

University of Cincinnati Recommendations In Response To A Request for Information on Development of an Artificial Intelligence Action Plan

Introduction and Executive Summary

The University of Cincinnati (UC) is pleased to provide the following recommendations in response to the subject request for information. The United States must seek an AI development and deployment action plan that produces both safe and secure AI. We propose such action plan adopt two innovative core foundations: 1. Approach AI as decision-making agents rather than tools of decision-making, thereby linking safe and secure development and deployment to the core elements of decision-making loops (observation, orientation, decision, and action); 2. Adopt a virtual laboratory structure with a fuzzy logic verification methodology as its cornerstone. UC is recognized in the U.S. and globally for performing advanced artificial intelligence (AI) research, development, and testing with a particular emphasis on verifiable AI models and fuzzy logic machine learning. This work, led by Professor Kelly Cohen is part of UC's Digital Futures initiative housed in an off-campus research facility populated by a collection of UC researchers with a track record of performing applied research in close cooperation with industry leading global companies, NASA, NSF, NIH, Department of Transportation, Department of Homeland Security and U.S. Department of Defense research labs, US Cyber Command and NSA. This AI expertise is complemented by Digital Futures hosting the Ohio Cyber Range Institute (OCRI), co-directed by Professor Richard Harknett. The OCRI provides a safe and secure environment to train, test, and verify the next generation of cyber systems and personnel and is actively utilized by both industry and government. The OCRI infrastructure provides cyber system analysts a platform to rapidly develop and test products and train on a fielded system. The Ohio Cyber Range is utilized by universities and educational institutions across the state of Ohio, many Ohio state agencies, the Ohio National Guard and is housed at the University of Cincinnati. The benefits of this range have reduced testing cycle times and provided a significant training ground to develop future cyber system experts. The central theme of UC's AI policy recommendations focuses on the pressing need to develop AI model training, testing and certification capabilities in a safe virtual environment with an emphasis on safety and mission critical applications. Based on the principles that have proven successful at the OCRI, UC recommends AI policies that promote creation of a similar capability focused on AI. This proven capability will allow for rapid, and safe AI development with enhanced testing capability.

The Need for a Different Approach to AI Training, Testing and Certification

The AI revolution is upon us with immense potential to enhance the quality of our lives and bring about economic gains, but AI comes along with risks. As AI systems continue to integrate into many aspects of everyday life at home, work, and in the defense of our nation, the need for transparency and explainability of these systems has never been more important. While AI use in safety critical systems has been studied by others, UC researchers are adopting a different framework, one tying AI development and deployment to a decision-making frame in which AI function aligns with the four basic elements of decision-making: observe, orient, decide, and act. Policies that support the rapid development of virtual environments that allow for independent verification, validation, and accreditation (VV&A) of these safety critical AI models is essential for public safety and for mission critical defense applications.

Establishing policies that promote the accelerated development of AI VV&A capabilities and infrastructure will address several of the priority areas identified in the RFI including:

- Model development
- Open-source development
- Application and use
- Explainability and assurance of AI model outputs
- Cybersecurity
- Data privacy and security
- Risks, regulation, and governance
- Comprehensive approaches for VV&A of safety/mission critical systems
- AI Testing framework and infrastructure
- Technical and safety standards
- National security and defense
- Research and development
- AI Education and workforce development
- Innovation and competition
- International collaboration

Of particular importance is promotion of AI policies that drive development of verifiability and transparent AI systems. Development of methods for verifying AI systems, especially in national security applications will ensure they are reliable and secure. Fuzzy logic-based AI is regarded as a foundation for responsible AI for several reasons. Key features include the ability to serve as universal approximators, simulate linguistic uncertainty, computational efficiency, capturing degrees of truth, and the ability to offer flexibility for more human-like reasoning. While conventional logic requires precise inputs and produces definite outputs, fuzzy logic allows for intermediate possibilities, mirroring human thought processes. This

ability makes fuzzy logic effective for uncertain data and can be effective in decision-making where information is unclear, vague or incomplete. By using fuzzy logic, AI systems can be made more explainable, as it allows for the representation of the certainty of each data point, which contributes to the development of explainable AI. Fuzzy logic is crucial in the development of more transparent and understandable systems, especially in safety-critical domains such as transportation, aerospace, health, cybersecurity, and manufacturing. These systems enable the transition from fault-tolerance to optimize fault adaptive in near real-time. Fuzzy logic systems have demonstrated capability and have met success in meaningful safety critical systems.

