Recommendations for Leveraging Cloud Computing Resources for Federally Funded Artificial Intelligence Research and Development

A Report by the

SELECT COMMITTEE ON ARTIFICIAL INTELLIGENCE

of the

NATIONAL SCIENCE & TECHNOLOGY COUNCIL

NOVEMBER 17, 2020

The United States Government [will] sustain and enhance the scientific, technological, and economic leadership position of the United States in AI R&D and deployment through a coordinated Federal Government strategy … [that includes] better enabling the use of cloud computing resources for federally funded AI R&D.

—President Donald J. Trump, February 11, 2019

Mr. President:

In your February 11, 2019, Executive Order on Maintaining American Leadership in Artificial Intelligence, you directed the Select Committee on Artificial Intelligence (AI) to prepare recommendations on better enabling the use of cloud computing resources for federally funded AI research and development (R&D). The attached report is a product of interagency collaboration, led by the National Science and Technology Council's Select Committee on AI and Subcommittee on Machine Learning and AI, that highlights key recommendations.

AI is a key driver in the economic growth and security of our Nation, as well as improved quality of life. Sustained investments in AI R&D are of paramount importance for continued technological breakthroughs that will maintain our national leadership in AI. Cloud platforms provide robust, agile, reliable, and scalable computing capabilities that can help accelerate advances in AI. Additionally, increased access to powerful cloud computing resources can broaden the ability of AI researchers to participate in the R&D needed for cutting-edge technological advances.

While it is becoming well recognized that cloud computing can advance AI R&D, several technical and administrative challenges are currently limiting cloud adoption. For example, mechanisms for providing access to cloud computing are varied, and there is a need to understand best practices. Inconsistencies in the methods for accessing and using different cloud systems can create inefficiencies in the research process. Limited access to education and training opportunities that can inform researchers how best to leverage cloud computing for AI R&D is slowing adoption. These and other challenges to the effective use of cloud computing present unnecessary barriers to AI innovation.

In this report, the Select Committee has identified four key recommendations for how the Federal Government can better enable the use of cloud computing resources for federally funded AI R&D: (1) launch and support pilot projects to identify and explore the advantages and challenges associated with the use of commercial clouds in conducting federally funded AI research; (2) improve education and training opportunities to help researchers better leverage cloud resources for AI R&D; (3) catalog best practices in identity management and single-sign-on strategies to enable more effective use of the variety of commercial cloud resources for AI R&D; and (4) establish and publish best practices for the seamless use of different cloud platforms for AI R&D. Each recommendation, if adopted, should accelerate the use of cloud resources for AI R&D.

By investing in AI R&D and democratizing access to powerful computational resources, including cloud computing, the United States will expand the ability of academia, industry, and government to explore innovative ideas for advancing AI. In turn, these advancements will lead to transformative technologies that improve lives, grow innovative industries, empower workers, and increase our national security. This report is another step in the overall strategy to position the United States as the world leader in artificial intelligence.

Sincerely,

Michael Kratsios
Chief Technology Officer of the United States

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Introduction

Access to advanced computational and data resources has powered many of the recent advances in AI, particularly in the area of machine learning. For federally funded researchers, these resources may be allocated and provisioned from agency high performance computing (HPC) resources, e.g., Department of Energy (DOE) systems such as Summit and Sierra located at DOE laboratories, and systems funded by the National Science Foundation (NSF) such as Stampede2 and Frontera located on university campuses. Increasingly, commercial cloud providers may be able to provide scalable and efficient computational and data resources for AI researchers, including federally funded researchers. A 2018 report on the workshop Enabling Computer and Information Science and Engineering Research and Education in the Cloud, funded by NSF, noted:

