

**Using Artificial Intelligence and Machine Learning to Tackle Big Data**

**By**

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Information is and will always play a dominant role in how the United States' military plans and operates. "Mission success depends on the right people getting the right information at the right time to inform decisionmaking."<sup>1</sup> The Air Force's scientific and intelligence (S&T) arm, the National Air and Space Intelligence Center (NASIC), like the seventeen intelligence community (IC) partners, reviews threat data on a daily basis. This data comes from a myriad of sources, such as finished intelligence reporting from individual intelligence disciplines, directly from intelligence, surveillance, and reconnaissance sensors, or files from a cyber exfiltration event. In the end, this amounts to a tremendous amount of data that is hard for analysts to sift through and organize to do their job most effectively. Data organization is a time-consuming task and especially well-suited to computer intervention utilizing Artificial Intelligence (AI) and Machine Learning (ML) techniques capable of tirelessly combing a dataset to find information on threat systems. In this respect, the IC has fallen behind commercial companies like Google, Amazon and, Microsoft who have developed data farms with storage, raw computing power and, more importantly, human talent to build algorithms and tools to make their businesses more successful. With the amount of stored information growing "four times faster than the world economy,"<sup>2</sup> Air Force intelligence must accelerate investments in short-term AI/ML successes and institute AI/ML teams at analytic organizations or they will lose the data war.

### *AI and ML Perception versus Reality*

Before delving into any potential technical solutions, one must first understand the origins of Artificial Intelligence (AI) and its subfield Machine Learning (ML), and what they can do now versus what they could do in the future. Many people think of the rise of computing technology in the 1980s as the beginning of AI and ML, but the ideas are much older. In fact,

the ancient Greeks imagined AI in their myths with wheeled machines acting as a waitstaff serving the Gods themselves.<sup>3</sup> Since the invention of machines in the 1800s, AI has been the muse of many science fiction writers who envision sentient robots, which can think, feel, and act like a human. Not until 1956 did serious research in the field of AI begin when, at a Dartmouth conference, John McCarthy and Marvin Minsky led discussions on mathematics, game theory, and logic.<sup>4</sup> At present, we are faced with cars that can mostly drive themselves, companies with so much data they can predict what you will search for before you finish typing the first word, and systems that can perform natural language processing so well as to be indistinguishable from humans.<sup>5</sup> These are the types of AI and ML that recent Department of Defense programs seek to build, but as Dr. Roper, Chief Acquisition Officer for the Air Force, contends “you have to do a lot of work that is not the glitzy algorithms doing cool things at the edge...you have to lay in the infrastructure.”<sup>6</sup>

A trendy buzzword, people often use “Artificial Intelligence” without truly understanding its capabilities and limitations in the context of current developmental systems. As the “overarching science that is concerned with intelligent algorithms whether or not they learn from data,” AI is not simply a program run on a computer or machine, but it is also not yet capable of knowing itself and functioning in a wide array of tasks autonomously.<sup>7</sup> The best AI systems are programmed to perform a specific set of tasks, and in this the military can and does benefit greatly. These programs are so effective at replacing humans because they perform basic repetitive functions like math or pattern recognition without growing tired.<sup>8</sup> One of the many ways the Air Force is investing in AI is in autonomous pilots. In August 2020, a Defense Advanced Research Projects Agency-sponsored a project that flew an AI pilot against a human

pilot and won each of the five simulated F-16 dogfights.<sup>9</sup> However, the system is a long way off from flying a real F-16.

Machine Learning is often more misunderstood than AI because they are nearly the same, except that ML learns from data presented to it.<sup>10</sup> ML is the process of providing meticulously structured data to tailored algorithms in order to train a model to recognize patterns in different, albeit related, data. This training is called learning, which enables the computer to become smarter each time it encounters new and different data. Learning is a very manpower-intensive task for most applications of ML. For example, a computer does not inherently know what a plane is, so humans must feed it millions of images of planes and tell it that they are planes. Furthermore, using an approach like supervised learning requires a human to monitor and correct the system every time it identifies something incorrectly. As the ML improves its capability to correctly pick out a Chinese fighter from their bombers, for example, the system could be used in conjunction with a camera on a missile to identify the aircraft and continue to pursue the aircraft no matter the countermeasure.

