



AMERICAN ARTIFICIAL INTELLIGENCE INITIATIVE: YEAR ONE ANNUAL REPORT

Prepared by

THE WHITE HOUSE

OFFICE OF SCIENCE AND TECHNOLOGY POLICY

FEBRUARY 2020

Continued American leadership in AI is of paramount importance to maintaining the economic and national security of the United States and to shaping the global evolution of AI in a manner consistent with our Nation's values, policies, and priorities.

—President Donald J. Trump, February 11, 2019.

February 2020

Dear Colleagues,

As we mark one year since President Donald J. Trump launched the American Artificial Intelligence Initiative, the Trump Administration has made critical progress in carrying out this national strategy and continues to make United States leadership in AI a top priority. In addition to establishing strategic areas of emphasis for United States AI research and development (R&D) and accelerated adoption of AI-enabled capabilities, the American AI Initiative directed Federal agencies to take specific actions that support its objectives.

President Trump made history when he became the first president to name artificial intelligence as an Administration R&D priority in 2017 — and since then, America has never looked back. The Trump Administration has called for record amounts of AI R&D investment, led the development of the first international statement on AI Principles, issued the first-ever strategy for engagement in AI technical standards, published the first-ever reporting of government-wide non-defense AI R&D spending, and released the first-ever AI regulatory document for the trustworthy development, testing, deployment, and adoption of AI technologies.

Under this Administration, the United States continues to be the best place in the world for AI technology to flourish and be developed for the benefit of all people. Our Nation is home to the world's top universities for AI, our research publications and patents stand out among our peers and competitors, and our AI industry is booming. American researchers, scientists, and technologists are advancing AI that improves medical diagnoses, makes our roads safer, assists first responders during emergencies, and helps farmers and researchers yield healthier crops.

America will maintain its global leadership in AI not through top-down government policies, but through our unparalleled innovation ecosystem where Federal agencies, the academic community, private sector innovators, and nonprofits each have a unique and necessary role, not to mention the synergistic effects of collaboration among these stakeholders. The American AI Initiative serves as a north star guiding this proven innovation model.

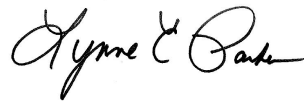
In a time of global power competition, our leadership in AI has never been more of an imperative. We remain committed to supporting the development and application of AI in a way that promotes public trust, protects civil liberties, and respects the privacy and dignity of every individual.

Under the American AI Initiative, the United States will continue to embrace AI as a key industry of the future that will help all Americans live longer, happier, and healthier lives.

Sincerely,



Michael Kratsios
United States Chief Technology Officer



Lynne E. Parker
Deputy United States Chief Technology Officer

Table of Contents

Executive Summary	iii
Introduction.....	1
Invest in AI Research and Development	4
Prioritize investments in AI R&D	4
Drive future technological breakthroughs in AI	5
Support R&D addressing AI technical hurdles to trust	6
Coordinate cross-agency AI investments.....	8
Track progress on Federally funded AI R&D.....	9
Unleash AI Resources	10
Increase access to Federal datasets for AI R&D and testing.....	10
Prioritize allocation of high-performance computing resources for AI.....	11
Enable better use of cloud computing to advance Federally funded AI R&D	11
Remove Barriers to AI Innovation	13
Foster trust in applications of AI.....	13
Provide regulatory guidance for AI.....	13
Develop relevant technical standards.....	15
Train an AI-Ready Workforce	17
Align education to future workforce needs	17
Prioritize AI within existing Federal fellowship and service programs	18
Leverage research to improve educational quality and opportunity	18
Promote an International Environment Supportive of American AI Innovation.....	20
Engage internationally to promote trustworthy AI innovation.....	20
Promote and implement international principles on AI stewardship	21
Embrace Trustworthy AI for Government Services and Missions	23
Leverage private sector expertise to improve government services using AI	23
Accelerate government adoption through interagency collaboration.....	24
Advance Federal agency progress.....	24
Develop an AI-ready Federal workforce	25
Build trust in the use of AI in government.....	25
Endnotes	26
Abbreviations.....	28

Executive Summary

On February 11, 2019, President Donald J. Trump launched the [American Artificial Intelligence Initiative](#),¹ the Nation's strategy for promoting American leadership in AI, by signing [Executive Order 13859](#).² The American AI Initiative focuses the resources of the Federal Government to support AI innovation that will increase prosperity, enhance national security, and improve quality of life for the American people. Since the signing of the Executive Order, the United States has made significant progress on achieving the objectives of this national strategy. This document provides both a summary of progress and a continued long-term vision for the American AI Initiative. This national strategy for promoting United States leadership in AI emphasizes the following key policies and practices:

- 1) **Invest in AI research and development:** The United States must promote Federal investment in AI R&D in collaboration with industry, academia, international partners and allies, and other non-Federal entities to generate technological breakthroughs in AI. President Trump called for a 2-year [doubling of non-defense AI R&D in his fiscal year \(FY\) 2021 budget proposal](#),³ and in 2019 the Administration [updated its AI R&D strategic plan](#),⁴ developed the first [progress report describing the impact of Federal R&D investments](#),⁵ and published the first-ever reporting of [government-wide non-defense AI R&D spending](#).⁶
- 2) **Unleash AI resources:** The United States must enhance access to high-quality Federal data, models, and computing resources to increase their value for AI R&D, while maintaining and extending safety, security, privacy, and confidentiality protections. The American AI Initiative called on Federal agencies to [identify new opportunities](#)⁷ to increase access to and use of Federal data and models. In 2019, the White House Office of Management and Budget established the [Federal Data Strategy](#)⁸ as a framework for operational principles and best practices around how Federal agencies use and manage data.
- 3) **Remove barriers to AI innovation:** The United States must reduce barriers to the safe development, testing, deployment, and adoption of AI technologies by providing guidance for the governance of AI consistent with our Nation's values and by driving the development of appropriate AI technical standards. As part of the American AI Initiative, The White House published for comment the proposed [United States AI Regulatory Principles](#),⁹ the first AI regulatory policy that advances innovation underpinned by American values and good regulatory practices. In addition, the National Institute of Standards and Technology (NIST) issued the first-ever [strategy for Federal engagement in the development of AI technical standards](#).¹⁰
- 4) **Train an AI-ready workforce:** The United States must empower current and future generations of American workers through apprenticeships; skills programs; and education in science, technology, engineering, and mathematics (STEM), with an emphasis on computer science, to ensure that American workers, including Federal workers, are capable of taking full advantage of the opportunities of AI. President Trump directed all Federal agencies to prioritize AI-related

apprenticeship and job training programs and opportunities. In addition to its R&D focus, the National Science Foundation's new [National AI Research Institutes](#)¹¹ program will also contribute to workforce development, particularly of AI researchers.

- 5) **Promote an international environment supportive of American AI innovation:** The United States must engage internationally to promote a global environment that supports American AI research and innovation and opens markets for American AI industries while also protecting our technological advantage in AI. Last year, the United States led historic efforts at the Organisation for Economic Cooperation and Development (OECD) to develop the first [international consensus agreements on fundamental principles for the stewardship of trustworthy AI](#).¹² The United States also worked with its international partners in the G7 and G20 to adopt similar AI principles.
- 6) **Embrace trustworthy AI for government services and missions:** The United States must embrace technology such as artificial intelligence to improve the provision and efficiency of government services to the American people and ensure its application shows due respect for our Nation's values, including privacy, civil rights, and civil liberties. The General Services Administration established an [AI Center of Excellence](#)¹³ to enable Federal agencies to determine best practices for incorporating AI into their organizations.

America's strong innovation ecosystem, fueled by strategic Federal investments, visionary scientists and entrepreneurs, and renowned research institutions, has propelled United States global leadership in AI. However, continued leadership is not predetermined. Maintaining America's preeminent role in AI can only be realized by continually building upon our progress and pursuing a strategic, forward-looking approach in partnership with industry, academia, nonprofit organizations, and other non-Federal entities (see box below).

Global leadership in AI matters. With the United States in the lead — together with like-minded allies — we will shape the trajectory of AI development for the good of the American people — enriching our lives, promoting innovation, fostering trust and understanding, and ensuring our national defense and security.

Importance of partnerships to maintaining United States leadership in AI

In all areas of strategic emphasis, partnerships and collaboration with academia, industry, nonprofit organizations, civil society, other non-Federal entities, and international partners and allies are of growing importance. Concurrent advances across government, universities, and industry mutually reinforce an innovative, vibrant American AI sector. Public-private partnerships enable strategic leveraging of resources, including facilities, datasets, and expertise. These partnerships also accelerate the transition of research innovations to practice, by leveraging industry expertise to turn open and published research results into viable products and services in the marketplace for economic growth. In the education and workforce area, partnerships are enhancing education and training for next-generation researchers, technicians, and workers, so that all can contribute to the 21st century economy. Partnerships with nonprofit organizations and civil society can help address important societal challenges arising from technological developments. The Nation also benefits from relationships between Federal agencies and international partners who work together to address key challenges. AI partnerships with allies and partners represent one of our sources of strategic competitive advantage.

