

# **FINDINGS: Enhancing AI's Positive Impact on Science and Medicine**

National Artificial Intelligence Advisory Committee (NAIAC)

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## INTRODUCTION

One of the most exciting and positive developments about artificial intelligence (AI) is its potential for scientific progress. Institutions, governments, and companies around the world are already using the technology to spark research breakthroughs, develop new drugs, and push the frontiers of knowledge. This is particularly true in the realms of medicine and healthcare.

The scope of the NAIAC AI Futures working group includes this intersection of AI and science. In April 2024, the group held a public briefing to hear from experts on the frontlines of this nexus. Their statements and answers informed our findings, below, about enhancing AI's positive impact on science and medicine through systems-level thinking, open source, discipline diversity, and more.

## FINDINGS

### **Finding 1:**

**To effectively leverage and engage with AI, scientists, policymakers, and other entities must approach the technology at a systems level.**

Oftentimes, scientists, policymakers, and others who leverage and engage with AI apply a narrow definition to these systems. AI can be misperceived as a singular agent capable of solving problems. In reality, AI is collaborative and decentralized, composed of multiple agents with multiple incentives. An AI system doesn't just entail machine learning technology, but also economics, social science, and other elements. Like science itself, AI is a collective endeavor.<sup>1</sup>

A systems perspective of AI, with consideration to economics, social context, relationships, human labor, and power dynamics, is critical to understand the outcomes produced by AI systems. Innovations in medicine, for example, will depend not only on technical advancements in machine learning and clinical studies, but also on the ability of AI deployers to carefully integrate new technologies into existing systems of patient care. A systems perspective calls for particular attention to how technologies, people, and practices, taken altogether, need to be arranged (and likely

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<sup>1</sup> Michael I. Jordan, NAIAC public briefing, April 16, 2024. [https://events.zoomgov.com/ejl/Ag2K0jMZDufpz3lBZRBqMddUddWtECjOTtDC9WDkUCMO9BapCJYo~A-a02qV9k7x\\_NIDq-wSIAMB8Ja6sg5PXH-hUwCxcgHkE85o49ac-iYzkOFujrjlfed7m-GD6jC6BOYngnktRv-lvrTP1p7x66O8KwX-qE-ypw/home](https://events.zoomgov.com/ejl/Ag2K0jMZDufpz3lBZRBqMddUddWtECjOTtDC9WDkUCMO9BapCJYo~A-a02qV9k7x_NIDq-wSIAMB8Ja6sg5PXH-hUwCxcgHkE85o49ac-iYzkOFujrjlfed7m-GD6jC6BOYngnktRv-lvrTP1p7x66O8KwX-qE-ypw/home).

rearranged again over time) in order to make the goals of a system, e.g. improving medical care, possible.<sup>23</sup>

Thus, design goals for AI must also be at the systems level. When scientists, policymakers, and others engage with AI they must factor in this context. For example, it's not enough to just check a model's training data. We also need to ask: *Why was the data gathered? How was it gathered? By whom? What were the incentives, and how will it be used in the future?* Attempts to confront and solve issues with AI without a systems perspective will ultimately be ineffective.

### **Finding 2:**

#### **There is a need for multidisciplinary stakeholders and researchers in the realm of AI.**

For AI systems and applications to reach their full potential, the technology must be designed with stakeholders and researchers with backgrounds outside computer science. (NAIAC previously addressed this notion in "FINDINGS: Exploring the Impact of AI."<sup>4</sup>)

Frequently, AI systems are designed and developed by groups with a specific set of expertise (e.g., computer science). It's critical to expand that group and include disciplines like sociology, economics, political science, statistics, ethnography, law, ethics, and others.<sup>5</sup> When it comes to the application of AI systems, institutions, government, and companies should couple AI acumen with other domain expertise, like supply chain, legal, finance, and procurement.<sup>6</sup> This philosophy should extend beyond industry and to the academy, as well, by embedding ethics and other modules within computer science curricula.<sup>7</sup>

It is equally important to involve diverse communities in the realm of AI. Many underrepresented communities can make key contributions to AI, but frequently lack the capability to do so.<sup>8</sup> The National Institutes of Health's Artificial

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<sup>2</sup> For more information see Madeleine Clare Elish, Elizabeth Anne Watkins. Repairing Innovation: A Study of Integrating AI in Clinical Care. Data & Society Research Institute (Sept. 2020).

<https://datasociety.net/library/repairing-innovation/>

<sup>3</sup> For more information see Mark Sendak, Madeleine Elish, et al; The Human Body is a Black Box: Supporting Clinical Decision Making with Deep Learning.

<https://dl.acm.org/doi/abs/10.1145/3351095.3372827>

<sup>4</sup> "FINDINGS: Exploring the Impact of AI," NAIAC, NIST, November 2023.

[https://ai.gov/wp-content/uploads/2023/12/Findings\\_Exploring-the-Impact-of-AI.pdf](https://ai.gov/wp-content/uploads/2023/12/Findings_Exploring-the-Impact-of-AI.pdf).

<sup>5</sup> Susan Gregurick, NAIAC public briefing, April 16, 2024; Michael I. Jordan.

<sup>6</sup> James Swanson, NAIAC public briefing, April 16, 2024.

<sup>7</sup> Surya Ganguli, NAIAC public briefing, April 16, 2024.

<sup>8</sup> Susan Gregurick.