The capabilities of AI and ML are astonishing now, and their future is limited only by the organization's imagination and manpower. Presently, there are numerous ML applications and a few AI applications that can be harnessed by the AF to affect improvements in how anyone, who relies on being able to find data, completes their mission. The focus of this research; however, will be on all-source intelligence analysts and their use of unstructured data, such as, scientific reports, journal entries, electronic books, email, pictures, audio, and video all make up approximately 90% of the data stored worldwide.<sup>11</sup>

### *Basic Problem in Data Heavy Mission Sets*

The all-source intelligence analyst pulls in data from a variety of sources within the intelligence community. When finding a valuable piece of information, they store it away in their carefully organized file structure. Over the course of several years, the analyst amasses several million files to support his threat analyses. Then, he looks for and receives a promotion in a different organization to gain experience. Since the position is part of the development program, a new person fresh from college is hired to take their place. The new analyst never met the old and after looking at the files in the shared folders, they are hopelessly lost. To further worsen the problem, the only tool at their disposal is the Windows search function, which fails to find any files of value because networked files are rarely indexed for searching through their contents. Compounding the problem is a new AI program which completes signals intelligence reporting on the threat system daily. “This abundance of data provides significant opportunities for the IC, including new avenues for collection and the potential for greater insight, but it also challenges the IC’s ability to collect, process, evaluate, and analyze such enormous volumes of data quickly enough to provide relevant and useful insight to its customers.”<sup>12</sup>

What is the analyst to do? They could spend countless hours looking through each file and organizing them to their preference. They could search the various IC websites to find the individual intelligence reporting again. Intelink is a great resource for finding some of this data hosted on external domains, yet not all data is properly searchable. How much time can this analyst allow to search for old data when they also must search for new data. As data is found, they must make the connections between the disparate sources, and how many files are missed by the search. It is therefore this problem set that AI can make a concerted difference by reducing “inefficiencies from manual, laborious, data-centric tasks ... [which] have the potential

to shift human attention to higher-level reasoning and judgment.”<sup>13</sup> To meet this goal, our analysts need three categories of applications, 1) data mining tools that identify meaning from data presented to it, 2) conversion tools for speech-to-text, language translation, and changing file types, and, 3) federated search tools that are capable of returning files sorted by relevance. Many of these capabilities exist already and some do not, but these practical applications of AI and ML are much closer to reality within data analysis than AI is to flying a fighter.

### *Discovering AI/ML Tools*

In support of this paper, an extensive amount of work went towards discovering systems that already exist to perform the basic functions mentioned. The author read many books, attempted to contact organizations directly, and searched a significant amount on multiple classified levels only to find that information from within the Department of Defense is very difficult to find. What follows therefore stems from discoveries made during a review of applications found while researching on unclassified networks. Appendix A lists the tools that were reviewed to support the information herein, although none were tested for capability to achieve the tasks described.

Industry understands the problem sets very clearly and have been working solutions for more than two decades. Data mining enabled a boom in medical analysis and stock market trading. Translation services afforded companies an effective way to globalize their businesses. Speech-to-text has more recently gained traction to improve services for the hearing impaired. Information retrieval is likely used more than any other practical application and it began with Google.<sup>14</sup>

## *Data and Text Mining*

Connecting the IC in multiple ways will enhance the usability of any service- or agency-developed AI or ML program designed to find information within the vast stores of unstructured data. The Department of Defense (DoD) understands this and has laid out a strategic approach, which “includes creating a *common foundation* of shared data, reusable tools, frameworks and standards, and cloud and edge services.”<sup>15</sup> Additionally, Lt Gen Shanahan, Director, Joint Artificial Intelligence Center, understands that “the warfighter needed the enterprise cloud yesterday” because AI at scale is not possible without it.<sup>16</sup> Specific implementations remain to be seen and it is unclear as to what type of data will be present on these cloud services. Nevertheless, there are several AI/ML tools that can be employed within organizational boundaries and through web interfaces to extract meaning from data—better known as data mining.