Introduction

Maintaining American leadership in AI requires a concerted effort to promote advancements in technology and innovation, while protecting American technology, economic and national security, civil liberties, privacy, and American values, and enhancing international and industry collaboration with foreign partners and allies. (Executive Order 13859, February 11, 2019)

Artificial intelligence (AI) is transforming every segment of American life, with applications ranging from medical diagnostics and precision agriculture, to advanced manufacturing and autonomous transportation, to national security and defense. The pace of AI development is rapid, and new technologies — like machine learning, autonomous systems, and natural language processing — continue to widen the scope of applications. AI is already having a substantial economic impact, not only for companies whose core business is AI, but also for nearly all other companies as they discover the need to adopt AI technologies to stay globally competitive.

The United States is the global leader in AI research, development, and adoption. Continued American leadership in AI will ensure that the United States reaps the benefits of these advancements in a manner consistent with our Nation’s values, policies, and priorities. Maintaining American leadership in AI requires a multipronged strategy to drive advancement and adoption of AI while also upholding civil rights, civil liberties, privacy, and other American values, and protecting our technology advantage.

In May 2018, The White House hosted its Artificial Intelligence for American Industry summit (see box on the next page), which brought together senior experts from across the United States to discuss policies needed to ensure American leadership in AI. The ideas shared at that meeting led to continued discussions that informed the development of a national strategy for promoting United States leadership in AI.

To further this strategy, on February 11, 2019, President Trump signed the Executive Order “Maintaining American Leadership in Artificial Intelligence.” The Executive Order launched the American AI Initiative, which is a concerted effort to promote national AI technology and innovation leadership. The Initiative implements a whole-of-government strategy in collaboration and engagement with the private sector, academia, civil society, state and local governments, nonprofit organizations, and like-minded international partners. It directs the Federal Government to pursue a number of key areas of emphasis, including investing in AI R&D, unleashing AI resources, removing barriers to AI innovation, training an AI-ready workforce, promoting an international environment supportive of American AI innovation, and leveraging AI for government services and missions.

This document — *American Artificial Intelligence Initiative: Year One Annual Report* — reviews the strategic objectives of the Initiative, as well as the United States’ substantial progress on implementing the strategy over the first year. The chapters that follow describe the six main elements of the strategy, as well as Federal progress to date in these elements. Figure 1 summarizes several of the impactful outcomes from the Initiative thus far, including White House actions (left half of the figure) as well as actions by Federal agencies (right half of the figure).

These actions are promoting and accelerating American leadership in AI as part of an overall national AI strategy of the United States, shaping the trajectory of AI development for the American people, improving the quality of our lives, and ensuring our economic and national security.

2018 White House Summit on AI for American Industry

In May 10, 2018, The White House hosted the Artificial Intelligence for American Industry summit, to discuss the promise of AI and the policies needed to realize that promise for the American people and maintain United States leadership in the age of artificial intelligence. The summit brought together over 100 senior government officials, technical experts from top academic institutions, heads of industrial research labs, and American business leaders who are adopting AI technologies to benefit their customers, workers, and shareholders. At this summit, participants engaged in two sets of breakout sessions focused on cross-cutting issues such as AI R&D, workforce development, regulatory barriers to AI innovation, and sector-specific applications of AI.

Timeline of U.S. Government Actions to Advance the American AI Initiative

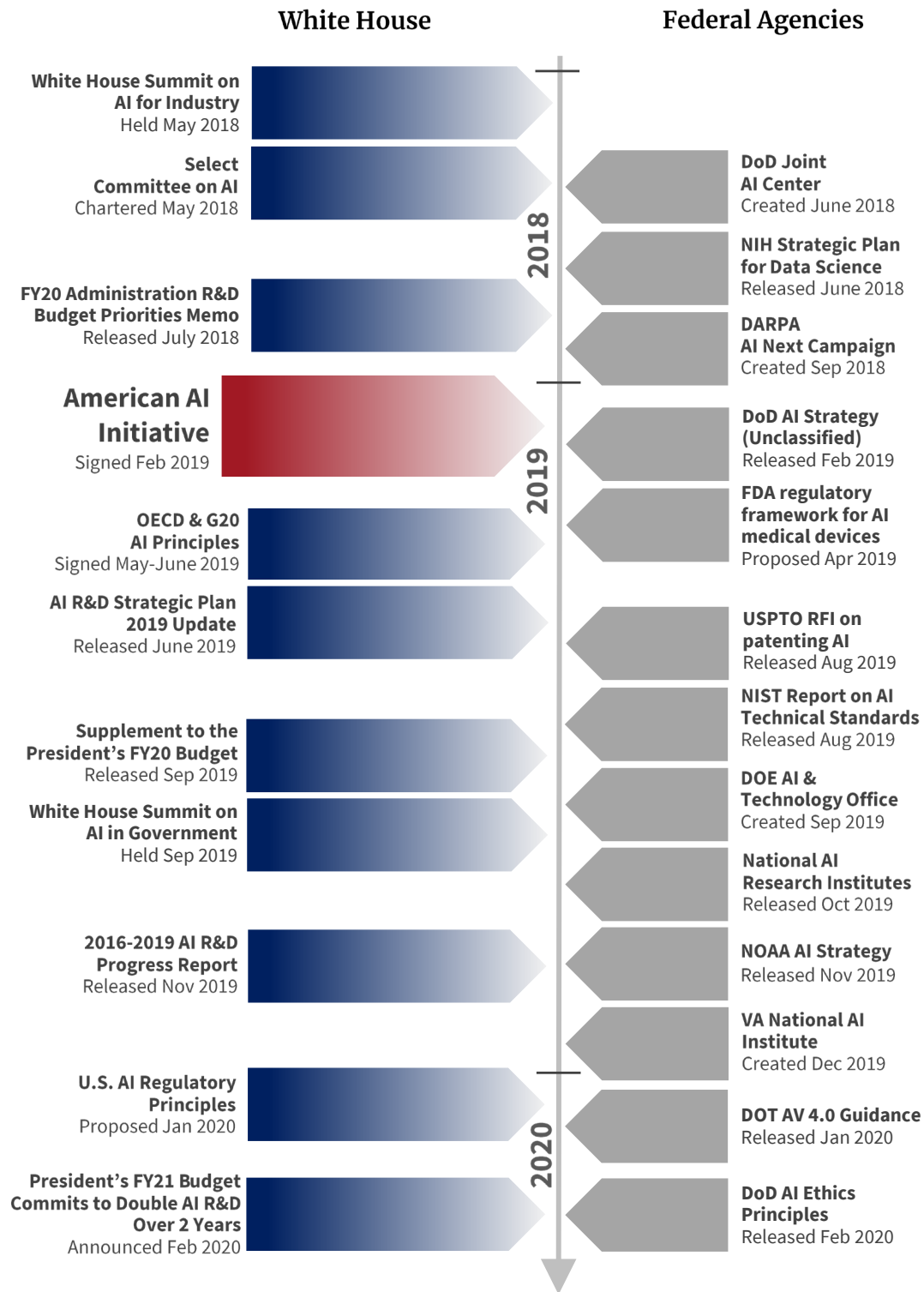


Figure 1. Timeline of United States Actions to Advance the American AI Initiative

Invest in AI Research and Development

The United States must drive technological breakthroughs in AI across the Federal Government, industry, and academia in order to promote scientific discovery, economic competitiveness, and national security. (Executive Order 13859, February 11, 2019)

The unique science and technology enterprise of the United States has positioned the Nation to pursue, realize, and become a global leader in AI. In this unique R&D ecosystem, academia, private industry, and government work together to create the world's greatest innovation engine. Maintaining this robust AI R&D ecosystem requires Federal investments and policies that promote robust cooperation among academia, industry, and the Federal Government. Although the Federal Government cannot — and should not — be the primary driver of United States innovation, the government does have a critical role in providing targeted R&D funding to support long-term fundamental research driving future technological breakthroughs, guiding the portfolio of R&D investments, using its resources to procure and adapt commercial AI capabilities for government missions, coordinating cross-agency AI investments, and leveraging Federal resources to accelerate AI R&D and adoption. Maintaining the thriving national AI R&D enterprise will help ensure that the United States continues to reap the benefits of these and future investments in AI and the emerging industries of the future.

Prioritize investments in AI R&D

To ensure the United States continues as a leader in AI innovation, the American AI Initiative requires Federal agencies to prioritize AI in their R&D investments, as appropriate to each agency's mission, consistent with law, and in accordance with the Office of Management and Budget (OMB) and the White House Office of Science and Technology Policy (OSTP) R&D budget priorities memoranda. In annual R&D budget priorities memos, the Trump Administration has consistently called for AI to be prioritized in Federal agency budgets. Heads of Federal agencies are directed to budget amounts for AI R&D appropriate for this priority.

The Initiative also directs Federal agencies to annually report AI R&D investments through the

Networking and Information Technology R&D (NITRD) Program. As required by law, NITRD annually prepares for Congress a Supplement to the President's Budget Request that outlines unclassified information technology budgets at Federal agencies. The [FY 2020 NITRD Budget Supplement](#),¹⁴ for the first time in history, provided an agency-by-agency reporting of unclassified, non-defense Federal investments in AI R&D, totaling \$973.5 million in FY 2020 across a range of agencies, programs, and initiatives. This new AI R&D reporting process provides an important mechanism and baseline for consistently tracking America's prioritization of AI R&D going forward.

