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General Comment

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Attachments

UMNRFI2025

University of Minnesota's Response to a Request for Information on the Development of a 2025 National Artificial Intelligence (AI) Research and Development (R&D) Strategic Plan

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Summary

The University of Minnesota (UMN) has a longstanding legacy of leadership in foundational artificial intelligence (AI) research, development, and real-world translation (e.g., see¹⁻⁸). Its faculty, research centers, and cross-disciplinary collaborations have consistently contributed to breakthroughs in core AI technologies, applications, and ethics. Today, the UMN continues to play a pivotal role in shaping the future of AI in ways that reinforce and strengthen the United States' leadership in this strategically vital domain.

While the University's ongoing investments and initiatives are strongly aligned with the priorities set forth in the 2023 National Artificial Intelligence Research and Development Strategic Plan⁹, UMN also brings a unique focus to emerging areas that merit further national attention. These include:

- 1. New approaches to developing the next generation of an AI literate workforce, including upskilling industry's current workforce¹⁰;**
- 2. Foundational research in Knowledge-Guided (e.g., Physics-informed) Machine Learning and its application¹¹;**
- 3. Support for —areas where UMN is not only advancing innovation but also influencing policy and public understanding¹².**

This alignment underscores UMN's deep commitment to advancing AI research, education, and societal impact in a responsible and future-oriented manner. Below, we highlight how UMN's current and emerging priorities correspond with—and in some cases, go beyond—the strategic priorities identified in the 2023 national AI plan, while outlining specific ways in which future federal investments are needed to advance these critical areas.

UMN Priority Areas for AI Training, Foundational AI Research, and AI for Scientific Discovery

1. Advance and Accelerate AI Training and Learning

To ensure that the United States remains globally competitive in a rapidly evolving economy shaped by artificial intelligence and data-driven technologies, new federal investments in university-led workforce development and upskilling are essential. As AI and data science transform sectors ranging from manufacturing and agriculture to healthcare and energy, industries are facing an urgent need for talent equipped with the technical, analytical, and ethical skills necessary to innovate responsibly. Universities are uniquely positioned to address this challenge by serving as hubs of talent development and knowledge transfer. The University of Minnesota's Data Science and AI (DSAI) Hub¹³ exemplifies this role. By fostering public-private partnerships and engaging with regional industries, the DSAI Hub is helping to align academic programs with real-world demands, co-develop training pathways, and provide access to cutting-edge tools and expertise that accelerate industry adoption of AI and data science.

However, meeting the scale of national workforce needs will require significant and sustained federal investment. Many industries—particularly those outside major tech hubs or in rural regions—lack the resources to independently train or recruit highly skilled AI and data science professionals. Through initiatives like the DSAI Hub, universities can serve as regional engines of economic development, providing upskilling opportunities for current workers, creating multiple entry points to address the unique challenges and opportunities facing our communities, and building lifelong learning systems that adapt to emerging technologies. To support this at a national scale, federal agencies must invest in infrastructure, curriculum development, internship and apprenticeship programs, and applied research collaborations that foster closer connections between academia and industry.

Specific actions that require federal investment include:

- Supporting the creation and expansion of university-based AI and data science hubs that engage directly with local and national industries
- Expanding access to reskilling programs for mid-career professionals in sectors undergoing AI-driven transformation
- Funding regional workforce development, upskilling and reskilling initiatives that provide certificates, microcredentials, and stackable degrees in AI-related fields
- Creating applied AI research fellowships and internships that embed students and faculty within industry to solve real-world problems

- Investing in multiple pathways that address unique challenges facing local communities seeking to be a part of the future AI workforce
- Developing national curriculum frameworks and accreditation standards for AI and data science education
- Support and expand the train-the-trainers programs to expand and upskill AI and data-science teachers
- Providing grants for public-private consortia focused on co-designing training modules, toolkits, and best practices for AI adoption in small and medium-sized enterprises

2. Support Foundational AI Research and Its Application

As the pace of AI innovation accelerates globally, new federal investments in university-led foundational AI research will be essential to maintain the United States' leadership in the field. Universities serve as the intellectual backbone of the nation's AI ecosystem—training the future workforce, developing novel algorithms, and enabling scientific discoveries that advance societal progress. These institutions are also uniquely positioned to strengthen today's AI systems by addressing persistent challenges such as hallucinations, bias, and reliability risks.