> Cloud platforms provide on-demand, elastic, and self-serve access to resources at scale and are thus capable of supporting large-scale and/or big data computing. They provide access to contemporary hardware and advanced software stacks, with users "riding the technology curve" as new technologies are made available in the cloud. The on-demand nature of access to resources can provide a "fast path" to computing—acquiring cloud resources is much faster than buying, installing, and operating on-premise, localized hardware [e.g., on many university campuses]. Cloud platforms can also support important new modalities of data, such as streaming data and real-time analytics on such data. … [R]esearchers and educators can leverage modern cloud platforms to accelerate and improve their research and teaching, instead of building and deploying dedicated local infrastructure.[1]

Numerous other workshops and Federal advisory committees have noted similar advantages of cloud use for research computing,[2,3,4] including for AI R&D. This report responds to the February 11, 2019, Executive Order on Maintaining American Leadership in Artificial Intelligence[5] and provides recommendations on better enabling the use of cloud computing resources for federally funded AI R&D.[6] Below is a summary of the recommendations of the NSTC Select Committee on AI, followed by additional details about each recommendation.

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[1] J. Rexford, M. Balazinska, D. Culler, and J. Wing. 2018. *Enabling Computer and Information Science and Engineering Research and Education in the Cloud*. Technical Report. Arlington, VA: National Science Foundation. https://dl.acm.org/citation.cfm?id=3233928

[2] J. Bottum, D. Atkins, A. Blatecky, R. McMullen, T. Tannenbaum, J. Cheetham, J. Wilgenbusch, K. Bhatia, E. Deumens, B. von Oehsen, G. Fox, M. Ziolkowski, A. Bedrossian, and D. Fay. 2017. *The Future of Cloud for Academic Research Computing*. Technical Report of the 2016 National Science Foundation-funded workshop "Cloud Forward." https://www.researchgate.net/publication/317835476_The_Future_of_Cloud_for_Academic_Research_Computing

[3] National Academies of Sciences, Engineering, and Medicine. 2016. *Future Directions for NSF Advanced Computing Infrastructure to Support U.S. Science and Engineering in 2017-2020*. Washington, DC: The National Academies Press. https://doi.org/10.17226/21886

[4] National Institutes of Health. 2018. "NIH Strategic Plan for Data Science." https://datascience.nih.gov/nih-strategic-plan-data-science

[5] The White House. 2019. Executive Order 13859 on Maintaining American Leadership in Artificial Intelligence. https://www.whitehouse.gov/presidential-actions/executive-order-maintaining-american-leadership-artificial-intelligence/

[6] The focus here is specifically on the use of commercial cloud computing services for AI R&D. The development of agency-hosted cloud services for R&D and other services is being considered elsewhere, notably at https://cloud.cio.gov/strategy/.

Summary of Recommendations

Recommendation 1: Coordinated by the NSTC Select Committee on AI and its operational arm, the NSTC Subcommittee on MLAI, Federal agencies that support AI R&D should launch and support pilot projects to identify and explore the advantages and challenges associated with the use of commercial clouds in conducting federally funded AI research, and document and broadly share the results and associated best practices that emerge from those experiences. Several agencies and departments—including the Department of Defense (DOD) Joint Artificial Intelligence Center (JAIC);[7] Department of Transportation (DOT);[8] National Aeronautics and Space Administration (NASA);[9] National Institutes of Health (NIH);[10,11] National Oceanic and Atmospheric Administration (NOAA);[12] National Science Foundation;[13] and the Department of Veterans Affairs (VA)[14]—have launched such activities. Other agencies should be encouraged to consider pilots that identify and explore the advantages and challenges associated with the use of commercial clouds in conducting federally funded AI research. From the date of the signing of the AI Executive Order, the NSTC MLAI Subcommittee should report annually to the Select Committee on AI regarding progress and lessons learned from these pilots.