Building upon this baseline and recognizing that increased investments are needed to

continue America's lead in cutting-edge AI, President Trump's FY 2021 budget includes a major increase in non-defense AI funding compared to the FY 2020 budget and is on a path to [double government-wide non-defense spending on AI R&D by FY 2022](#).¹⁵ The budget includes over \$850 million for AI activities at the National Science Foundation (NSF), which represents a 70-plus percent increase over the FY 2020 budget. This increase will advance NSF's ability to invest in both foundational and translational AI research, and it will enable NSF to create several additional [National AI Research Institutes](#),¹⁶ in collaboration with the Departments of Agriculture, Homeland Security, Transportation, and Veterans Affairs (VA). These institutes serve as focal points for multisector, multidisciplinary research and workforce efforts among academia, industry, Federal agencies, and nonprofits, helping to ensure that America remains the global AI leader.

The President's FY 2021 budget also includes an increase of \$54 million in core AI research at the Department of Energy's (DOE) Office of Science, as well as an additional \$50 million at the National Institutes of Health (NIH) for new research on tackling chronic diseases using AI-related approaches.

Drive future technological breakthroughs in AI

The decades-long technological leadership of the United States in AI is a reflection of the Nation's strong, long-term strategic emphasis on visionary, competitive, and high-payoff fundamental R&D programs that advance the frontiers of science and engineering. The Federal Government invests in a wide range of AI R&D that drives future technological breakthroughs. These investments cut across many executive departments and agencies and cover a broad range of topics relevant to the

agencies' missions, including core AI techniques and technologies; AI prototype systems; application and adaptation of AI techniques; architectural and systems support for AI; and cyberinfrastructure, datasets, and technical standards for AI. American R&D investments in AI are measured not just by the specific dollar total of the financial investments, but also — and perhaps more importantly — in the quality and impact of those investments. These investments are now paying off in everyday lives, in applications from healthcare to financial services, from weather forecasting to transportation, and more.

Many areas of AI development have matured to the stage where industry and nonprofit organizations are now investing significantly in continued development of AI. Their investments are leading to technology advancements that move AI from the research laboratory into commercial products and services. The Federal Government will leverage private sector investments in AI innovation whenever possible. However, many tough AI R&D challenges remain that industry is unlikely to solve. Some of these challenges lack near-term market drivers, while others address agency-specific requirements or societal needs that are unlikely to lead to commercial profits. These continued research challenges require investment by the Federal Government. Just as today's revolution in machine learning has its roots in Federally funded research projects going back decades, today's investments will ensure the United States maintains its global leadership for decades to come.

As part of the Nation's strategy to promote United States leadership in AI, it is the policy of the United States to maintain a current strategic plan for Federal R&D investments in AI and to track the progress and implementation

Updating the National AI R&D Strategic Plan

In June 2019, The White House Office of Science and Technology Policy's National Science and Technology Council released the [National AI R&D Strategic Plan: 2019 Update](#),¹⁷ which defines eight key strategies guiding Federal AI R&D investments. The process for creating this Plan began in August 2018, when the Administration directed the Select Committee on AI to refresh the 2016 National AI R&D Strategic Plan to account for significant recent advancements in AI, and to ensure that Federal R&D investments remain at the forefront of science and technology. The Select Committee then issued a [Request for Information](#) (RFI)¹⁸ to solicit input from the public on the current AI R&D Strategic Plan, to determine ways the strategy should be revised or improved. The [responses to this RFI](#),¹⁹ as well as an independent agency review, informed the 2019 update to the Plan, affirming the continued relevance of the original seven strategies of the 2016 Strategic Plan while also calling for greater attention to partnering with the private sector. Thus, a new, eighth strategy was added to place increased emphasis on effective partnerships between the Federal Government and academia, industry, other non-Federal entities, and international allies.

of that plan. Guiding the Nation's AI R&D investments is the [National AI R&D Strategic Plan: 2019 Update](#)²⁰ ("Plan"), which identifies the critical areas of AI R&D that require Federal Government investment (see box above). The Plan defines eight key areas of priority focus for the Federal agencies that invest in AI, including continuing long-term investments in AI research; developing effective methods for human-AI collaboration; understanding and addressing the ethical, legal, and societal implications of AI; ensuring the safety and security of AI systems; developing shared public datasets and environments for AI training and testing; measuring and evaluating AI technologies through standards and benchmarks; better understanding the national AI R&D workforce needs; and expanding public-private partnerships to accelerate advances in AI.

The Plan defines a coordinated effort across the Federal Government to help the United States realize the full potential of AI for the betterment of our Nation. However, the Plan does not define specific research agendas for individual Federal agencies. Instead, it is the policy of the United States for agencies to pursue priorities

consistent with their missions, capabilities, authorities, and budgets, while coordinating the investments so that the overall portfolio of Federal research is consistent with this Plan. Each Federal agency has a unique mission and role in the Nation's R&D ecosystem (see box on the next page). Together, these Federal agencies provide a whole-of-government approach to AI innovation across all segments of society.

Support R&D addressing AI technical hurdles to trust

To garner trust and confidence, AI technologies should be transparent in how they work and provide reasonable guarantees on the safety, security, robustness, and resiliency of their operation. Many existing AI systems, however, lack these characteristics due to unsolved technical hurdles that require further R&D. Priority areas of AI R&D emphasize the development of explainability mechanisms that help human users understand reasons for AI outputs, along with methods to test, evaluate, verify, and validate their performance.

Unique roles of Federal agencies in advancing AI research, development, and deployment

The United States benefits significantly from the broad spectrum of Federal agencies that invest in AI from their unique mission perspectives.

- The **National Science Foundation** has long supported transformative fundamental research in AI, with investments made decades ago leading today's deep learning systems in applications such as automated vehicles.
- The **Defense Advanced Research Projects Agency** has long been a pioneer in AI research and is now investing in the “third wave” of AI systems that have characteristics essential for military and safety-critical systems such as abilities to deal with contextual reasoning and explaining actions.
- The **Department of Defense** established the Joint Artificial Intelligence Center to scale AI and its impact across DoD, accelerate translating AI research into military capabilities, and strengthen our Nation's defense.
- The **Intelligence Advanced Research Projects Activity** invests in AI for intelligence challenges, such as understanding imagery, as well as human language transcription and translation.
- The **National Institute for Standards and Technology** is a leader in foundational research that informs the development of technical standards for reliable, robust, and trustworthy AI.
- The **Department of Energy** is pioneering and sponsoring AI R&D to support its broad mission and is a world leader in the development of high-performance computing infrastructure that supports AI research. DOE established the Artificial Intelligence and Technology Office to accelerate DOE's AI capabilities, ensuring the national and economic security of the United States.
- The **Department of Veterans Affairs** in partnership with the Department of Energy is exploring the secure analysis of large digital health and genomic data to help advance healthcare for veterans and others in areas such as suicide prevention, cancer, and heart disease.
- The **National Institutes of Health** explores effective ways to use AI in medicine, such as for diagnosing illnesses or personalizing treatments.
- The **Department of Transportation** has developed voluntary guidance for safely integrating automated vehicles that leverage AI techniques into the Nation's roadways.
- In collaboration with others, the **Departments of Labor, Commerce, and Health and Human Services** are studying the impacts of automated vehicles on the workforce and understanding what new skills the workforce will need to thrive in the AI-based economy of the future.
- The **National Oceanic and Atmospheric Administration** is using AI to better understand satellite data for weather applications such as predicting the tracks of hurricanes.

Collectively, these and other Federal agencies provide critical expertise and leadership to ensure our Nation continues to benefit from advances in AI in a manner that is consistent with our values, policies, and priorities.

For data-intensive AI approaches, transparency further depends on a deeper understanding of the data used to train AI systems, including veracity, provenance, and fitness for the application. Future research advances are being explored, such as in the Defense Advanced

Research Projects Agency's (DARPA) [AI Next Campaign](#)²¹ to create more data-efficient approaches to AI that are much less dependent on large-scale data, thus potentially mitigating the ethical and technical disadvantages of data-intensive AI. The National AI Research

Institutes program includes a focused theme on trustworthy AI. Other Federal agency programs are funding research to mitigate the cybersecurity risks of certain AI techniques that are vulnerable to adversarial attacks. For example, DOE is partnering with academia and industry to develop resilient AI-based methods that automatically detect and respond to cyber-attacks against our Nation’s power grid and communications networks.

To address these technical hurdles, the *National AI R&D Strategic Plan* identifies numerous open AI R&D challenges that the Federal Government will prioritize to increase the trustworthiness of AI technologies and their application. These investments are critically important as one component of a broad strategy to help ensure that future AI technologies are developed and used in a manner consistent with our Nation’s core values.