One strategic frontier in this effort is Knowledge-Guided Machine Learning (KGML), an emerging area that integrates data-driven methods with the laws of nature, domain knowledge, and causal reasoning. KGML has the potential to produce AI systems that are not only more reliable and interpretable, but also more trustworthy in high-stakes applications. The University of Minnesota is helping to lead this field by embedding scientific principles into AI models to address critical challenges in environmental science, healthcare, and engineering¹⁶.

However, the complexity and interdisciplinary nature of foundational AI research demands sustained, targeted support beyond what current funding structures typically allow. To keep pace with the rising complexity and strategic importance of AI, universities must have the capacity to invest in large-scale computing infrastructure, attract and retain top interdisciplinary talent, and foster collaboration across traditional academic boundaries. Foundational AI research—especially in areas such as KGML, scalable learning systems, AI for scientific discovery, and trustworthy AI—requires a long-term commitment and flexible research environments that are often difficult to sustain with short-term or narrowly scoped funding. With the University of Minnesota already contributing nationally recognized advances in these areas, increased federal investment would amplify the university's ability to expand its impact, scale its innovations, and help shape the future of responsible AI development nationwide.

Specific actions that require federal investment include:

- Establishing national AI research centers dedicated to foundational areas like KGML, explainable AI, and scientific machine learning to strengthen AI for reducing hallucinations and other risks
- Funding large-scale, interdisciplinary research programs that connect AI with core scientific domains (e.g., Biomedicine, Agriculture and the Environment, and Advanced Materials)
- Expanding campus-based or regional academic consortia of high-performance computing infrastructure for hybrid modeling and AI experimentation
- Creating faculty and postdoctoral fellowship programs that support dual-domain expertise (e.g., AI + Agriculture, AI + Healthcare)
- Supporting the development of open-source AI tools, datasets, and simulation environments
- Investing in education and workforce development programs that train the next generation of foundational and use-inspired AI researchers in both theory and societal applications

3. Support the Development of Data Science and Other Research Areas Essential for the Advancement of Artificial Intelligence

To advance the frontiers of AI, new investments in universities are critically needed to strengthen the foundational ecosystem of data science, which underpins nearly every aspect of AI development. High-quality, well-curated data is essential for building robust, generalizable, and ethical AI systems. Universities like the UMN are leading by example through initiatives such as the Data Science and AI (DSAI) Hub¹³, which serves as a campus-wide nexus for data innovation. The DSAI-Hub promotes cross-disciplinary collaboration, supports infrastructure development, and provides strategic leadership on data-intensive research. A key component of this initiative is UMN's recognition of data as a strategic asset. Through seed grant programs, the university funds pilot projects that harness data for scientific discovery and societal impact, while fostering partnerships across academia, government, and industry.

Moreover, UMN is empowering the broader research community by improving access to public datasets through platforms such as DRUM (Data Repository for the University of Minnesota)¹⁴ and the Research Computing Data Portal¹⁵. These resources exemplify how universities can democratize data access, encourage reproducibility, and catalyze innovation across disciplines. However, expanding such efforts nationwide requires federal support. To stay competitive on the global stage, the U.S. must ensure its academic institutions have the resources to develop the infrastructure, governance models, and data-sharing practices that are essential for AI advancement. Without

robust data ecosystems and the institutional capacity to support them, even the most promising AI models will fall short of their potential.

Specific actions that require federal investment include:

- Funding the creation and expansion of university-based data science institutes that serve as national and regional hubs for data-centric research
- Supporting seed grant programs that enable early-stage, data-driven AI research and promote cross-sector collaboration
- Investing in public data repositories, tools for data governance, and long-term curation and maintenance of research datasets
- Providing grants for the development of interoperable, secure, and ethically governed data infrastructures
- Encouraging the adoption of FAIR data principles (Findable, Accessible, Interoperable, Reusable) across academic and federal research programs
- Promoting data literacy and training programs for researchers, students, and professionals working with AI systems
- Enabling the creation of federated and privacy-preserving data sharing platforms to unlock access to sensitive or distributed datasets without compromising security or trust

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