Recommendation 2: Within 90 days of publishing this report, the NTSC MLAI Subcommittee should establish a task force to outline an approach to educating and equipping those engaged in AI R&D with the skills needed to use cloud-based platforms and technologies to help realize their full benefits for advancing AI frontiers. The task force should publish a report on its findings within 180 days. The task force should: (1) collect information about the minimum skill requirements for conducting cloud-based work; (2) propose new mechanisms of training and skill development, new instructional materials, and/or an inventory of links to existing ones; and (3) encourage piloting approaches for equipping and credentialing.

Recommendation 3: Within 90 days of publishing this report, the NSTC MLAI Subcommittee should establish a task force to examine best practices in identity management and single-sign-on strategies within government and across the research community to identify near- and long-term approaches that will enable more effective use of the variety of commercial cloud resources, with a focus on accelerating AI R&D activities. Implementation of the best practices and strategies

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7 Department of Defense. Joint Artificial Intelligence Center. https://dodcio.defense.gov/About-DoD-CIO/Organization/JAIC/

8 Department of Transportation. Secure Data Commons. https://its.dot.gov/data/secure/

9 National Aeronautics and Space Administration. 2019. "Global Hydrology Resource Center Distributed Active Archive Center (GHRC DAAC) Moves to the Earthdata Cloud." https://earthdata.nasa.gov/learn/articles/tools-and-technology-articles/ghrc-moves-to-the-earthdata-cloud

10 National Institutes of Health. Science and Technology Research Infrastructure for Discovery, Experimentation, and Sustainability (STRIDES) Initiative. https://datascience.nih.gov/strides

11 National Institutes of Health. Artificial Intelligence for Biomedical Excellence (AIBLE). Last updated May 2020. https://dpcpsi.nih.gov/sites/default/files/CoC_May_2020_1.05PM_Concept_Clearance_AIBLE_Brennan_508.pdf

12 National Oceanic and Atmospheric Administration. Big Data Program. https://www.noaa.gov/organization/information-technology/big-data-program

13 National Science Foundation Program Solicitation. 2018. Enabling Access to Cloud Computing Resources for CISE Research and Education (Cloud Access). https://www.nsf.gov/pubs/2019/nsf19510/nsf19510.htm

14 Department of Veterans Affairs. n.d. "The National VA Data Commons Pilot: Principles and Early Results." https://www.research.va.gov/data/the_national_va_data_commons_pilot.pdf

should be coordinated through the NSTC MLAI Subcommittee, with the results shared broadly. This task force should consider the extent to which existing activities provide guidance appropriate to AI R&D.

Recommendation 4: Within 90 days of publishing this report, the NSTC MLAI Subcommittee should establish a task force to establish and publish best practices that use open approaches and promote model/code reuse/interoperability among commercial cloud provider platforms so that AI software can work seamlessly across different platforms without the need for per-cloud customization, again with a focus on accelerating AI R&D activities. Implementation of the best practices should be coordinated through the NSTC MLAI Subcommittee, with the results shared broadly. This task force should consider the extent to which existing activities can be leveraged for AI R&D.

Recommendation Details

Recommendation 1: Coordinated by the NSTC Select Committee on AI and its operational arm, the NSTC MLAI Subcommittee, Federal agencies that support AI R&D should launch and support pilot projects to identify and explore the advantages and challenges associated with the use of commercial clouds in conducting federally funded AI research, and document and broadly share the results and associated best practices that emerge from those experiences.

Several Federal agencies have launched pilot projects to identify and explore the advantages and challenges associated with the use of commercial clouds in conducting federally funded AI research. Some of these are highlighted below. The efforts are complementary and have differing aims and goals in supporting the research computing and data needs of each agency's target community(ies). Thus, a broad range of experiences and insights will be drawn from these pilots. (See earlier footnotes for additional resources.)