Coordinate cross-agency AI investments

Given the broad spectrum of Federal R&D investments in AI, it is important for these investments to be coordinated to improve the overall effectiveness and productivity of these efforts. This coordination is the responsibility of the National Science and Technology Council (NSTC), a Cabinet-level council that is the principal means for the President to coordinate science and technology policies across the Executive Branch. The NSTC has established a framework to coordinate AI R&D across the Federal R&D agencies, consisting of three unique NSTC subgroups with representation from across the Federal R&D agencies. These groups include (1) senior leadership and strategic vision, (2) operational planning and tactical implementation, and (3) research and technical expertise, comprising:

- The [Select Committee on AI](#)²² (“Select Committee”). It was chartered by The White House in May of 2018 and consists of the

heads of departments and agencies principally responsible for the government’s AI R&D. The Select Committee advises the Administration on interagency AI R&D priorities; considers the creation of Federal partnerships with industry and academia; establishes structures to improve government planning and coordination of AI R&D; identifies opportunities to leverage Federal data and computational resources to support our national AI R&D ecosystem; and supports the growth of a technical, national AI workforce.

- The ***NSTC Subcommittee on Machine Learning and Artificial Intelligence*** (MLAI). It consists of agency AI leaders and administrators and serves as the operational and implementation arm of the Select Committee, responsible for fulfilling tasking from the Select Committee; creating and maintaining the *National AI R&D Strategic Plan*; identifying and addressing important policy issues related to AI research, testing, standards, education, implementation, outreach, and related areas; and related activities.
- The ***AI R&D Interagency Working Group***. It operates under the NSTC’s NITRD Subcommittee and consists of research program managers and technical experts from across the Federal Government. It reports to the MLAI and NITRD Subcommittees; helps coordinate interagency AI R&D programmatic efforts; serves as the interagency AI R&D community of practice; and reports government-wide AI R&D spending through the NITRD Subcommittee’s annual Supplement to the President’s Budget.

Given the strong AI expertise in industry, academia, and nonprofit organizations, Federal AI R&D coordination groups will benefit from strong engagement with these partners. It is also the policy of the United States to seek

expert advice from outside the Federal Government when appropriate, consistent with the Federal Advisory Committee Act, 5 U.S.C. App., as amended. This may include consulting the [President's Council of Advisors on Science and Technology](#)²³ and other NSTC subcommittees to obtain appropriate advice from the private sector. Public engagement is also important to the coordination of Federal AI activities, with general convenings, workshops, formal requests for information, and related opportunities providing important perspectives to inform Federal R&D efforts.

Track progress on Federally funded AI R&D

To document the impactful progress the Nation has made in AI through Federal R&D investments, The White House issued the [2016-2019 Progress Report: Advancing Artificial Intelligence R&D](#)²⁴ in November 2019. This progress report highlights AI research first by R&D strategy, then by sector, with subsequent supporting details describing individual agency contributions that provide a whole-of-

government overview. The progress report highlights not only the broad themes of Federal R&D but also provides illustrative examples that highlight individual agency AI R&D breakthroughs that have advanced the state of the field. The diversity of programs and activities reflects the remarkable breadth and depth of transformative Federal investments into innovative AI concepts.

The United States benefits significantly from the broad spectrum of Federal agencies that invest in AI from their unique mission perspectives, consistent with the *National AI R&D Strategic Plan*. It is clear that Federal investments are generating impactful breakthroughs that are revolutionizing our society for the better. Collectively, the investments demonstrate how the Federal Government leverages and improves America's AI capabilities through R&D, leading to further advances that increase prosperity, safety, security, and quality of life for the American people for decades to come.

Unleash AI Resources

[Agencies must] enhance access to high-quality and fully traceable Federal data, models, and computing resources to increase the value of such resources for AI R&D, while maintaining safety, security, privacy, and confidentiality protections consistent with applicable laws and policies.

(Executive Order 13859, February 11, 2019)

The Federal Government has significant resources in the form of data, models, and computing resources that would be of vital benefit to America's AI research and development. Increased access to data and computing resources will broaden the community of experts, researchers, and industries participating at the cutting edge of AI R&D, thus increasing the competitiveness of experts across the country. To realize this potential, it is the policy of the United States to expand the access of experts to high-quality, valid, and fully traceable Federal data, models, and computing resources for Federally funded AI R&D.

Increase access to Federal datasets for AI R&D and testing

The American AI Initiative calls for Federal agencies to continually review their data and models as budgets allow, to identify opportunities to increase access and use of these data and models for AI R&D and testing. Increasing access to data and models must be done in a manner that benefits the greater non-Federal AI research community, while also maintaining safety, security, privacy, and confidentiality protections.

Enhancing this activity is the Cross-Agency Priority Goal of the President's Management Agenda to leverage data as a strategic asset. The [Federal Data Strategy](#)²⁵ defines an integrated and coordinated approach to fully leverage the value of Federal data for agency missions and the public good by guiding the Federal Government in practicing ethical governance, conscious design, and a learning culture. The Strategy's [2020 Action Plan](#)²⁶ has

also been developed, which identifies and prioritizes practice-related steps for the agencies for the year, along with targeted timeframes and responsible entities.

In accordance with the Federal Data Strategy, the American AI Initiative directs agencies to further improve their data and model inventory documentation to enable discovery and usability, prioritizing access and quality improvements to support AI research, development, and testing.

Informing this process, The White House in July 2019 issued an RFI to [ask the public for comments on the needs for additional access to, or improvements in the quality of, Federal data and models](#)²⁷ that would improve the Nation's AI R&D and testing efforts.

A number of challenges must also be addressed in order to make data and models more available to the greater non-Federal research community, while ensuring appropriate protections remain in place. The American AI

Initiative directs agencies to identify the barriers to making data and models more available to the greater non-Federal research community. Identified barriers include format, quality, and scale considerations. Other barriers include challenges in data and model discoverability, accessibility, and usability, as well as barriers in how models are trained and validated. Additionally, governance issues that include provenance, access constraints, privacy, safety, security, and intellectual property must be carefully considered and managed.

Many efforts are underway now across the Federal agencies to take the information gathered from the RFI, in the context of the identified barriers and additional considerations, and deliver on making more Federal data more available for AI R&D and testing, as appropriate. For example, NSF and the Department of Transportation's Federal Highway Administration (DOT/FHWA) are collaborating on research on privacy techniques that would enable the [Strategic Highway Research Project dataset](#)²⁸ to be accessible remotely.

Prioritize allocation of high-performance computing resources for AI

While algorithms and data play strong roles in the performance of AI systems, equally important is the computing infrastructure upon which AI systems run. Advances in AI will continue to be dependent on hardware optimized by AI algorithms, including novel designs for neuromorphic computing, hardware accelerators for machine learning, embedded systems, and parallel architecture research motivated by AI processing requirements and in light of the limitations of Moore's Law.

For example, NSF and DARPA are partnering on the Real-Time Machine Learning (RTML) program to explore high-performance, energy-efficient hardware and machine-learning architectures that can learn from a continuous stream of new data in real time. Through RTML, NSF and DARPA are enabling teaming between researchers they support.

The United States is a world leader in the development of high-performance computing infrastructure that supports AI research, and the Administration is committed to maintaining this leadership through the recently updated [National Strategic Computing Initiative](#).²⁹ As part of the American AI Initiative, Federal agencies are prioritizing the allocation of high-performance computing resources for AI-related applications through discretionary allocation of resources and resource reserves to prioritize AI research, to the extent appropriate and consistent with law. For example, DOE made available the world's largest supercomputers in a partnership with the National Cancer Institutes of the NIH, to build novel AI solutions for the Nation's pressing cancer challenges.

Enable better use of cloud computing to advance Federally funded AI R&D

Agencies are also identifying ways in which cloud computing resources can be better used to advance Federally funded AI R&D. 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 extent of AI researchers who are able to participate in the R&D needed for cutting-edge technological advances. Agencies are exploring technical and administrative challenges that are limiting cloud adoption, along with actions needed to

remove any unnecessary barriers to AI innovation.

For example, [NSF has funded an entity](#)³⁰ to enhance access for the academic computer science research and education community to cloud computing providers. Similarly, NIH is experimenting with using cloud environments to streamline NIH data use by partnering with commercial providers through its [Science and Technology Research Infrastructure for](#)

[Discovery, Experimentation, and Sustainability \(STRIDES\) Initiative](#).³¹

By democratizing access to powerful cloud computing resources, the United States will expand the ability of academia and industry 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 national security.

Remove Barriers to AI Innovation

[The Federal Government must] reduce barriers to the use of AI technologies to promote their innovative application while protecting American technology, economic and national security, civil liberties, privacy, and values. (Executive Order 13859, February 11, 2019)

AI is still in its infancy. Although we are seeing numerous actual and potential benefits and challenges of AI, the true extent of AI's impact on society is still unknown. A responsible approach to AI removes barriers to the use of AI technologies in order to promote their innovative application while protecting economic and national security, civil liberties, privacy, and American values. The Federal Government plays an important role to ensure that regulations guiding the development and use of AI are supportive of innovation and not overly burdensome. The Federal Government also contributes to industry-driven technical standards that support the development and use of AI. By addressing regulatory and standards challenges for AI innovation, the government fosters a business environment that allows entrepreneurs to create new American industries and enables our Nation's innovation ecosystem to thrive.

