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Comment On: NSF-2025-OGC-0001-0001
Request for Information: Development of a 2025 National Artificial Intelligence Research and Development Strategic Plan

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Submitter Information

Organization: University of California, Davis

General Comment

Please see attached for a response from the University of California, Davis Office of Research and College of Engineering.

Attachments

NSF AI RD Strategic Plan RFI - UC Davis Response

May 29, 2025

Subject: Request for Information on the Development of a 2025 National Artificial Intelligence (AI) Research and Development (R&D) Strategic Plan

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To Whom It May Concern:

The University of California, Davis Office of Research is pleased to provide a response to this RFI from the Networking and Information Technology Research and Development National Coordination Office. Enclosed are responses from faculty members Drs. Chen-Nee Chuah, Raissa D'Souza, Zhi Ding, Lifeng Lai, Junshan Zhang, Lifu Huang, Muhao Chen, Xin Liu, Zhe Zhao, Zhaodan Kong, and Yubei Chen from the College of Engineering.

The UC Davis College of Engineering (CoE) is a public land-grant research college committed to creating a sustainable world through socially responsible engineering, inspiring education, and transformative research. Its mission includes addressing real-world challenges in energy systems, climate resilience, health, mobility, agriculture and the environment – areas where artificial intelligence (AI) is playing an increasingly critical role.

In 2024, the CoE launched the **UC Davis AI Center in Engineering** to build transformative collaboration on AI for foundational research, translational applications, and education by engaging campus and industry partners, policymakers and the community to leverage AI for the betterment of humanity and the planet. The Center builds on long-standing faculty leadership in AI research and education, spanning all eight engineering departments. Its research agenda reflects the College's interdisciplinary vision and includes ten focus areas, such as Foundations of AI, AI and Agriculture, AI and Energy, AI and Health, AI and Robotics, AI and Education, and AI and Society.

The College's strategic goals align closely with federal AI R&D priorities. We work collaboratively across campus (e.g., through the Chancellor's AI Council, established in 2024 to guide responsible AI governance), with industry partners, and with the broader community on grand societal challenges—including smart agriculture, clean energy, and precision health. Our education and innovation efforts are closely tied to workforce development and to the promotion of ethical, trustworthy AI.

Major campus initiatives such as **UC Davis Grand Challenges**, the **Center for Artificial Intelligence and Experimental Futures (CAIEF)**, the **AI Institute for Next Generation Food Systems (AIFS)**,

and the **DataLab** further embed AI into UC Davis's research and public service mission. The CoE aims to support the national AI R&D strategic plan by advancing cutting-edge research and training that improves quality of life and supports environmental and economic sustainability and development.

UC Davis researchers are contributing significantly across the full spectrum of AI priorities:

- The UC Davis College of Engineering supports prioritizing federal AI R&D investments across several key domains aligned with national priorities and institutional strengths. UC Davis faculty are advancing **foundational AI research**, including novel machine learning algorithms, optimization methods, and theoretical approaches critical for long-term U.S. leadership. For instance, Professor Xin Liu is developing a new post-hoc explainability algorithm for deep learning models, enhancing the widely used "Integrated Gradients" method for computer vision applications.
- The College is also pursuing **high-risk, high-reward AI projects**, such as collaborative autonomy for field robotics and AI-enhanced prosthetics. Professor Karen Moxon leads the Moxon Neurorobotics Laboratory, which focuses on brain-machine interfaces and has demonstrated closed-loop, real-time systems in rodent subjects, contributing to advancements in neural engineering.
- In **AI hardware and architectures**, UC Davis engineers are exploring neuromorphic computing and developing low-power edge AI systems with applications in environmental sensing and embedded devices. The Electrical and Computer Engineering department offers foundational coding courses and specialized training in AI, preparing students to engage in cutting-edge hardware-software co-design.
- Faculty leverage AI to **accelerate scientific discovery** in areas like genomics and materials science including technologies like **digital twins**. The AI Institute for Next Generation Food Systems (AIFS), led by Professor Ilias Tagkopoulos, integrates AI and machine learning technologies to create a nutritious, efficient, and safe food supply, fostering healthier, sustainable food solutions.
- UC Davis emphasizes **robust, adaptive AI systems** designed to function in uncertain, real-world environments. Researchers are using drone imagery and advanced modeling to track nitrogen levels in almond orchards, aiding in efficient farming practices and environmental sustainability.
- Researchers contribute to **AI standards, security, and reliability**, including formal methods for machine learning system verification and bias detection tools in AI decision systems. The College's commitment to trustworthy AI is evident in its interdisciplinary collaborations and educational efforts.
- Projects with implications for **national security and critical infrastructure** include research in cyber-physical system resilience, AI-driven wildfire monitoring using UAVs, and intelligent transportation systems. These initiatives aim to enhance the reliability and safety of essential services.
- UC Davis is advancing **physically embodied and agentic AI**, with robotics research in autonomous grapevine pruning, drone-based phenotyping in agriculture, and AI-integrated wearable sensors for healthcare monitoring. These projects support U.S. leadership in ag-tech, defense, and climate resilience.
- The College maintains a strong commitment to **AI research infrastructure**, offering high-performance computing clusters, agricultural test fields, and interdisciplinary centers like the UC