Professor Kelly Cohen, the Brian H. Rowe Endowed Chair in Aerospace Engineering at the University of Cincinnati, has extensively researched the integration of artificial intelligence (AI) in data fusion and situational awareness, focusing on applications in unmanned aerial vehicles (UAVs) and autonomous systems. His work emphasizes the development of genetic fuzzy logic-based AI methodologies to enhance decision-making and control in dynamic environments.

One notable contribution is his research on genetic fuzzy systems for UAV control. In the paper "Genetic fuzzy based artificial intelligence for unmanned combat aerial vehicle control in simulated air combat missions," Cohen and his co-authors developed AI algorithms that enable UAVs to autonomously perform complex maneuvers in simulated combat scenarios. This study demonstrated the potential of genetic fuzzy systems to manage uncertainties and improve the autonomy of UAVs in mission-critical situations.

Cohen has also explored cooperative control strategies for multiple UAVs. In "Cooperative control of multiple uninhabited aerial vehicles for monitoring and fighting wildfires," he investigated how multiple UAVs can work collaboratively to monitor and combat wildfires. This research highlighted the effectiveness of multi-agent systems in enhancing situational awareness and response efficiency during emergency management operations.

Additionally, Cohen's work on explainable AI (XAI) is noteworthy. His research focuses on developing fuzzy logic-based AI solutions that are transparent and interpretable, addressing the need for responsible AI in safety-critical applications. This approach ensures that AI-driven decisions in areas like air traffic control and emergency management are understandable to human operators, thereby fostering trust and facilitating integration into existing systems.

Through these efforts, Professor Cohen has significantly advanced the application of AI in enhancing data fusion and situational awareness, contributing to improved safety and efficiency in various domains.

These advances in AI are applicable across multidomain information systems and industries. They are applicable for advances across not only UAV platforms, but throughout the medical, energy, and cyber communities. To continue the advancements in this dynamic field, the University of Cincinnati, recommends the following policy focus recommendations.

- AI Testing Infrastructure to Assess Risks for Startups - Immediate (6-12 months)
 - Create an AI regulatory sandbox for startups to safely test and validate AI solutions under supervision
 - Develop standardized AI risk assessment frameworks to evaluate new AI applications' safety, fairness, and privacy
 - Provide mentorship and compliance guidance for AI startups to ensure ethical best practices and regulatory alignment
- Long-Term (High-Reward Gains)
 - Make Cincinnati a safe AI innovation hub, known for a supportive environment and strong ethical standards that attract startups and investors
 - Influence broader policy by showcasing effective AI risk management, positioning the region as a leader in shaping responsible AI governance
- AI for Emergency Management - Immediate (6-12 months)
 - Implement AI-driven disaster prediction and early warning systems for events like floods or severe weather
 - Use AI to optimize emergency resource allocation (e.g. smart dispatching of fire, police, EMS) based on real-time data
 - Deploy AI chatbots for real-time public crisis communication, providing citizens with timely updates and guidance during emergencies
- Long-Term (High-Reward Gains)
 - Build an AI-powered emergency management network that anticipates risks and coordinates rapid response across agencies
 - Continuously improve disaster preparedness through AI simulations and analytics, reducing response times and mitigating impacts

These recommendations directly align with the priority of "Explainability and assurance of AI model outputs" as well as "Technical and safety standards". In part, this policy should include implementing robust safety protocols for AI systems, with a specific focus on fuzzy logic and safety AI drivers to improve reliability and decision-making in autonomous systems.

Policies for AI development that build upon the successful train, test and certify approach taken at the Ohio Cyber Range should be implemented to accelerate national AI capabilities. In addition, policies that promote research that explores AI applications in cybersecurity, such as threat detection, network security, and incident response should be implemented.

These recommendations align with the "Cybersecurity" and "National security and defense" priorities and would build on existing strengths at UC, such as the Ohio Cyber Range Institute.

Broader AI Recommendations

While UC's policy recommendations primarily focus on accelerating the development of the application of fuzzy logic, UC recommends seven additional focus areas to secure and accelerate U.S. dominance in AI technology.

- Academic Institutions Enhancement
 - Strengthen Trustworthy AI and related programs in universities and research centers in a way that creates pathways of opportunity for industry.
 - Foster collaborations between academia and industry for cutting-edge research
 - Enhance AI research infrastructure by providing access to state-of-the-art laboratories, computational resources, and data storage facilities to provide industry efficiencies.
 - Support the development of AI education programs to train the next generation of AI researchers and practitioners, ensuring a steady pipeline of skilled professionals.
- Business Community Development
 - Support the growth of AI startups and established technology companies
 - Encourage venture capital investment in AI-focused enterprises
 - Facilitate mentorship programs linking startups with industry veterans
 - Foster interdisciplinary AI research across various industrial sectors to enhance innovation and application.
 - Encouraging interdisciplinary research by facilitating collaborations between AI researchers and experts from other fields such as healthcare, education, and environmental science.
- Government Support
 - Advocate for policies that promote AI innovation and development
 - Offer grants and tax incentives to support AI projects and companies
 - Establish innovation zones with benefits for AI-related businesses
 - Promote the development of explainable AI to ensure transparency and accountability in AI systems.