- **DOD JAIC's Joint Common Foundation (JCF)** is being built in the cloud so that machine learning (ML) and AI development can be integrated with cloud security practices, to include infrastructure-as-code and DevSecOps.[15] The JCF will leverage cloud computing capabilities for data storage and accelerated ML/AI development. In particular, the JCF will integrate cloud platform-as-a-service offerings for data science and ML to enable developers to begin developing on day one. Leveraging the cloud will allow DoD to store, view, and easily share DoD source code and data that can be reused and/or repurposed securely to accelerate ML/AI development at scale.
- **DOT's Secure Data Commons** uses commercial cloud services to provide a secure, collaborative environment for analysis of transportation research data. DOT will be documenting the lessons learned along the way and building the entire platform "in the open" (e.g., sharing source code and cloud architectures). DOT is already ingesting and analyzing "AI-relevant" data.
- **NASA has several projects focusing on utilizing commercial cloud resources for storing large data sets such as Earth-observing satellite data for easy and on-demand access by interested third parties.** NASA also recently launched a pilot project to study the use of commercial cloud resources for AI R&D by the agency's staff and their collaborators. The focus is to understand the extent and viability of the services supported by such entities and to develop a platform for seamless access to a combination of on-premises resources and those provided by multiple commercial cloud providers.

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[15] DevSecOps manage *Development* (programmers, developers, security, application owners and analysts, and project managers); *IT Operations* (administration of system, network, and database, and data center and storage); and *Information Security* as tightly integrated processes.

- **NIH, through the activity Science and Technology Research Infrastructure for Discovery, Experimentation, and Sustainability (STRIDES) and the Artificial Intelligence for Biomedical Excellence (AIBLE) initiatives**, is addressing the challenges associated with data storage and accessibility by establishing partnerships with commercial cloud service providers and harnessing the power of the commercial cloud in support of biomedical research. STRIDES and AIBLE are providing mechanisms for NIH biomedical researchers to access the most advanced data sets to accelerate machine learning and AI and associated research outcomes. A central tenet is that data made available through these partnerships will incorporate standards endorsed by the biomedical research community to make data discoverable, accessible, and useable, and consistent with all applicable laws, regulations, and policies governing data use, disclosure, and sharing.

- **The NOAA Big Data Program (BDP)** improves the accessibility of NOAA's publicly available data by partnering with commercial cloud service providers to leverage the marketplace value inherent in NOAA's data. The BDP enables public use of NOAA data by lowering technical obstacles such as availability of data, network bandwidth, storage, and access tools, thus facilitating new ways for NOAA data to be understood and used by all. These partnerships allow NOAA to explore the use of cloud technologies for modeling, detection, classification, and data quality control, thereby enabling AI and advanced analytics. The BDP seeks to curb increasing costs and risks associated with Federal data access services while securely and rapidly scaling to meet the emerging data access needs and requirements of users. By leveraging these public-private partnerships with the cloud computing and information services industries (that will themselves monetize value-added services built on those open Federal data), NOAA ensures that the value in its data is more widely realized, and this ultimately enables new jobs and economic growth in the information services industries. The NOAA BDP is currently in its operational phase, and the agency has signed contracts with multiple commercial cloud computing service providers. These contracts have solidified the partnerships between NOAA and these cloud service providers, and they show a commitment to advancing NOAA's data footprint in the cloud and providing increased access to NOAA data.

- **NSF's Directorate for Computer and Information Science and Engineering (CISE)** has funded an entity that can serve as a principal interface between the CISE research and education community and public cloud computing providers. This entity has multiple responsibilities, including: (1) establishing partnerships with the various public cloud computing providers; (2) assisting NSF in allocating cloud computing resources to qualifying CISE-funded projects; (3) managing cloud computing accounts and resources allocated to individual CISE projects; (4) providing user training and other support to CISE researchers and educators using cloud computing in their work; and (5) providing strategic technical guidance for CISE researchers and educators interested in using public cloud computing platforms. NSF is undertaking this activity in order to better support the growing use of cloud computing resources by the NSF/CISE research and education community, including AI researchers and educators. Given the initial success of this activity, NSF is beginning to leverage the entity to expand access to cloud resources to programs beyond CISE. As this pilot approach (and the others noted as part of this recommendation) scales, it serves to inform policymakers on the feasibility of a potential future "National Research Cloud" to enable AI research and education.[16]

