27 February 2018

The Honorable William Hurd   The Honorable Robin Kelly
Chairman   Ranking Member
Subcommittee on Information Technology   Subcommittee on Information Technology
House Oversight & Government Reform   House Oversight & Government Reform
Washington, DC 20515   Washington, DC 20515

Dear Chairman Hurd and Ranking Member Kelly,

We applaud your effort to explore the issues related to research and development of artificial intelligence (AI) technology, and we welcome the opportunity to discuss barriers to adoption and development, and the potential challenges and advantages of government use of artificial intelligence. IEEE-USA agrees that, if we are to remain competitive and realize the full economic and societal potential of AI technology, we need to adopt public policies that enhance and promote, not inhibit, American leadership in this field.

During the February 14th hearing, members of the House Oversight & Government Reform Subcommittee on Information Technology asked many questions that we can help answer, including where and how much the US should invest in research and development; what kinds of research would yield greater competitiveness; and how to eliminate risks such as biases in data. We can find the answers by looking at what other countries are doing, as well as by assessing our own strengths and weaknesses.

In its July 2017 **Next Generation Artificial Intelligence Development Plan**, China announced that it sees AI as a key transformative technology underpinning its future economic and military power. China states that it is determined to build a domestic AI industry worth $150 Billion over the next five years, and that it plans to lead the world in AI by 2030. If China attains this lead, it will dwarf current United States investments. Furthermore, China is intent on pursuing a strategy of "military-civil fusion" in AI, and government-sponsored industry partnerships to provide a platform for dual-use advances in AI.

Similarly, the **FY2019 OMB-OSTP joint memo on US R&D budget priorities** prioritized investing in emerging technologies research such as autonomous systems, machine learning, and quantum computing, to drive American economic prosperity. Also, the **White House National Security Strategy** cited autonomous technologies, data science, advanced computing technologies and artificial intelligence as critical for economic growth, national security and maintenance of the US lead in research, technology, invention, and innovation. Furthermore, the **2017 Defense Science Board summer study on autonomy** indicated that artificial intelligence, machine learning, and autonomous systems would be critical for the Department of Defense Third Offset Strategy.

However, despite our similar stance, the United States is not investing in AI R&D as IEEE-USA believes it should. Much of the US government's dedicated AI research is taking place within agencies comprising the NITRD consortium's (The Networking and Information Technology Research and Development), specifically within the RIS (Robotics and Intelligent Systems) Program. The RIS Program includes federal

agency research and development involving robotics and intelligent systems to advance physical and embodied computational agents that complement, augment, enhance, or emulate human physical capabilities or human intelligence. RIS' budget in FY 2017 was **$220.5 million,** only 4 percent of the total NITRD budget, which is remarkably meager in comparison to Chinese investments in AI. This budget comprised of $43.5 million from the NSF, $102.9 million from DoD and $53.5 million from NASA.

The largest contributor to the NITRD RIS Program Component Area is DoD. Several DoD RDT&E activities across DoD agencies focus on Artificial Intelligence, Unmanned and Autonomous Vehicles and intelligent agents geared towards early threat identification and mitigation. These activities include for instance: XAI - Explainable AI, AIDA - Active Interpretation of Disparate Alternatives, L2M - Lifelong Learning Machines and PPAML - Probabilistic Programming for Advancing Machine Learning in DARPA; Autonomous Systems within the Army Research Lab (ARL) Robotics Collaborative Technology Alliance (CTA), and Robotics, Autonomy, Manipulations and Portability Research within the Army Defense Research Sciences directorate. We estimate however, that the total spending on research dedicated to AI at DoD does not exceed **$200 million**.

Moreover, at the National Science Foundation, the 3rd largest contributor to the NITRD RIS program, spending on Information and Intelligent Systems has been modest; in fact it decreased by **10.3 percent** to just **$174.75 million**, compared to the FY16 actual budget **($194.80 million)**. The same budget cutback was applied to CCF (Computing & Communications Foundations), CNS (Computer Network Systems) & ITR (Information Technology Research), all of which are programs that drive research promoting the progress of AI. The total spending on Computer and Information Science and Engineering (CISE) **on AI** has been either flat or declining since 2012, and these decreases negatively impacted US competitiveness in AI. For FY 2019, the NSF is requesting a 2 percent increase in Research and Related Activities (R&RA) for its six research directorates, v. FY 2017. The White House FY 2019 budget proposal – after the addendum – matches the NSF request.

To answer the committee's questions about what the United States should be spending on AI, IEEE-USA recommends the following:

- Double the budget for NITRD's RIS to **$400 million** in FY 2019 with a target of **$1 billion** in 5 years. The increased budget is to be distributed among contributing members of the NITRD RIS program: DoD, NSF, NASA and NIST.
- Significantly increase the budget for NSF CISE to **$1.1 billion** in FY 2019, with 10-20 percent annual increases for at least five more years. CISE has an impressive track record of identifying and funding early research that led to the Google search algorithm, among many other feats.
- Ramp up DoD RDT&E's long-term research in accelerating maturation of artificial intelligence (AI) technologies and, the emergence of increasingly automated or semi-autonomous systems. These advances can be expected to provide new tactical and strategic options for national security in terms of defending against adversaries who use these powers to create sophisticated threats.
- Significantly increase the investments in AI research at DoD to **$1 billion** in FY 2019. The White House FY 2019 budget proposal includes **$20 billion** increase for DoD RDT&E (**27 percent**). At least **5 percent** of this increase should be dedicated for AI research.
- Prioritize investments in high performance computing (HPC) which will accelerate the progress of AI. HPC programs include: (EHCS) - Enabling R&D for High-Capability Computing Systems & (HCIA) High Capability Computing Infrastructure and Applications, both within NITRD, High Productivity & High Performance Responsive Architectures in ITC within DARPA and Advanced Scientific Computing at DOE.

To answer the Committee's question about how we might ensure the elimination of biases in AI and increased workplace diversity, we can look at STEM education funding. The administration promised $200 million in Department of Education funding toward improving STEM education. We recommend exploring ways that these funds could be used to institute human capital development programs that promote the growth of university-centric entrepreneurial ecosystems and business clusters around the country. This investment should focus on ways of reaching diverse and traditionally underrepresented groups of society.

Additionally, the CISE IIS, NITRD RIS, DoD and DOE are poised to focus research on the fundamentals of AI and data-intensive theories and applications, high performance and supercomputing, novel computer architectures like neuromorphic computing and novel semiconductor materials, to enable faster and more powerful artificial intelligence computing. These programs should devise research projects in preventing cognitive biases of human administrators, and unintentional inferred biases which largely depend on the available data from extending to AI. Research into making AI human-centric, explainable, accountable, and transparent is warranted to avoid subjecting any group of people to harm, including discrimination, misrepresentation of their interests and societal values, deprivation of equal opportunities, discriminatory compensation, unfair hiring, and promotion practices within the US government and the private sector.

We agree that AI technology is rapidly developing, but it is critical that we do not attempt to regulate or mandate before we fully understand the impact of this technology and the advancements we can make using it. We look forward to hearing more from the Committee's series of hearings and to helping you ensure that our workforce and our government can take full advantage of the significant benefits that AI will offer our economy and society. IEEE-USA thanks you for the attention that you and your fellow committee members are giving to the increasing importance of AI technology. If we can be of assistance, or if you have any questions, please do not hesitate to contact Erica Wissolik at (202) 530-8347 or e.wissolik@ieee.org.

Sincerely,

Sandra L. Robinson
2018 President, IEEE-USA