- Infrastructure Improvement
 - Upgrade technological infrastructure to support AI development
 - Ensure high-speed internet and robust data centers are available
 - Promote smart city initiatives integrating AI for urban improvement
 - Facilitating access to high-quality datasets and computational resources for AI research and development.
 - Establishing partnerships with AI research institutions to promote national collaboration and knowledge sharing.
- Talent Pool Expansion
 - Create workforce development programs that leverages AI
 - Attract and retain skilled AI professionals in the U.S
 - Develop local education and training programs in AI and data science
 - Support universities to create specialized AI certification programs
 - Implement AI curriculum in schools (K-12 and vocational schools)
- Networking and Collaboration
 - Support organization of regular conferences, workshops, and meetups to foster community and partnerships
 - Create platforms for collaboration between academia, industry, and government
 - Create platforms for knowledge sharing and innovation exchange
- Healthcare Innovation
 - Leverage AI to improve diagnostics, treatment personalization, and patient care
 - Support AI-driven health research through partnerships with local hospitals and research center
 - Expand preventative health services with AI to identify community health risks.
 - Establish healthcare AI talent pipelines through collaborations with medical schools and healthcare providers.

Qualifications of UC Researchers Providing AI Policy Recommendations

Kelly Cohen, PhD

- Director, AI Bio Lab, Digital Futures, UC, May 2022-present
- Aerospace Engineer since 1986 (joined UC in 2007, fuzzy logic developer since 1994)
- BS, MS, and PhD from Israel Institute of Technology, Technion
- Developing Explainable Fuzzy AI systems since 1994
- Interim Department Head, UC/Aerospace: 2017-2021
- Chair of American Institute for Aeronautics and Astronautics (AIAA), Intelligent Systems Technical Committee, 2013-15
- President, North American Fuzzy Information Processing Society (NAFIPS), May 2024-May 2026
- Honorary Co-Chair and Industrial Liaison Chair, 2025 IFSA/NAFIPS, International Fuzzy Systems Association Joint Congress to be held in Banff, Alberta, Canada, August 15-18, 2025.
- Board Member, Cincinnati AI Catalyst (CAIC)
- Genexia, LLC, Co-Founder and Chairman of the Board – Genexia is a start-up
- Brandrank, Chief Academic Advisor
- Associate Editor, IEEE Transactions on Fuzzy Systems, Impact Factor – 10.7
- Subject Editor for Aerospace and Intelligent Systems: *Complex Engineering Systems*, OAE Publishers, Impact Factor - 3.7
- Specialty Chief Editor for Intelligent Aerospace Systems, *Frontiers in Aerospace Engineering*, Frontiers, Switzerland

Richard Harknett, PhD

- Professor of Political Science and Director of the School of Public and International Affairs, Director of the Center for Cyber Strategy and Policy, Co-Director of the Ohio Cyber Range Institute at the University of Cincinnati. He holds an affiliate faculty position with the School of Information Technology at UC.
- First Scholar-in-Residence at United States Cyber Command and NSA in 2017.
- Advisor to the US government and state of Ohio and contributor to US Cyber Command's doctrine of persistent engagement as well as advising allies on adopting similar proactive cyber postures.
- Co-author of *Cyber Persistence Theory: Redefining national security in cyberspace* (UK: Oxford University Press, 2022).
- Professorial lectureship at the Diplomatic Academy Vienna, Austria, where he served as Fulbright Professor in 2001.
- Inaugural Fulbright Professor in cyber studies at Oxford University, UK in 2017
- Over 60 publications with research focus on international relations theory and international security studies with particular focus on cyber strategy.

Conclusion

The University of Cincinnati is dedicated to advancing AI research that aligns with national priorities and fosters innovation. By leveraging the expertise of our esteemed faculty and supporting responsible AI policies, we aim to contribute significantly to the development of a robust AI action plan. In addition, we believe that policy recommendations focused on cyber security enabled AI which leverage the capabilities of the Ohio Cyber Range Institute will allow for continued growth within the AI field. By implementing these policies, the University of Cincinnati aims to create a supportive environment for all AI researchers, fostering innovation, collaboration, and responsible AI development.