Testimony of Chaouki Abdallah

Chairmen Williams and Collins, Ranking Members Bowman and Stevens, and members of the committee – thank you for the opportunity to testify on the topic of "Federal Science Agencies and the Promise of AI in Driving Scientific Discoveries" from the vantage point of a research university.

I currently serve as the Executive Vice President for Research at Georgia Tech, a prominent research institution renowned for its contributions to various fields. Prior to my role here, I held positions at the University of New Mexico, another distinguished public research university. I highlight the public nature of my affiliations to underscore the pivotal role such institutions play in advancing education, research, and innovation, and the significance of federal and public investments in their mission. Public institutions educate a substantial 74% of college students in the U.S. and conduct approximately two-thirds of all university-based research.
Furthermore, Georgia Tech stands out among research universities due to the presence of the Georgia Tech Research Institute (GTRI), our applied research division. GTRI is home to over 3,000 scientists, engineers, support professionals, and students who tackle complex challenges confronting government and industry on a national and global scale. Notably, GTRI also operates as an Army University Affiliated Research Center (UARC), providing invaluable expertise in advanced science and technology, including AI and machine learning, to multiple national security clients across the federal sector. Georgia Tech also engages closely with Department of Energy national laboratories such as Oak Ridge, Sandia, Pacific Northwest, National Renewable Energy, Savannah River, and others in many critical areas such as energy, cybersecurity, materials science, hypersonics, manufacturing, quantum systems, and of course AI.

My testimony is informed by my role and by my institution's mission as well as by information gained from colleagues and collaborators. Today, I would like to address three crucial points: the imperative of long-term planning and funding to fully unlock AI's potential, the necessity of complementing U.S. leadership in basic science and engineering with the capability to develop AI hardware and systems, and the critical importance of expanding our talent pool. In this context, I see the National AI Research Resource (NAIRR) as a commendable initiative, jointly undertaken by NSF and 10 federal agencies, and supported by 25 non-governmental partners, to address these critical aspects. I would also like to recognize this Committee's role in providing the necessary federal foundation to fund many of the building blocks to AI – such as legislation to support high performance computing over the last 40 years, including the Networking and Information Technology Research and Development, the National AI Initiative Act, and most recently, the Quantum Information Science Act Reauthorization.

I will describe the work, capabilities, and challenges that academic institutions such as mine and other less resourced institutions are facing in delivering on the promise of AI. Before delving into the specifics of AI at academic institutions and the challenges we encounter, I want to acknowledge that the success of AI technologies today is the result of decades of foundational research conducted at universities and industrial laboratories. Universities have been at the forefront of AI and machine learning research since the early 1960s when federal agencies like NSF initiated their investments in this field. And while recent AI-driven discoveries and technologies are promising practical solutions to global challenges, from food production and climate change to manufacturing, healthcare, and education, it is important to realize that such benefits would not have been possible without the foundational work of dedicated researchers who persisted through multiple AI "winters" before becoming the overnight sensations of the business, technological, and academic worlds.

Universities have always played a critically important and supporting role to government agencies and a complementary role to industry in maintaining our global competitiveness. Industry focuses on commercial gain – and most of their R&D funding are directed into well-defined businesses. Universities focus on discovering and innovating in areas not yet created. For the US to continue to lead in AI, we need industries to continue to push the state-of-the-art in their areas of commercial gain, and universities to solve fundamental problems for applications and industries not yet on the horizon. ARPANET was such an endeavor. No business was remotely thinking of launching let alone funding an online division. A federal agency, DARPA, funded the internet efforts at universities that fundamentally changed the communication and business landscapes, and with them our daily lives. Government funding must therefore continue to provide the seeds and the water to the universities' fertile grounds, so that industries can bloom, and ecosystems can grow and thrive.

Let me describe how AI research is being conducted at my university, as one example of the symbiotic relationship between federal agencies, academia, and industry. At Georgia Tech we were fortunate to be awarded three NSF AI Institutes, and a Build Back Better EDA grant focusing on AI for manufacturing.

One such institute is the National AI Institute for Adult Learning and Online Education (or AI-ALOE), which is using Generative AI to personalize learning, transform online education for distant learners, and to build a data architecture for supporting AI in learning.

Another institute, AI4Opt, is creating AI and optimization tools for complex system design. These are applied to design and operate the next generation of power grids with an increasing share of renewable energy. This requires solving machine learning problems with hundreds of thousands of outputs and millions of inputs. AI4Opt researchers are also applying AI to the largest supply chains in the country, including in the semiconductor industry, retail, and the transportation industry, as well as to the design of the next generation of chips, and to the design and operations of new mobility systems.

