *Supporting Research Infrastructure for the AI Ecosystem*: As we all know, AI technologies comprise not only software-based algorithms but also hardware-based supercomputing and

high-speed communication systems. These hardware-based systems are high-maintenance, exhibiting significant needs for energy, space, and skilled labor. What is more, they need to be refurbished every 3 to 4 years. Federal strategies must include funding support for the maintenance and renewal of the fundamental AI research infrastructure necessary for the basic conduct of research.

- *Cybersecurity for AI and AI for Cybersecurity*: As the saying goes, “whatever you cannot defend is not yours.” This should be understood as a fundamental premise not only for the critical cyberinfrastructure of the nation, but for the discrete infrastructure of the AI ecosystem itself – including, for example, safeguarding foundational AI models from data poisoning. Federal investments should be directed to support researchers developing the most advanced cybersecurity technologies in the world.
- *Domain-inspired AI*: While achieving AGI (Artificial General Intelligence) is an important research agenda, the LSTIRD strategy recognizes the need for supporting domain-specific innovations that can help AI technologies be more precise and accurate. Hence, we advocate long-term funding for domains such as AI in the military, manufacturing, health care, critical infrastructure, etc.
- *AI for Sustainability and Sustainable AI*: While several research advances are being made to minimize energy needs, the ubiquitous use of AI implies increased future energy demand. IoT (Internet of Things) devices that generate multimodal AI data and the edge computing devices that help process this information need more and more power. Hence, LSTIRD advocates federal research support both for using AI to develop more sustainable approaches and to make AI itself more sustainable through more efficient hardware and software.

LSTIRD Short Term Strategy

- *Sustaining and Growing the Innovation-Commercialization Bridge*: The USA owes its technological superiority both to innovators who had a disruptive vision and to the accompanying support system that included not only funding but also legal protection for intellectual property. LSTIRD argues the need for federal investment in innovators whose research might not be deemed viable within the contemporary commercial ecosystem (comprising actors such as angel investors and venture capitalists). This strategy includes funding for the “valley of death” in startups, education for innovators and legal experts, among other things. Some possible options include sustaining and growing federal funding mechanisms such as SBIR (Small Business Innovation Research), STTR (Small Business Technology Transfer), and NSF Innovation Corps (I-Corps™).
- *Transition-to-Practice and Transition-to-Scale*: Some AI technologies may not have “commercial paths” in the near/short-term in the sense of profit-making but may have a huge and immediate impact in some fields. These lab-based AI technologies would need support for deploying them in specific domains, at scale or both.

- *Supporting Exploratory, Emerging, and Time-sensitive Research Topics:* High-risk research topics imply not only a high risk for failures but also a high possibility for rewards. These topics are typically exploratory in emerging areas where the industry and commercial actors may stay away as they worry about high failure rates. Some topics (such as regional, national, or international crises) may be highly time sensitive with no commercial buy-ins.

Enabling Mechanisms Proposed for LSTIRD Strategy:

The ultimate success of any strategy depends upon the enabling and implementation mechanisms used. To this end, we advocate the following:

Researcher-Facing Organic Agenda for Investment: We emphasize the need for federal agencies to listen to the domain experts in the USA as well as other countries while formulating the federal research funding agenda on both short- and long-term scales. This can be facilitated through multiple avenues, including focused or theme-specific, invitation-only workshops as well as working groups.

Growing the Next Generation Thought Leaders: A nation owes its prosperity to the vision and actions of its leaders, who contribute the highest value to their country's success. LSTIRD recognizes this strategic need for sustaining and growing the pool of AI thought leaders who can work tirelessly in advancing the superiority of the USA's AI technologies. These leaders need an environment for training and mentoring to grow and hone their skills. These environments could include rotating positions in federal agencies, sabbatical opportunities in federal research labs, and salaried opportunities in advisory panels, among other things.

Fair Playing Ground: The success of federal research funding is also contingent upon the processes used to fairly evaluate the quality of the research produced by said support. The standard in this context has been established by the rigorous peer review strategies followed by the National Science Foundation and the National Institutes of Health. An additional – and perhaps less obvious – benefit of these processes is that they also provide invaluable feedback that can not only refine and improve active research but also stimulate the elaboration of new ideas. These peer review strategies also serve as a training and recruiting tool for the next generation of research thought leaders.

Supporting Domestic and International Involvement for Researchers: LSTIRD recognizes the fact that advancements in AI technologies are continuously unfolding around the world. To extend its competitive edge, America needs its researchers to travel to domestic and international conferences and to invite international researchers to come to the USA. Further, the United States must attract the best talent in the world to come as students and create a pathway to retain them in the country, thus enabling the center of gravity in tech leadership to remain in the US. Federal funding mechanisms need to recognize this fact by providing support for researchers' travel, funding for

joint research projects involving international researchers and scholarships and fellowships to attract top talent to the United States.

Conclusion

The University at Albany appreciates the opportunity to respond to the Office of Science and Technology Policy (OSTP), the Networking and Information Technology Research and Development (NITRD) National Coordination Office (NCO) request for input on how the previous administration's National Artificial Intelligence Research and Development Strategic Plan (2023 Update) can be updated so that the United States can secure its position as the unrivaled world leader in artificial intelligence. Federal policies that support research in workforce transformation, institutional trust, social resilience, and technological change will ensure that national policies are informed by rigorous research and analysis. UAlbany's faculty are well-positioned to contribute to these efforts, offering insights into economic mobility, governance frameworks, and technological adaptation. Continued investment in these areas will promote national competitiveness, enhance institutional effectiveness, and ensure long-term socio-political and economic prosperity.

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