- **The VA Data Commons** pilot has three goals: (1) establish a regulatory framework to securely transfer, store, and use VA data within a VA Data Commons; (2) capture the technical requirements

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[16] J. Etchemendy and F. Li. 2020. "National Research Cloud: Ensuring the Continuation of American Innovation."
https://hai.stanford.edu/blog/national-research-cloud-ensuring-continuation-american-innovation

and software applications needed to conduct common research functions using VA data within a VA Data Commons; and (3) obtain an estimate of the anticipated costs needed to maintain an on-premises and cloud-based platform for a VA Data Commons capable of scaling to support thousands of approved research studies. A number of the considerations and lessons learned from this pilot are expected to be applicable to commercial cloud services as well.

Starting with the pilots as an evidence base, the NSTC MLAI Subcommittee should develop a plan for evaluating the impact of Federal investment in commercial cloud computing resources on advancing AI R&D and for identifying lessons learned and informing the viability of a potential future National Research Cloud. This plan should address resource availability and integrity, use, and impact, including enumeration of resources, key descriptors (e.g., the agency supporting the resource, capacity, cost structure, access pathway, data quality, and model composition), and performance measures such as system availability. Security considerations should also be addressed to provide appropriate access and levels of protection depending on who is accessing the data (e.g., government, university-affiliated research centers, federally funded research and development centers, universities, or contractors); the type of data (e.g., controlled unclassified information, controlled technical information, personally identifiable information, or proprietary information); the government's right to the data (e.g., unlimited, government-purpose, or restricted); and the data classification. Use should account for both human-initiated use and machine access, addressing system-level encounters; enumeration of services used (e.g., the data extract, search, or algorithm implementation); and characteristics of the session (e.g., the length of time or number of services per session). Impact should incorporate documentation of the purpose, consequences of use including results of AI methods applied, costs offset from on-premises approaches, and new results that it enabled. Ultimately, the plan should allow for a better understanding of demand and research workloads to enable strategic pricing models for providers and researchers alike. To support the implementation of this plan, the NSTC MLAI Subcommittee should track how agencies' uses of cloud computing to advance AI R&D are evolving.

An important cost attribute associated with extramurally funded cloud computing resources is the corresponding indirect cost. While existing statute[17] precludes some agencies from revising indirect cost rates associated with cloud computing resources, should additional flexibilities be afforded, this topic warrants further discussion to level the playing field when considering overall costs of local on-premises computing versus commercial cloud services and aligning overall costs with incentives.

Recommendation 2: Within 90 days of publishing this report, the NTSC MLAI Subcommittee should establish a task force to outline an approach to educating and equipping those engaged in AI R&D with the skills needed to use cloud-based platforms and technologies to help realize their full benefits for advancing AI frontiers. The task force should publish a report on its findings within 180 days.

Although many researchers, ranging from students to faculty and others, may leverage limited cloud computing in various capacities, there are few materials geared for educating researchers in use of the cloud in their R&D activities. There are limited processes for formalizing the knowledge that such users have acquired or for allowing them to share publicly the new skills that they have acquired. The task force of the NSTC MLAI subcommittee should: (1) collect information about the minimum skill requirements for conducting cloud-based work; (2) propose new mechanisms of training and skill

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[17] Public Law 115-245. 2018. An Act: Making consolidated appropriations for the Departments of Defense, Labor, Health and Human Services, and Education, and Related Agencies for the fiscal year ending September 30, 2019, and for other purposes. https://www.congress.gov/bill/115th-congress/house-bill/6157/text?overview=closed

development, new instructional materials, and/or an inventory of links to existing ones; and (3) encourage piloting approaches for equipping and credentialing. Such efforts may include expanding or formalizing existing programs that develop such materials, like the VA Big Data-Scientist Training Enhancement Program[18] that provides Government with increased access to academic expertise by linking researchers with postdoctoral fellows in training.