The third Institute, AI-CARING, is developing personalized collaborative AI systems to improve the quality of life and independence of aging adults living at home. They are doing so by building AI systems that learn personalized longitudinal models of user behavior, recognize, and adapt to changing user abilities, goals, and values, as well as the complex interpersonal relationships governed by those values. Building on such models, researchers are building networked teams of agents that provide coordinated assistance through personalized and value-driven interaction with aging adults, which will lead to more fulfilled lives and substantial savings in their healthcare.

Georgia-AIM is a Build Back Better EDA-funded network of universities, technical colleges, industries, and community organizations, that is assisting 38 small manufacturing businesses around the state of Georgia with cybersecurity assessments and compliance to make them resistant to AI attacks. In addition, AI technologies produced through Georgia-AIM have reduced scrap and increased efficiency for automotive suppliers. Georgia-AIM is also expanding the AI manufacturing workforce by developing AI manufacturing training curriculum and studios and leveraging next-gen AI technologies for the Technical College System of Georgia. Lastly, Georgia-AIM is upskilling workers by training them to program and operate robotic-assistive technologies for AI automation to maximize efficiency of their operations. It has also established a new 18-week AI Robotics technician training curriculum and studio at the Georgia Veterans Education Career Transition Resource Center (VECTR) with pathways for the graduates to transition to Robins Air Force Base or fill small business workforce gaps around the nation.

I have spoken to the various promising applications of AI technologies in many sections of our society, so let me next highlight some of the challenges faced by academic institutions as they attempt to deliver their solutions to the public at large. It has been remarked that the sum of all computing resources available to all AI researchers at all US universities may not equal those available to a single company, OpenAI. While at Georgia Tech we have vast computer facilities compared to many of our peers, we are reaching the limits of what our computing systems can provide for all our AI projects. This is not always about the last generation of Graphical Processing Units (GPUs) but more about the sheer number of them that we need and the need for large local storage, local memory, and fast connections to the GPUs and Central Processing Units (CPUs). Using commercial computer facilities is also costly. As an example, our Institute, AI-ALOE, has allocated $1,000 per month for using ChatGPT 3.5. Recently, one researcher used ChatGPT 4.0 instead and exhausted the AI-ALOE allocation in one day. (ChatGPT 4.0 is about 20 times the cost of ChatGPT 3.5). As another illustrative example of challenges faced by academia, a recent global ranking of AI programs at universities by US New & World Report places 11 universities (seven of which are in China) ahead of the top American university, pointing to a growing competitive advantage of international universities.

As it should be apparent from this discussion, a fundamental requirement for AI breakthroughs today is massive compute/data capacities. Making available resources similar to those of Google, Microsoft, or OpenAI to universities will greatly increase the likelihood of a much broader set of breakthroughs and the creation of entirely new start-ups and industries.

Access to data for AI research is also critical. Tens of millions of students and teachers use Google, Facebook, and OpenAI each day for various kinds of searches. That data, when properly protected and accessed only by trained and

need-to-know experts, becomes valuable for understanding what an individual student is searching for, their prompts, their current state of knowledge, etc., in order to personalize their learning experiences.

Current pressures on both scale of compute/data/code as well as sustainability are exacerbated by the way that universities typically build and sustain large-scale compute: budget items are tacked on each research grant for compute. This forces universities to put together their compute infrastructure piecemeal. The NAIRR flips this on its head and provides the compute infrastructure in a centralized and hopefully sustainable way.

As we have already seen, AI has already shown its exciting potential across many areas: healthcare, education, clean energy, smart cities, etc. Transformative advances in AI, ones that truly convert theory to practice, require not only resources (data, funding, compute), but also the availability of a large pool of talented contributors. And that is why I believe that the NAIRR is particularly promising as it brings together industry, government, and academic partners, fostering rich multidisciplinary and multisectoral collaborations that will help drive advances in AI.

As you know, the NAIRR was established by Congress "to stand up a national research infrastructure that would broaden access to the resources essential to artificial intelligence (AI) research and development". After gatherings and feedback of global experts and stakeholders, an implementation plan for a pilot was released last month to bring together computational, data, software, model, training, and user support resources to demonstrate and investigate all major elements of the NAIRR vision first laid out by the NAIRR Task Force. The pilot makes available government-funded, industry and other contributed resources in support of the nation's research and education community. NAIRR could then help reduce the data and compute gulf between industries and academia, especially for the less resourced institutions.

I spoke earlier of the key role that AI plays in our national and economic security. As you know, the economic impact of falling behind other nations in research and development will manifest itself in a reduction of our ability to create new industries, and in increasing our cost in playing catch-up with other foes and friends. It will also reduce our ability to continue to attract and retain the best and brightest minds from around the world.