Foster trust in applications of AI

Due to the complexity of many AI technologies, they are not always easily understood by the general public. Since AI technologies are so broadly applicable across society, some people fear that they will be used — openly or opaquely — in ways that conflict with our Nation's core values and civil liberties. Not using AI technologies because of perceived or potential harms, however, could be just as problematic, depriving individuals — or the Nation — of the significant benefits that AI technologies could bring.

Fully realizing the potential of AI, therefore, requires public trust and confidence in these technologies. Gaining trust and confidence in the use of AI technologies requires a broad range of actions, including accelerating AI R&D to address technical hurdles, creating and implementing effective guidance for oversight of these technologies, evaluating relevance of

existing legal and regulatory approaches overseeing the use of AI and addressing gaps when needed, educating AI developer and user communities on potential limitations and harms in the use of AI technologies, and setting expectations for the appropriate development and use of AI by technical professionals.

Provide regulatory guidance for AI

Innovative technologies like AI can create significant new ways of solving problems that existing regulations may not have considered. Many existing laws and regulations apply whether or not AI is used, such as the expectation that employers will not discriminate when hiring workers, or that personally identifiable information will remain confidential. However, other existing laws and regulations could introduce unnecessary and unintended barriers to novel designs, such as a past regulation that may have presumed cars to always have human drivers.

Examples of Federal actions that are removing barriers to AI innovation

Department of Transportation: DOT is taking steps to develop voluntary guidance for how best to integrate automated vehicles into our Nation's transportation systems. In January 2020, DOT and OSTP released [Ensuring American Leadership in Automated Vehicle Technologies: Automated Vehicles 4.0](#),³² which details 10 United States Government principles to protect users and communities, to promote efficient markets, and to facilitate coordinated efforts to ensure a standardized Federal approach. This new document builds on DOT's [2018 AV 3.0 guidance](#)³³ and [2017 ADS 2.0 guidance](#),³⁴ which focused on innovation for surface transportation modes and safe testing and integration of automated vehicles.

Federal Aviation Administration (FAA): In October 2017, President Trump signed a [Presidential Memorandum](#)³⁵ that launched the Unmanned Aircraft Systems (UAS) Integration Pilot Program, permitting States and localities to conduct innovative commercial and public drone operations previously prohibited under FAA regulations. This program is being used to [accelerate the safe integration of UAS](#)³⁶ into the national airspace and to realize the benefits of unmanned technology in our economy.

Food and Drug Administration (FDA): In April 2018, [FDA approved the first-ever AI-based device to detect diabetic retinopathy](#),³⁷ the leading cause of blindness among working-age Americans. This device can be used by primary care physicians for early detection of this disease to improve the healthcare screening of people with diabetes by doctors who are not normally involved in eye care.

Food and Drug Administration: In April 2019, [FDA proposed a regulatory framework for AI-based software as a medical device](#).³⁸ FDA is considering a total product lifecycle-based regulatory framework for these technologies that would allow for modifications to be made from real-world learning and adaptation while still ensuring that the safety and effectiveness of the software as a medical device is maintained. This was followed in September 2019 with [draft guidance for clinical decision support software](#).³⁹

The advancement of AI is sufficiently far along that we are now seeing new ways that AI is being used across society. While it is not prudent for regulatory agencies to regulate against imagined harms, it is appropriate for these agencies to evaluate their current regulatory approaches to determine the updates needed to account for innovative AI capabilities.

Regulatory progress for AI innovation is already being made with actions by DOT, FAA, and FDA (see box above). However, further overarching guidance is needed to inform the development of regulatory and nonregulatory approaches by individual agencies regarding technologies and industrial sectors that are either empowered or

enabled by AI. In particular, guidance is needed to address challenges specific to AI, not simply reformulations of existing broader efforts to consider challenges of data, privacy, cybersecurity, competition, digital economy, or related topics.

Addressing this issue, as directed by the American AI Initiative, in January 2020, The White House published a request for public comment on [proposed first-of-their-kind AI regulatory principles](#)⁴⁰ on regulatory and nonregulatory policies to govern the development and use of AI technologies in the private sector. When finalized, this guidance will ensure that agencies consider ways to reduce

barriers to the development and adoption of AI before proposing any regulation of technologies and industrial sectors that are empowered or enabled by AI. The guidance also calls on regulatory agencies to review their authorities relevant to the application of AI and to develop plans to achieve consistency with the guidance.

The proposed United States AI regulatory principles are underpinned by three goals designed to drive AI innovation:

- *Ensure Public Engagement:* The AI regulatory principles call for Federal agencies to increase public participation in the policymaking process, building public trust and confidence in AI technologies. Regulators must base technical and policy decisions on scientific evidence and feedback from the American public, industry leaders, the academic community, nonprofits, and civil society.
- *Limit Regulatory Overreach:* Regulators must carefully assess risk and the costs and benefits before considering regulations related to the development and deployment of AI applications, with a focus on establishing flexible, performance-based frameworks rather than one-size-fits-all regulation. The principles also direct Federal agencies to reduce duplicative efforts and ensure consistency government-wide.
- *Promote Trustworthy AI:* When evaluating regulatory and nonregulatory approaches to AI, Federal agencies must consider fairness, nondiscrimination, disclosure, transparency, safety, and security. In recognizing American values and the importance of scientific integrity and information quality, the principles address challenging technical questions and societal concerns to support the development of innovative, reliable, robust, and trustworthy AI systems.

The principles detail the United States approach to AI regulation for innovators and entrepreneurs. The principles seek to reduce regulatory uncertainty that could hinder private sector innovation and development of AI technologies. The principles also convey the importance of avoiding heavy-handed innovation-killing models. The best way to counter authoritarian uses of AI is to make sure America and our international partners remain the global hubs of innovation, shaping the evolution of technology in a manner consistent with our common values. These AI regulatory principles put our Nation on a path towards continued AI leadership, innovation, and discovery.

Develop relevant technical standards

The United States will lead in the development of appropriate technical standards and related tools in support of the safe development, testing, and deployment of AI technologies. Such standards promote the development of reliable, robust, trustworthy, secure, portable, and interoperable AI systems. Appropriate technical standards will foster the creation of new AI-related industries and the adoption of AI by today's industries. Standards can provide developers with clear guidelines for the design of AI systems to ensure that they can be easily integrated with other technologies, utilize best practices for cybersecurity and safety, and adhere to a variety of technical specifications that maximize their utility. They can also serve as a mechanism for evaluating and comparing AI systems. The development of standards should be market-driven, led by the private sector based on a voluntary, transparent, and consensus-driven approach.

The Department of Commerce, through NIST, leads Federal engagement in the development of technical standards and related tools. As

directed by the American AI Initiative, in August 2019, NIST released a [*Plan for Federal Engagement in Developing Technical Standards and Related Tools*](#).⁴¹ The goal is to ensure that technical standards reflect Federal priorities for innovation, public trust, and public confidence in systems that use AI technologies, and that international standards are developed to promote and protect those priorities.

United States global leadership in AI depends upon the Federal Government playing an active and purpose-driven role in AI standards development. In this role, and according to their missions, agencies should support and conduct AI standards R&D, actively engage in AI standards development, procure and deploy standards-based products and services, and

develop and implement supportive policies, including regulatory policies where needed.

The government's meaningful engagement in standards development is necessary — but not sufficient — for the Nation to maintain its leadership in this competitive realm. Active involvement and leadership by the private sector, as well as academia, is required. Prepared with extensive public and private sector input, NIST's plan provides guidance for bolstering the engagement of Federal agencies in AI technical standards to promote continued United States leadership in AI. It focuses on the Federal Government's role in advancing AI standards and priorities for research that supports development of technically sound and fit-for-purpose standards.

Train an AI-Ready Workforce

The United States must train current and future generations of American workers with the skills to develop and apply AI technologies to prepare them for today's economy and jobs of the future.

(Executive Order 13859, February 11, 2019)

AI and related technologies are creating entirely new career paths and increasing the demands for new and advanced technical skills across a wide range of industries. AI also holds the promise of improving worker safety, increasing productivity, and creating new industry sectors not yet imagined. At the same time, these technologies are changing the nature of work and raising some concerns that many existing occupations will change significantly or become obsolete. The United States is empowering current and future generations of American workers with the skills needed to adapt to — and thrive in — this new age of AI. American workers are being provided opportunities to develop and apply AI technologies so they can compete in the 21st century economy, embrace new AI technologies, and succeed in the jobs of the future.

Align education to future workforce needs

The AI-ready workforce includes people with a broad spectrum of capabilities, from those who are novices in technology but capable of using AI-based tools, to those experts who create the next innovations at the cutting edge of AI. Preparing this AI-ready workforce requires an enhanced focus on the STEM education talent pipeline, as well as technical apprenticeships, reskilling, and lifelong learning programs to better match Americans' skills with the needs of industry. Significant progress is being made by the Federal Government toward these objectives (see box on the next page). All of these efforts require concerted partnerships among academia, industry, and Federal, state, and local governments.