Recommendation 3: Within 90 days of publishing this report, the NSTC MLAI Subcommittee should establish a task force to examine best practices in identity management and single-sign-on strategies within Government and across the research community to identify near- and long-term approaches that will enable more effective use of the variety of commercial cloud resources, with a focus on accelerating AI R&D activities. Implementation of the best practices and strategies should be coordinated through the NSTC MLAI Subcommittee, with the results shared broadly.

Different research areas have different resource-access constraints and approaches. For example, investigators who deal with research data from a variety of sources (e.g., clinical records, institutional capture during the research process, and instrument data capture) inherit different controls and restrictions over that data.

Accelerating AI R&D benefits from researchers' access to data sets in a way that simultaneously respects the data contributors' rights while facilitating discovery and availability of relevant data sets. It is time to move beyond role-based access to data to new strategies that promote investigator access to data in a manner that provides fine-grained access control. A promising technology in this area is the use of token-based access management control, in which an individual who has authenticated to a valid resource can subsequently negotiate access to a variety of research resource data sources: once the combination of person, data permission, and data access instructions is met, the individual gains access to the various desired data resources. The task force should consider the extent to which existing activities, e.g., login.gov and IDmanagement.gov, provide guidance appropriate to AI R&D. The task force should also consider approaches for operational delivery and ongoing management of controlled access protocols that support research objectives, security of data sets, visibility to the roles of the personnel accessing the data, and appropriate use of Federal data.

Recommendation 4: Within 90 days of publishing this report, the NSTC MLAI Subcommittee should establish a task force to identify and publish best practices that use open approaches and promote model/code reuse/interoperability among commercial cloud provider platforms so that AI software can work seamlessly across different platforms without the need for per-cloud customization, again with a focus on accelerating AI R&D activities. Implementation of the best practices should be coordinated through the NSTC MLAI Subcommittee, with the results shared broadly.

The task force will collect information from agency representatives on promoting model and code reuse across cloud environments. This may include work being developed inside and outside the Federal Government. Areas for further elucidation include: (1) data and model sheets to capture meta information for making portability across cloud providers easier; (2) community-based practices and associated platforms (e.g., open-source Kubernetes automation processes) that enable sharing models and data across cloud providers; (3) approaches for easily porting models and associated data across different cloud platform instances (e.g., Docker); and (4) definition of requirements for data management (cleansing, anonymization, taxonomy, tagging, lifecycle management, etc.) and data

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[18] https://www.va.gov/oaa/specialfellows/programs/sf_bdstep.asp

movement that impact the agency sourcing and maintaining the data. The task force should consider the extent to which existing activities, e.g., code.gov, can be leveraged for AI R&D.

It is recognized that there are varying needs for different AI R&D activities. Some may achieve optimal performance by customizing for a single specialized cloud environment, while others may benefit from integrating data in real time across platforms in a manner where heterogeneous cloud interoperability is paramount, and still others may simply benefit from facilitating deployments in different environments.

Abbreviations

AI	artificial intelligence
AIBLE	Artificial Intelligence for Biomedical Excellence (NIH)
BDP	Big Data Program (NOAA)
CISE	Computer & Information Science & Engineering Directorate of NSF
DARPA	Defense Advanced Research Projects Agency
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
GSA	General Services Administration
HPC	high performance computing
IT	information technology
JAIC	Joint Artificial Intelligence Center (DOD)
JCF	Joint Common Foundation (DOD JAIC)
ML	machine learning
MLAI	Machine Learning and Artificial Intelligence (Subcommittee of the NSTC)