Davis AI Institute for Food Systems and the AI Center in Engineering. These resources facilitate cross-disciplinary research and innovation.

- Faculty are actively engaged in **AI for cybersecurity and cyberspace operations**, with research focused on anomaly detection, secure control systems, and adversarial learning. These efforts address critical gaps beyond commercial priorities.
- Faculty are actively engaged in developing **sustainable data centers** using liquid cooling and modular approaches.
- UC Davis projects in **public sector and government applications** include AI for flood prediction, smart grid optimization, and sustainable urban planning. These initiatives aim to improve public services and infrastructure through intelligent systems.
- Finally, the College supports **AI for workforce development and productivity** through data-informed curriculum innovation, collaborative capstone projects with industry, and the development of AI-powered tools for education and clinical decision support. These programs prepare students and professionals to thrive in an AI-driven economy.

The UC Davis College of Engineering invited faculty and researchers across its departments to provide input on the research priorities outlined in the 2025 National Artificial Intelligence (AI) Research and Development Strategic Plan. Reflecting the College's broad expertise in artificial intelligence and its applications, the following comments and suggestions represent a collective response from faculty working at the forefront of AI theory, systems, and domain-driven innovation. These insights are organized according to the key thematic categories identified in the Request for Information (RFI).

Foundational AI Research:

Strategic priorities in Foundational AI Research should include the development of data augmentation and regularization algorithms for mitigation of cross-modality interfaces. Such algorithms may be used in general alignment of foundation AI models.

High-Risk, High-Reward AI:

As a specific use case, the development of multi-agent systems offers a new means of accelerating traditional software development through interactions between the system and human engineers and teams. Furthermore, principles of human-AI interaction should be applied to research into the deployment of large foundational AI models, such as those governing the personalization experience on social media platforms.

AI for Scientific Discovery:

UC Davis faculty are presently developing foundation AI models to enhance studies and investigations in the areas of radiology, food science, and material science, among others. Research into tailoring AI models for discipline-specific use will be important to augmenting conventional research and improving experimental efficiency through targeted studies and AI-driven parameter screening.

Adaptive & Robust AI Systems:

UC Davis faculty are developing automated red teaming algorithms to proactively identify vulnerabilities and safety threats of LLMs, code agents and system AI agents. This will aid the development of guardrail models to defend against these threats.

Standards, Security, and Reliability:

Addressing the issue of risky and sensitive knowledge in foundation AI models, areas for future investigation include detection, access control, and unlearning mechanisms. Regarding transparency, further work is needed to develop controllable explanation algorithms to suit user needs. As an example, UC Davis faculty are currently designing explanation algorithms for time series data for better model debugging and knowledge discovery, which are further dictated by user-specified levels of granularity.

AI for Public Sector & Government Applications:

To maximize the intersection of AI and government and public sector application, one key thrust area is autonomous robotics. UC Davis faculty are currently investigating the use of unmanned aircraft systems (UAS) for public safety applications such as wildfire detection and response, as well as agricultural and environmental uses such as pesticide delivery with minimal health risk to a human operator. In addition to these examples, we also anticipate a growing interest in UAS technology in the public health and defense sectors.

AI for Workforce Development and Productivity:

To equip the future American workforce with the tools to best utilize and leverage AI for productivity, there should be significant attention directed to student, researcher, and public training. As an example, UC Davis has administered the AIBridge bootcamp program over 11 times across the nation to provide interested individuals, both within the field and from the general public, with hands-on experiential learning. It should also be noted that such training would benefit from being location-agnostic, as we have also administered this bootcamp at public libraries to maximize engagement outside of higher education.

Questions about this RFI response can be directed to the Strategic Initiatives team at strategicinitiatives@ucdavis.edu. UC Davis appreciates the opportunity to provide input pertinent to NITRD's directives and looks forward to future collaboration.