The urgency of providing opportunities for Americans to engage in the emerging industries of the future is increasing and is becoming a national and economic security issue. As noted

in the [2017 National Security Strategy](#),⁴² a priority action is to protect and increase critical skills in the United States. There is a growing shortage of AI technical talent across academia, industry, and government, spanning all levels of AI expertise.

The United States will expand opportunities for all Americans to gain the skills needed to participate in an AI-ready workforce, including those from diverse backgrounds who are historically underrepresented in STEM fields. General STEM educational and training opportunities relevant for AI are being addressed in other Federal efforts, including the [2018 Five-Year Strategy for STEM Education](#),⁴³ [Task Force for Apprenticeship Expansion](#),⁴⁴ and [President's National Council for the American Worker](#).⁴⁵

As directed by the American AI Initiative, the Select Committee on AI is providing expertise to the National Council for the American Worker on education and workforce recommendations for developing an AI-ready workforce, which

Providing American workers with skills for the 21st century economy

Prioritizing STEM Education: In September 2017, President Trump signed a Presidential Memorandum prioritizing high-quality science, technology, engineering, and mathematics education, with a particular focus on computer science education, and committing \$200 million in grant funds from the Department of Education that were matched by private industry commitments of \$300 million. NSF's [CSforAll](#)⁴⁶ program is also providing opportunities for students to participate in computer science and computational thinking education in their schools at the preK-12 levels.

STEM Strategic Plan: In December 2018, The White House released a 5-year strategic plan — [Charting a Course for Success: America's Strategy for STEM Education](#)⁴⁷— to strengthen and better coordinate STEM education programs across the Federal Government. The goals of this plan are to help ensure that all Americans have access to quality STEM education and to safeguard America's place as the global leader in STEM innovation and employment. A key focus of this plan is on enhancing access to curricula in computer science and computational thinking.

Apprenticeships: In June 2017, President Trump signed an Executive Order establishing industry-recognized apprenticeships and creating a Cabinet-level [Task Force on Apprenticeship Expansion](#).⁴⁸

National Council for the American Worker: In July 2018, President Trump signed an Executive Order establishing the [President's National Council for the American Worker](#)⁴⁹ to ensure that students and workers have access to innovative education and job training opportunities. Through this action, President Trump charged companies and trade groups across the country to sign the [Pledge to America's Workers](#),⁵⁰ committing to expand education, training, and reskilling opportunities for American workers. As of February 2020, over 400 companies have pledged to create more than fourteen million such opportunities.

will be included as part of the National Council for the American Worker's National Workforce Strategy.

Prioritize AI within existing Federal fellowship and service programs

In addition to these efforts, the American AI Initiative specifies that heads of agencies will, to the extent consistent with law, consider AI as a priority area within existing Federal fellowship and service programs. Eligible programs for prioritization will give preference to American citizens to the extent permitted by law and will include high school, undergraduate, and graduate fellowships; alternative education and training programs; programs to recognize and fund early-career faculty AI researchers; scholarship-for-service programs; direct commissioning programs of the Armed Forces; and programs that support the development of

instructional programs and curricula that encourage the integration of AI technologies into courses in order to facilitate personalized and adaptive learning experiences for formal and informal education and training.

Many existing Federal agency programs are now funding students and early-career faculty who are focused on AI education, training, and/or research (see box on the next page).

Leverage research to improve educational quality and opportunity

Interestingly, AI itself can help improve educational quality and opportunity, such as through virtual AI-based tutors that personalize educational experiences and customize learning plans to address the unique needs of each individual. Such tools are complementary to the education provided by human teachers,

Agency fellowship and service training programs funding AI training

Many existing fellowship and scholarship programs at the Federal agencies are supporting students and early career researchers in AI, including:

DARPA: Young Faculty Award

DoD: Science, Mathematics, and Research for Transformation Scholarship for Service Program; National Defense Science and Engineering Graduate Fellowship Program; DoD Historically Black Colleges/Universities and Minority-serving Institutions (HBCU/MI) Research and Education Program; United States Air Force Rome Laboratory Summer Faculty Fellowship Program; Autonomy Technology Research Center and Center for Surveillance Research Internship Program

DOE: Artificial Intelligence Summer Institute (AISI); Next Generation STEM Internship Program (NEXTGENS); Community College Internships (CCI); Science Undergraduate Laboratory Internship (SULI); Office of Science Graduate Student Research Program (SCGSR); Visiting Faculty Program (VFP); Albert Einstein Distinguished Educator Fellowship Program (AEF); Early Career Research Program; Computational Science Graduate Fellowship

NASA (National Aeronautics and Space Administration): NASA Fellowship Activity

NIH: Individual (F32) and institutional (T32) training programs; internship opportunities to bring AI experts into NIH to work alongside Federal staff; other internship programs for industry experts, researchers, and students.

NOAA: Dr. Nancy Foster Scholarship Program; Educational Partnership Program with Minority Serving Institutions; Margaret A. Davidson Graduate Fellowship; John A. Knauss Marine Policy Fellowship Program; National Marine Fisheries Service – Sea Grant Joint Fellowship Program in Population and Ecosystem Dynamics and Marine Resource Economics

NSF: Faculty Early Career Program (CAREER); Research Experiences for Undergraduates (REU) Sites; Training-based Workforce Development for Advanced Cyberinfrastructure (CI-Training); SBE Postdoctoral Research Fellowships (SPRF); Post-Doctoral Research Fellowship (MPS); Postdoctoral Research Fellowships in Biology (PRFB); Graduate Research Fellowships Program; Advanced Technological Education Program (ATE); Advancing Informal STEM Learning (AISL); CyberCorps: Scholarship for Service; Discovery Research PreK-12 (DRK-12); EHR Core Research (ECR); Historically Black Colleges and Universities Undergraduate Program (HBCU-UP); Improving Undergraduate STEM Education (IUSE); NSF Research Traineeship (NRT); Computer Science for All (CSforAll)

USDA/NIFA (National Institute of Food and Agriculture): Agriculture and Food Research Initiative (AFRI) Predoctoral Fellowships; AFRI Postdoctoral Fellowships; Food and Agricultural Sciences National Needs Graduate Fellowships; Research and Extension Experiences for Undergraduates.

with appropriate personalized training to augment and enhance outcomes of the learner. While some of these efforts are still in the research and development stage, other tools are being used in practical applications. More broadly, research that provides a deeper understanding of the impacts of AI on the future of work — such as NSF’s program [The Future of Work at the Human-Technology Frontier](#)⁵¹ — is

critically important, along with strategies that inform future educational and training programs to prepare workers for the industries of the future. These efforts will help us better understand the human-technology partnership and the emerging sociotechnological landscape, create new technologies to augment human performance, and foster lifelong and pervasive learning with technology.

Promote an International Environment Supportive of American AI Innovation

The United States must promote an international environment that supports American AI research and innovation and opens markets for American AI industries.

(Executive Order 13859, February 11, 2019)

The United States further advances its leadership in AI through strategic engagement and international vehicles that promote national economic strength and security and quality of life. The United States values collaborations with global allies on applications of AI, as well as strategies for addressing opportunities and challenges of common interest. International partners provide important perspectives and expertise that can be mutually beneficial. International engagements should foster and promote trust and adoption, advance economic growth, and promote development and innovation in the AI field.

Engage internationally to promote trustworthy AI innovation

The United States is committed to promoting an international environment that supports AI R&D, opens markets for American AI industries, and promotes the development of AI technology in a manner consistent with our Nation's values and interests. In particular, the United States supports international AI collaborations and partnerships that are grounded in evidence-based approaches, analytical research, and multistakeholder engagements that bring different perspectives together.

The United States has long been a champion and defender of the core values of freedom, guarantees of human rights, individual dignity, the rule of law, rights to privacy, respect for intellectual property, and opportunities for all to pursue their dreams. The AI technologies the Nation develops and uses must reflect these

fundamental values and be devoted to helping people. This is especially important today, given the growing use of AI by authoritarian governments to infringe on the rights of its citizens. The Federal Government will continue to work with international partners to take actions that foster public trust and confidence in AI technologies while ensuring the protection of civil liberties, privacy, and American values in their application.

Recognizing that many international organizations are pursuing overlapping initiatives in AI, the United States advocates for strategic engagement with like-minded international organizations that have established infrastructure, resources, and actionable plans for advancing AI policy activities.

The United States engages actively in many international venues on topics of relevance to AI, through fora that include G7 Innovation and

Technology Ministerials, G20 Digital Economy Ministerials, NATO, the European Union, meetings of the OECD, and other multilateral discussions. These meetings are important opportunities to identify common values and approaches for increasing trust in and adoption of AI. For example, at the 2018 G7 Innovation and Technology Ministerial, the United States and other G7 nations signed a [joint statement on AI](#)⁵² to advance these shared goals (see box below).

The United States also values bilateral agreements with allies on science and technology matters of mutual agreement. For example, in 2017 the United States signed the first-ever science and technology cooperative agreement between the United States and the United Kingdom, and in 2018 the United States and France issued a Joint Statement on science and technology cooperation. As appropriate and mutually beneficial, the United States will continue to seek out bilateral partnerships to accelerate joint activities in AI.