Text mining is a subcomponent within the data mining umbrella, and it is the key to finding information within unstructured data. The most successful text mining applications use natural language processing (NLP) to derive meaning from the text, by applying syntactics, semantics, and discourse algorithms.<sup>17</sup> In syntactics, the machine learns the relationship of the words in sentences, ensuring the machine more quickly ascertains sentence structure to speed processing. In semantics, the machine learns the correct meaning of the words presented to it, which is vital to understanding technical or jargon words not used in the common language. In discourse, the machine learns the meaning of the sentences near each other, which is important to automatic summarization enabling analysts to get a sense of what a document contains. As text mining works through a document, the server tags the files to provide some structured data as well as making it searchable. Through recursive searching within the newly tagged files, a text

mining system is capable of connecting documents that have similar themes or are about the same topic. These are just a few of the robust capabilities text mining could bring to the intelligence community.

Text mining is a crucial step towards ending the battle against information overload. Employed in the IC, text mining could connect to disparate sources from multiple agencies to make connections analysts may miss as they search for information. In our defined problem, the analyst would be able to push all of their files through the text mining service, which would sift through all the files creating structured data where possible and report back to the analyst with key themes about the files, such as, which files discuss particular target sets. Taking this a step further, an analyst could create a text mining profile with key words and topics they are interested in. Once fully connected across the IC, the text mining service can push newly released finished intelligence or uploaded data to the analyst automatically—greatly reducing time to find data and allowing more time for the analyst to complete their own finished intelligence reporting.

### *Conversion Tools*

Finding data can be hard and sometimes requires tools to change the file from one type to another to make it usable to the AI or ML program. For example, Project Maven is employing computer-vision algorithms to automatically detect systems in full motion video.<sup>18</sup> If the video contains speech, another program could be used to create the script, so that it may become a searchable product. Converting files covers a wide range of applications given the various file-types across the multitude of operating systems and applications. However, there are three key areas for automatic data manipulation, the data mining application, and thus intelligence analyst,



needs to be widely successful: 1) speech-to-text capabilities, 2) language translation, and 3) file type conversion.

Speech-to-text capabilities are everywhere these days, they are even on your phone as a standard capability of most messaging platforms. Audio and video files contain a wealth of information, but an analyst cannot spend their workdays reviewing files with unknown content. Even at up to two times playback speed, a one-hour video will take an analyst thirty minutes to watch and if there is no valuable information, then that is thirty minutes they have lost. By employing a speech-to-text ML application, text mining can be performed on the transcript to provide a relevant summary of the content or to determine if a target was discussed at any length in the conversation. Industry appreciates the benefit of providing a text version of an audio or video file. For example, YouTube developed an automatic captioning capability to make content more accessible for viewers, using ML algorithms to improve the accuracy and quality.<sup>19</sup>

One key function the military relies on machine learning for is machine language translation. The United States' military operates around the world, with key partners in many nations. Translating files from one language to another would speed partnership especially in time-critical missions. The U.S. Army has already developed a system used to communicate more effectively with indigenous populations where human translators are not always available. Since 2017, the U.S. Army has used the Machine Foreign Language Translation System (MFLTS) to enable soldiers to communicate with non-English speaking populations. The system uses ML to update its dictionaries when new words or phrases, usually of technical or jargon-type, are picked up during use.<sup>20</sup>

Files come in many thousands of formats, many requiring unique applications to open that analysts do not have on their computers. Only a few of the AI/ML tools offered file

conversion capabilities and then only for a few file types. Many of these unique software programs; however, can open the file and convert it to a known file type. For example, a server-based application could open an AutoCAD® file, which is not a part of the military's standard desktop software suite, then save it as a Portable Document Format (PDF). This will allow everyone to view the data, and, if it appears useful, the person will use the same server application to open the file in its native format. Connecting this to the whole system, the text mining application will be able to recognize text in the new file, and upon finding threat matches, could send the analyst a link to the files automatically.

### *Tools for Searching through Data*

In the problem statement above, the analyst is inundated with data—a problem many people face. Operating systems provide users a way to structure data to their liking (i.e., flat file structure, folders and files, modest tagging through filename conventions), however, this is a time intensive task and one that is most useful only to the one who created it. Consider now an organization working in a problem-centric environment, where many people across the organization will need access to the same data to conduct their job. Inevitably, analysts will duplicate the same files many times across various shared network folders to help them better remember where to find the data they need. In the case study, the analysts eventually found over 30% of the files were duplicates. If, however, the files were stored in a central location without a particular file structure, then an AI/ML application could sort through the files, make everything searchable, and perform rigorous data analytics to identify connections between data. The right type of search platform would not focus solely on key words an analyst supplied but would also

be able to help the analyst find information on a previously unknown system that has similar features as their known system.