NASA	National Aeronautics and Space Administration
NCO	National Coordination Office for NITRD
NIH	National Institutes of Health
NIST	National Institute of Standards and Technology
NITRD	Networking and Information Technology Research and Development program
NOAA	National Oceanic and Atmospheric Administration
NSF	National Science Foundation
NSTC	National Science and Technology Council
OSTP	Office of Science and Technology Policy
R&D	research and development
STRIDES	Science and Technology Research Infrastructure for Discovery, Experimentation, and Sustainability (NIH)
VA	Department of Veterans Affairs

About the National Science and Technology Council

The National Science and Technology Council (NSTC) is the principal means by which the Executive Branch coordinates science and technology policy across the diverse entities that make up the Federal research and development enterprise. A primary objective of the NSTC is to ensure that science and technology policy decisions and programs are consistent with the President's stated goals. The NSTC prepares research and development strategies that are coordinated across Federal agencies aimed at accomplishing multiple national goals. The work of the NSTC is organized under committees that oversee subcommittees and working groups focused on different aspects of science and technology. More information is available at https://www.whitehouse.gov/ostp/nstc.

About the Office of Science and Technology Policy

The Office of Science and Technology Policy (OSTP) was established by the National Science and Technology Policy, Organization, and Priorities Act of 1976 to provide the President and others within the Executive Office of the President with advice on the scientific, engineering, and technological aspects of the economy, national security, homeland security, health, foreign relations, the environment, and the technological recovery and use of resources, among other topics. OSTP leads interagency science and technology policy coordination efforts, assists the Office of Management and Budget with an annual review and analysis of Federal research and development in budgets, and serves as a source of scientific and technological analysis and judgment for the President with respect to major policies, plans, and programs of the Federal Government. More information is available at https://www.whitehouse.gov/ostp.

About the Select Committee on Artificial Intelligence

The Select Committee on Artificial Intelligence advises and assists the NSTC to improve the overall effectiveness and productivity of Federal R&D efforts related to AI to ensure continued U.S. leadership in this field. It addresses national and international policy matters that cut across agency boundaries, and provides formal mechanisms for interagency policy coordination and development for Federal AI R&D activities. It also advises the Executive Office of the President on interagency AI R&D priorities; works to create balanced and comprehensive AI R&D programs and partnerships; leverages Federal data and computational resources across department and agency missions; and supports a technical, national AI workforce.

About the Subcommittee on Machine Learning & Artificial Intelligence

The Machine Learning and Artificial Intelligence (MLAI) Subcommittee monitors the state of the art in machine learning and artificial intelligence within the Federal Government, in the private sector, and internationally to watch for the arrival of important technology milestones in the development of AI, to coordinate the use of and foster the sharing of knowledge and best practices about ML and AI by the Federal Government, and to consult in the development of Federal MLAI R&D priorities. The MLAI Subcommittee reports to the Committee on Technology and the Select Committee on AI. The MLAI Subcommittee also coordinates AI taskings with the Artificial Intelligence R&D Interagency Working Group of the NSTC Subcommittee on Networking and Information Technology Research and Development (NITRD).

About the Subcommittee on Networking & Information Technology Research & Development

The NITRD Program is the Nation's primary source of federally funded work on pioneering information technologies (IT) in computing, networking, and software. The NITRD Subcommittee of the NSTC Committee on Science and Technology Enterprise guides the multiagency NITRD Program in its work to provide the research and development (R&D) foundations for assuring continued U.S. technological leadership and meeting the needs of the Nation for advanced IT. The National Coordination Office (NCO) supports the NITRD Subcommittee and the Interagency Working Groups (IWGs) that report to it. More information is available at https://www.nitrd.gov/about/.

About this Document

This report provides recommendations for leveraging cloud computing resources for federally funded artificial intelligence research and development. Cloud platforms provide robust, agile, reliable, and scalable computing capabilities, which can help accelerate advances in AI R&D. Cloud computing can also democratize access to the powerful computing capabilities needed for many types of AI R&D. This report is another step in the overall strategy to position the United States as the world leader in artificial intelligence.

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