Federal officials also frequently participate in international meetings, conferences, symposia, and workshops to engage with multiple stakeholders on the stewardship of trustworthy AI. Through these and other venues, the United States collaborates with international partners to emphasize the importance of AI innovation for economic growth and global security, as well as taking actions for promoting trust in and adoption of AI technologies to provide new opportunities and address key challenges.

Promote and implement international principles on AI stewardship

In May 2019, the United States joined with other OECD countries to advance common AI principles as outlined in the [OECD Recommendation on AI](#)⁵³ (see box on the next page). This recommendation formalizes principles for the innovative and trustworthy development and application of AI, marking the first time that the United States and like-minded democracies have committed to common AI principles.

2018 G7 Innovation and Technology Ministerial Joint Statement on AI — Increasing Trust in and Adoption of AI

In 2018, United States Chief Technology Officer Michael Kratsios led the United States delegation to the G7 Innovation and Technology Ministerial, which resulted in a Statement on Artificial Intelligence that affirmed, in part, that:

...increasing trust in and adoption of AI are necessary ingredients for economic growth and the fuel for future innovations that can benefit society as a whole. G7 members recognize that trust and adoption can be encouraged through a robust multistakeholder approach involving: education initiatives and public awareness of the benefits of AI technologies; increasing the participation of women in the workforce; promoting safe and reliable AI applications in the marketplace; giving early considerations to impacts on citizens, including through respecting privacy as a fundamental value and respecting applicable frameworks for privacy and data protection; mechanisms to ensure the accountability of AI systems; enabling industry-led processes to promote safety and vigilance in design and implementation of AI systems; efforts to prevent the misuse of AI applications that could cause harm; initiatives, notably those led by industry, that promote guidance on human intervention in AI decision-making processes, among others.

These principles reflect many of the priorities championed by the American AI Initiative, including prioritizing long-term R&D, removing barriers to innovation and discovery, building the AI workforce, and fostering public trust. In June 2019, the G20 also adopted these principles, expanding their impact around the world.

In ongoing work with the OECD, the United States is supporting efforts to continue implementing the OECD AI Principles through the OECD AI Policy Observatory. This AI Policy Observatory aims to help countries encourage, nurture, and monitor the responsible development of trustworthy AI systems for the benefit of society by combining resources from across the OECD with those of multistakeholder partners to facilitate dialogue and provide multidisciplinary, evidence-based policy analysis on AI.

OECD Recommendations on AI — AI Principles

In May 2019, the United States joined with more than 40 other countries to endorse the [OECD AI Principles](#).⁵⁴ In brief, these principles encompass the following:

1. Principles for responsible stewardship of trustworthy AI

- 1.1. Inclusive growth, sustainable development, and well-being
- 1.2. Human-centered values and fairness
- 1.3. Transparency and explainability
- 1.4. Robustness, security, and safety
- 1.5. Accountability

2. National policies and international cooperation for trustworthy AI

- 2.1. Investing in AI research and development
- 2.2. Fostering a digital ecosystem for AI
- 2.3. Providing an enabling policy environment for AI
- 2.4. Building human capacity and preparing for labor transition
- 2.5. International cooperation

Embrace Trustworthy AI for Government Services and Missions

Artificial Intelligence will affect the missions of nearly all executive departments and agencies.
(Executive Order 13859, February 11, 2019)

The Federal Government is committed to taking full advantage of AI, when appropriate, in a manner that is consistent with the Constitution and our Nation’s values and protective of civil liberties and privacy. The Federal Government will take action to use AI to improve government services and fulfill their missions for the American people.

Leverage private sector expertise to improve government services using AI

In recent years, the private sector has demonstrated that AI can be used to improve the quality of services, assist in the creation of new products, and increase efficiency. Likewise, AI provides opportunities to help the Federal Government be more responsive, effective, and efficient for the American people.

Some Federal agencies are already leading the way by using AI to process grant applications, check Federal solicitations for regulatory compliance, improve nautical charts, process satellite imagery, perform predictive maintenance, and much more. Still, there is significant room for increased use of AI. A number of interrelated challenges must be addressed — some technical, some requiring process changes, and some involving talent and workforce issues.

To leverage the expertise of academia, industry, nonprofits, and civil society in addressing this challenge, The White House held a Summit on AI in Government in September 2019 (see box). Through discussions

2019 White House Summit on Artificial Intelligence in Government

In September 2019, The White House hosted The Summit on Artificial Intelligence in Government. The Summit brought together over 175 leaders and experts from government, industry, and academia to spark ideas for how the Federal Government can adopt AI to achieve its mission and improve services to the American people. At the Summit, attendees discussed identifying best practices in the use of AI, opportunities to foster collaborative partnerships, and ways to develop a Federal AI workforce. The Summit highlighted innovative efforts at Federal agencies that have already adopted AI and looked ahead to future transformative AI applications that will make government more effective, efficient, and responsive.

at this summit, the Federal Government sought near-term solutions for improving government services using AI. Some applications of AI are

easier and more useful for the government to implement in the near term, based on existing experience. Attention must be paid to how best to manage process changes that arise from the new capabilities that AI provides. Experience from the private sector is informing the development of appropriate strategies for building organizational trust in the adoption of AI within the Federal Government.

Accelerate government adoption through interagency collaboration

Collaboration across the Federal Government can also be fostered through a Center of Excellence (COE) model, which can serve as an important mechanism for agencies to share AI expertise and best practices. The General Services Administration (GSA) has launched an [AI COE](#)⁵⁵ to enable agencies to develop AI solutions by incorporating machine learning, computer vision, natural language processing, intelligent process design, and robotic process automation into their operations. The AI COE is providing strategic tools and infrastructure support to help agencies rapidly discover use cases, identify applicable artificial intelligence methods, and deploy scalable solutions.

Federal agencies have active efforts underway to examine their own processes, procedures, and activities to identify ways that AI can be used to better achieve the missions of agencies and improve their provision of services to the American people. For example, GSA is piloting an AI-based tool for evaluating regulatory compliance in contracting programs. Historically, regulatory compliance has been a time-consuming and challenging task because of the variability between contracting practices across agencies. An AI-based tool could automatically determine whether an agency's contract solicitation complies with Federal regulations.

In other efforts, DoD established the [Joint Artificial Intelligence Center](#) (JAIC)⁵⁶ to serve as the focal point for the execution of the DoD AI Strategy and as an AI Center of Excellence. The JAIC aims to accelerate DoD's adoption of AI through repeatability at scale, creating leveraged products, policies, people, platforms, and processes. Its products focus on a set of challenging use cases that can benefit from AI, including Joint Warfighting Operations; Warfighter Health; Predictive Maintenance; Intelligent Business Automation; Humanitarian Assistance and Disaster Relief; and Cyber Sensemaking. The intent is both to deliver new AI-enabled capabilities to DoD end users and to build a common foundation of shared data, reusable tools, frameworks, libraries, and standards that are essential for scaling the impact of AI across DoD. These efforts can also be leveraged across the non-defense Federal agencies.

DOE established the [Artificial Intelligence and Technology Office](#) (AITO)⁵⁷ to serve as a nexus for coordinating AI activities and accelerating intradepartmental and interagency collaborations. AITO is working on projects with the VA, Health and Human Services, and the JAIC to create AI solutions that address our Nation's health priorities and will enable humanitarian assistance and disaster response for wildfires and floods.

Advance Federal agency progress

As illustrated in Figure 1, Federal agencies have also been very active over the past year in implementing their own strategies and actions to advance their missions using AI. Several agencies have released their own AI and data science strategies, including the NIH [Strategic Plan for Data Science](#),⁵⁸ the [DoD AI Strategy](#),⁵⁹ and the [National Oceanic and Atmospheric Administration \(NOAA\) AI Strategy](#).⁶⁰ Agencies

are also setting up centers and offices focused on coordinating and advancing AI activities across their agency, such as DoD's JAIC, DOE's AITO, and the VA's [National AI Institute](#).⁶¹ The United States Patent and Trademark Office is engaging with the innovation community and experts in AI to consider potential guidance on patenting AI inventions, issuing a [request for comments](#)⁶² to gather information from interested stakeholders. DOT has released a series of [guidance reports for how best to integrate automated vehicles](#)⁶³ into our transportation system. These and related efforts contribute significantly to the Nation's leadership in AI and to accelerating the use of AI by the agencies for the benefit of the Nation.

Develop an AI-ready Federal workforce

Increasing the use of AI in government requires a workforce skilled in the design, development, and use of AI systems. Federal agencies are exploring appropriate approaches for hiring, training, reskilling, and retaining Federal

workers with the new skills needed to innovate through the application of AI technologies. Strategic partnerships among government, industry, and academia can accelerate the development of effective approaches to prepare the Federal workforce for the design, development, and use of AI.

Build trust in the use of AI in government

As the Federal Government increases its use of AI to improve the delivery of services to the American people, it is of paramount importance that this be done in a way that builds citizen trust. The Federal Government will develop a governance approach to its own design, development, and use of AI. Importantly, the Federal use of AI must always be done in a manner consistent with the Constitution and all applicable laws and government policies. Such development and use must show due respect for our Nation's values, including privacy, civil rights, and civil liberties.