Intelligence/Machine Learning Consortium to Advance Health Equity and Researcher Diversity (AIM-AHEAD) is one example of an initiative addressing this.<sup>9</sup> The program increases the participation and integration of underrepresented communities in AI, providing resources and better engaging them in either clinical or biomedical research. One element of the program trains researchers from rural and disadvantaged communities, helping to uncover factors that drive health disparities in those communities using AI.<sup>10</sup> Similarly, the healthcare sector can endeavor to include a diversity of communities in clinical trials, to ensure the resulting data and AI systems it trains yield better outcomes.<sup>11,12</sup>

### **Finding 3:**

#### **Open source and open science can accelerate AI's impact on healthcare and medical research.**

AI can have a range of positive impacts on human health. The technology can help first responders triage casualties after a disaster; it can enhance the ability to collect clinical trial data; it can accelerate drug discovery; it can reduce healthcare inequities; and more.<sup>13</sup>

These positive impacts are frequently made possible through open approaches to technology and science. Open-source AI models allow scientists and startups to build upon the work of others.<sup>14,15</sup> Similarly, open datasets allow for collective innovation. For example, the DARPA Triage Challenge is an initiative that enhances the capabilities of first responders and medical personnel in situations like battlefields and earthquakes.<sup>16</sup> The Challenge's AI systems help predict which injuries are the most critical and how to address them. In order to do this, DARPA team partnered with medical professionals at the University of Maryland and the University of Pittsburgh to build de-identified, clinical trauma patient datasets for training.<sup>17</sup> Meanwhile, the National AI Research Resource (NAIRR) is contributing to immunological datasets, cancer data sets, and other large data sets to better study disease.<sup>18</sup>

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<sup>9</sup> "AIM-AHEAD." n.d. <https://www.aim-ahead.net/>.

<sup>10</sup> Susan Gregurick.

<sup>11</sup> James Swanson.

<sup>12</sup> [Diversity & Inclusion in Clinical Trials \(nih.gov\)](#)

<sup>13</sup> Jean-Paul Chretien, NAIAC public briefing, April 16, 2024; Surya Gongoli; Susan Gregurick; James Swanson.

<sup>14</sup> Surya Ganguli.

<sup>15</sup> [Open-Source Clinical Machine Learning Models: Critical Appraisal of Feasibility, Advantages, and Challenges - PMC \(nih.gov\)](#)

<sup>16</sup> "DARPA Triage Challenge." DARPA, 2023. <https://triagechallenge.darpa.mil/>.

<sup>17</sup> Jean-Paul Chretien.

<sup>18</sup> [NAIRR Pilot - NAIAC Pilot](#)

At this moment, however, open approaches are facing obstacles. AI companies are publishing and sharing less research.<sup>19 20 21 22</sup> For this reason, heightened public investment in open-source research and open science is crucial. Investment in public compute is also essential: Right now, private companies like Meta have orders of magnitude more computing power than public research universities, despite those institutions being the ones conducting public interest research.<sup>23</sup> NAIRR is a strong start, but more should be done.

#### **Finding 4:**

#### **Enhancing AI's positive impact on science and medicine requires several key ingredients.**

A lack of data, computing power, and talent are all friction that must be addressed in order to enhance AI's positive impact on science. However, there are other frictions that must be addressed, too.

The inability to integrate models and the lack of standards should also be addressed, especially in the biomedical domain. For example, scientists would benefit from being able to better integrate a high-fidelity model for a particular physiological system with a more holistic whole body simulator. Likewise, shared approaches on developing and documenting these models would be fruitful.<sup>24</sup>

Improving informed consent is another friction that should be addressed. In our connected world, the abundance of “data exhaust” that products and services produce could, if gathered in a privacy- and agency-respecting way, fuel positive scientific progress. For example, data gathered from a wearable device could help predict atrial fibrillation and/or contribute to cutting-edge medical research on the topic.<sup>25</sup> Similarly, better practices around the provenance, collection, organization, and access of healthcare data — and other scientifically-relevant data — will have a positive impact.<sup>26</sup>

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<sup>19</sup> Surya Ganguli.

<sup>20</sup> [Research and Development: U.S. Trends and International Comparisons | NSF - National Science Foundation](#)

<sup>21</sup> [Information-sharing in academia and the industry: A comparative study - ScienceDirect](#)

<sup>22</sup> <https://aibusiness.com/companies/google-to-halt-sharing-ai-research-until-product-is-developed>

<sup>23</sup> Surya Ganguli.

<sup>24</sup> Jean-Paul Chretien.

<sup>25</sup> James Swanson.

<sup>26</sup> Michael I. Jordan; Susan Gregurick.

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## ABOUT NAIAC

The National Artificial Intelligence Advisory Committee (NAIAC) advises the President and the White House National AI Initiative Office (NAIIO) on the intersection of AI and innovation, competition, societal issues, the economy, law, international relations, and other areas that can and will be impacted by AI in the near and long term. Their work guides the U.S. government in leveraging AI in a uniquely American way — one that prioritizes democratic values and civil liberties, while also increasing opportunity.

NAIAC was established in April 2022 by the William M. (Mac) Thornberry National Defense Authorization Act. It first convened in May 2022. It consists of leading experts in AI across a wide range of domains, from industry to academia to civil society.  
<https://www.ai.gov/naiac/>

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