While the establishment of NAIRR and similar coordinated activities across the federal and industrial funding landscape are steps in the right direction, I believe the following are important additional steps to follow.

1) **A commitment to the long-term funding and certainty in supporting NAIRR.** The research enterprise, while used to fostering big ideas and big bets, needs the certainty of long-term planning and funding. Our scientific agencies realize this and with congressional funding have been able to support multi-year programs and large centers such as the NSF AI Institutes and Regional Innovation Engines. Realizing the importance and promise of NAIRR to our national and economic security, its start-up funding should also be supplemented with stable operating support. Federal investment must continue to flow steadily to continue priming the pumps of the research enterprise, and to maintain a predictable and increasing flow of talent and ideas. This is the promise of the CHIPS and Science Act, which would benefit from supplemental appropriations for AI. Congress was wise to enact CHIPS and Science, fund CHIPS, and put a down payment on the Science aspects - but now is the time to accelerate our American competitiveness goals and realize the Science and AI needs are just as critical to American security. Federal funds often play multiple roles: they help recruit, educate, and retain top talent, support research facilities, and create intellectual property that leads to new markets and enterprises. Universities are increasingly leveraging federal research funds, along with state and industry support, to create a vibrant entrepreneurship culture and innovation centers. Such activities have served to attract students as well as a new generation of researchers and entrepreneurs. Increasing and maintaining funding to agencies such as NSF, NIST, DARPA, NASA, DOE, NIH, and others, also sends positive signals to the greater research enterprise, encouraging students to pursue AI studies and companies to invest in their own R&D.

2) **Reclaim our ability to translate our fundamental research into usable products.** Increasingly, federal agencies are encouraging universities to translate their fundamental research into products, therapeutics, and companies. Along with a renewed focus on re-shoring and friend shoring manufacturing this is a welcome development as many of our fundamental discoveries were left to wither on the vine, only to be exploited by others. It is remarkable that in the field of generative AI, we were able to claim the lead when OpenAI released ChatGPT. Note however the speed at which other companies and countries were able to

release their own tools. While it remains critically important to continue to support curiosity-based fundamental research, new approaches and tools to support translating such research into business and products are becoming more critical. We must do so however while accounting for the ethical and societal implications at the forefront of product and tool development. At Georgia Tech we have established educational programs such as Create-X and Vertically Integrated Projects and competitions such as the InVenture Prize to help students in moving from the laboratory to industry and to better prepare our graduates for the fast-pace of business.

3) **Increase our efforts to attract and retain more talent into AI.** I recently learned from the CTO of a leading US manufacturer that their competitive advantage is only limited by the availability of talent. There are international and national aspects to this problem. We must regain our role as the strongest magnet for talent and creativity from around the world. The benefits of such a policy have already manifested themselves in the notable impact of foreign-born scientists, engineers, and entrepreneurs. It also seems obvious that such individuals, many of whom, like myself, were initially educated under a different educational system, and funded by the resources of another country, bring with them a different way of thinking, learning, and problem solving. Those unique perspectives, when coupled with our open research system and our American values, lead to a dynamic and healthy R&D enterprise. The demographic trends of the U.S. are also conspiring to reduce the number of U.S.-born, college-age students and graduates, furthering the need to attract international students and researchers. There also exists, however, a national and moral imperative to attract more U.S. students into higher education and more specifically, to attract women and underrepresented minorities into STEM in general and AI in particular. The benefits of their diverse backgrounds and experiences are already felt in laboratories and companies, and the growth opportunity in such populations is obvious. That rich and diverse pool of candidates must be increased, prepared, and nurtured in the K-12 system. The best opportunity and most enduring strategy for improving our S&T position is obviously to nurture and engage a larger number from untapped domestic populations, and to provide an academic environment for them to strive and succeed as students, faculty, and researchers. Lastly, the potential of AI for reskilling and upskilling displaced American workers, as is done through our Georgia-AIM for example, cannot be overemphasized.

I would like to end with a strong endorsement of the stated goals for NAIRR, namely, to spur innovation, to increase diversity of talent, to improve capacity, and to advance trustworthy AI. I welcome the opportunity to discuss the promise of AI in driving scientific discoveries, and of the role that universities should play in achieving NAIRR's goals. Nevertheless, we should not lose sight of the disruptive effects such technologies can have on our society. We are keenly aware that AI technologies have ethical dimensions and employment implications for a large segment of our workforce. Such implications will affect the distribution of knowledge and wealth within and between countries and must be accounted for by educators and policy makers alike. Appropriately supporting the goals of NAIRR and funding them should help us fulfill the promise of AI in driving scientific discoveries for the benefit of the United States and all of humanity.