Endnotes

Executive Summary

- ¹ <https://www.whitehouse.gov/articles/accelerating-americas-leadership-in-artificial-intelligence/>
- ² <https://www.federalregister.gov/documents/2019/02/14/2019-02544/maintaining-american-leadership-in-artificial-intelligence>
- ³ <https://www.whitehouse.gov/briefings-statements/president-trumps-fy-2021-budget-commits-double-investments-key-industries-future/>
- ⁴ <https://www.whitehouse.gov/wp-content/uploads/2019/06/National-AI-Research-and-Development-Strategic-Plan-2019-Update-June-2019.pdf>
- ⁵ <https://www.whitehouse.gov/wp-content/uploads/2019/11/AI-Research-and-Development-Progress-Report-2016-2019.pdf>
- ⁶ <https://www.whitehouse.gov/wp-content/uploads/2019/09/FY2020-NITRD-AI-RD-Budget-September-2019.pdf>
- ⁷ <https://www.federalregister.gov/documents/2019/07/10/2019-14618/identifying-priority-access-or-quality-improvements-for-federal-data-and-models-for-artificial>
- ⁸ <https://strategy.data.gov/>
- ⁹ <https://www.whitehouse.gov/wp-content/uploads/2020/01/Draft-OMB-Memo-on-Regulation-of-AI-1-7-19.pdf>
- ¹⁰ https://www.nist.gov/system/files/documents/2019/08/10/ai_standards_fedengagement_plan_9aug2019.pdf
- ¹¹ https://www.nsf.gov/news/news_summ.jsp?cntn_id=299329&org=NSF&from=news
- ¹² <http://www.oecd.org/going-digital/ai/principles/>
- ¹³ <https://coe.gsa.gov/coe/artificial-intelligence.html>

Invest in AI Research and Development

- ¹⁴ <https://www.whitehouse.gov/wp-content/uploads/2019/09/FY2020-NITRD-AI-RD-Budget-September-2019.pdf>
- ¹⁵ https://www.whitehouse.gov/wp-content/uploads/2020/02/ap_17_research_fy21.pdf, p. 233.
- ¹⁶ https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505686
- ¹⁷ <https://www.whitehouse.gov/wp-content/uploads/2019/06/National-AI-Research-and-Development-Strategic-Plan-2019-Update-June-2019.pdf>
- ¹⁸ <https://www.federalregister.gov/documents/2018/09/26/2018-20914/request-for-information-on-update-to-the-2016-national-artificial-intelligence-research-and>
- ¹⁹ <https://www.nitrd.gov/nitrdgroups/index.php?title=AI-RFI-Responses-2018>
- ²⁰ <https://www.whitehouse.gov/wp-content/uploads/2019/06/National-AI-Research-and-Development-Strategic-Plan-2019-Update-June-2019.pdf>
- ²¹ <https://www.darpa.mil/work-with-us/ai-next-campaign>
- ²² <https://www.whitehouse.gov/wp-content/uploads/2018/05/Summary-Report-of-White-House-AI-Summit.pdf?latest#page=13>
- ²³ <https://science.osti.gov/About/PCAST>
- ²⁴ <https://www.whitehouse.gov/wp-content/uploads/2019/11/AI-Research-and-Development-Progress-Report-2016-2019.pdf>

Unleash AI Resources

- ²⁵ <https://strategy.data.gov/>
- ²⁶ <https://strategy.data.gov/action-plan/>
- ²⁷ <https://www.federalregister.gov/documents/2019/07/10/2019-14618/identifying-priority-access-or-quality-improvements-for-federal-data-and-models-for-artificial>
- ²⁸ <https://cms7.fhwa.dot.gov/research/data-sets/safety-training-analysis-center/data>
- ²⁹ <https://www.whitehouse.gov/wp-content/uploads/2019/11/National-Strategic-Computing-Initiative-Update-2019.pdf>
- ³⁰ https://www.nsf.gov/awardsearch/showAward?AWD_ID=1925001
- ³¹ <https://datascience.nih.gov/strides>

Remove Barriers to AI Innovation

- 32 <https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/360956/ensuringamericanleadershipav4.pdf>
- 33 <https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/320711/preparing-future-transportation-automated-vehicle-30.pdf>
- 34 https://www.nhtsa.gov/sites/nhtsa.dot.gov/files/documents/13069a-ads2.0_090617_v9a_tag.pdf
- 35 <https://www.whitehouse.gov/presidential-actions/presidential-memorandum-secretary-transportation/>
- 36 https://www.faa.gov/regulations_policies/rulemaking/recently_published/
- 37 <https://www.fda.gov/news-events/press-announcements/fda-permits-marketing-artificial-intelligence-based-device-detect-certain-diabetes-related-eye>
- 38 <https://www.regulations.gov/document?D=FDA-2019-N-1185-0001>
- 39 <https://www.fda.gov/media/109618/download>
- 40 <https://www.federalregister.gov/documents/2020/01/13/2020-00261/request-for-comments-on-a-draft-memorandum-to-the-heads-of-executive-departments-and-agencies>
- 41 https://www.nist.gov/system/files/documents/2019/08/10/ai_standards_fedengagement_plan_9aug2019.pdf

Train an AI-Ready Workforce

- 42 <https://www.whitehouse.gov/wp-content/uploads/2017/12/NSS-Final-12-18-2017-0905-2.pdf>
- 43 <https://www.whitehouse.gov/wp-content/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf>
- 44 <https://www.dol.gov/apprenticeship/task-force.htm>
- 45 <https://www.whitehouse.gov/presidential-actions/executive-order-establishing-presidents-national-council-american-worker/>
- 46 https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505359
- 47 <https://www.whitehouse.gov/wp-content/uploads/2018/12/STEM-Education-Strategic-Plan-2018.pdf>
- 48 <https://www.dol.gov/apprenticeship/task-force.htm>
- 49 <https://www.whitehouse.gov/presidential-actions/executive-order-establishing-presidents-national-council-american-worker/>
- 50 <https://www.whitehouse.gov/pledge-to-americas-workers/>
- 51 https://nsf.gov/funding/pgm_summ.jsp?pims_id=505620&org=NSF

Promote an International Environment Supportive of American AI Innovation

- 52 <http://www.g8.utoronto.ca/employment/2018-labour-annex-b-en.html>
- 53 <https://www.oecd.org/going-digital/ai/principles/>
- 54 <https://www.oecd.org/going-digital/ai/principles/>

Embrace Trustworthy AI for Government Services and Missions

- 55 <https://coe.gsa.gov/coe/artificial-intelligence.html>
- 56 <https://www.ai.mil/>
- 57 <https://www.energy.gov/science-innovation/artificial-intelligence-and-technology-office>
- 58 <https://datascience.nih.gov/strategicplan>
- 59 <https://media.defense.gov/2019/Feb/12/2002088963/-1/-1/1/SUMMARY-OF-DOD-AI-STRATEGY.PDF>
- 60 https://nrc.noaa.gov/Portals/0/Draft%20NOAA%20AI%20Strategy_v1-6.1_11.13.2019.pdf?ver=2019-11-14-004543-583
- 61 <https://www.research.va.gov/naii/default.cfm>
- 62 <https://www.federalregister.gov/documents/2019/08/27/2019-18443/request-for-comments-on-patenting-artificial-intelligence-inventions>
- 63 <https://www.transportation.gov/sites/dot.gov/files/docs/policy-initiatives/automated-vehicles/360956/ensuringamericanleadershipav4.pdf>

Abbreviations

AI	artificial intelligence
COE	Center of Excellence
DARPA	Defense Advanced Research Projects Agency
DoD	Department of Defense
DOE	Department of Energy
DOT	Department of Transportation
FAA	Federal Aviation Administration
FDA	Food and Drug Administration
FHWA	Federal Highway Administration
FY	fiscal year
G7	Group of Seven
G20	Group of Twenty
GSA	General Services Administration
JAIC	Joint AI Center (DoD)
MLAI	Machine Learning and Artificial Intelligence (Subcommittee of the NSTC)
NASA	National Aeronautics and Space Administration
NIFA	National Institute of Food and Agriculture (USDA)
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
OECD	Organisation for Economic Cooperation and Development
OMB	Office of Management and Budget
OSTP	Office of Science and Technology Policy
PCAST	President’s Council of Advisors on Science and Technology
R&D	research and development
RFI	Request for Information
RTML	real time machine learning
STEM	science, technology, engineering, and mathematics
UAS	Unmanned Aerial (or Aircraft) System
USDA	United States Department of Agriculture
VA	Department of Veterans Affairs

Copyright Information

This document is a work of the United States Government and is in the public domain (see 17 U.S.C. §105). Subject to the stipulations below, it may be distributed and copied with acknowledgment to OSTP. Copyrights to graphics included in this document are reserved by the original copyright holders or their assignees and are used here under the Government's license and by permission. Requests to use any images must be made to the provider identified in the image credits or to OSTP if no provider is identified.

Published in the United States of America, 2020.



THE WHITE HOUSE