### *Manpower Is Not Just Bodies*

Artificial Intelligence and Machine Learning tools are many, varied, and complex, and their successful implementation comes from manpower, who must work at all phases of an AI/ML program's lifecycle to meaningfully support it. An organization needs AI and ML champions who are well versed in what those systems can and cannot do with respect to the data one is trying to analyze. These personnel would operate at every level of the organization to identify data requirements, develop AI/ML solutions, and oversee AI/ML contracts for technical sufficiency and integration within current and future information technology infrastructure. One study conducted on manpower required for AI/ML implementation concluded that large companies should create an AI Center of Excellence. This organization would develop and drive the vision, build relationships across other organizations, and manage talent needed for these complex solutions.<sup>21</sup> To put this in perspective, there are only three personnel at NASIC, a 3,000-person organization, dedicated to working AI- and ML-type problems, from understanding its data to basic IT. Further, other responsibilities have pulled their focus in many directions, preventing them from effectively informing the organization on AI/ML.<sup>22</sup> This is simply not enough personnel to do any one thing meaningfully, let alone develop and manage AI and ML platforms to meet the needs of such a data-rich organization.

The Department of Defense already has an AI Center of Excellence in its Joint Artificial Intelligence Center (JAIC), but the Air Force needs to inculcate a culture of teaming to effectively engage in the development and/or deployment of AI and ML. In the *2020 DoD AI*

*Training and Education Strategy*, the JAIC called these teams AI Integrated Product Teams (AI IPT), which include a cadre of “product managers, data scientists, AI/ML engineers, IT technicians, and UI/UX designers.”<sup>23</sup> This long-term goal is too far away, and the Air Force must act quickly at its various analytic organizations to begin the process of upskilling members to meet the needs of current AI projects.

NASIC is an example of a large analytic organization, who should have a fair number of members dedicated to this AI/ML mission. Using the AI workforce archetypes found in the *2020 DoD AI Training and Education Strategy*, NASIC could build an AI quick reaction team (AI-QRT) to gather data sources and types, research available AI platforms ready to implement, use AI tools to perform analytics and solve problems. The AI-QRT would consist of the following:

- AI Driver – a senior member in the organization, ensuring AI tools and capabilities are developed and deployed per the center’s AI vision.
- Two AI Researchers – Expert in AI technology and research who can develop new AI/ML models to address the organization’s data need
- Four Data Scientists – Initially gathers data types found within the center and once systems deploy, they train the new AI/ML systems and apply AI tools to perform analytics and create use case-specific solutions
- Four Deployment Engineers – Manage integration, deployment, and operation of AI systems at enterprise scale to include troubleshooting, hardware requirements, and model interconnectedness across networks and/or organizations

NASIC’s AI-QRT would be a conduit where they would gather internal efforts and reach across the vast network of similar AI teams in other organizations to solve problems together. This

would be a necessary part of dismantling what General Shanahan called the “series of small-scale, stovepiped projects,” to save time and money when a solution already exists.<sup>24</sup>

Talent management is tough for many organizations, but it must be a key initiative for AI and ML applications to grow and become more effective. In two years, NASIC twice lost their lead for a critical ML program, both went to work for much larger companies for much more money. Nevertheless, the United States must continue to 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.<sup>25</sup> This process starts with leaders promoting the importance of AI and ML in their organizations by carving out the resources required to form this local Center of Excellence, developing partnerships with universities to offer training to all employees, and developing paths to promotions or salaries commensurate with the private sector.

### *Recommendations*

1. Build a team of AI enthusiasts at analytic organizations to engage the workforce for ideas and who can seek programs funded internally or in work externally to meet their needs.
2. Develop policy to mandate the use of AI/ML whenever possible in acquisition programs, at the very least to ensure an Analysis of Alternatives include a review of AI/ML options.
3. Implement basic AI and ML tools to show the workforce the benefit by giving quick wins. These systems could easily scale to work across the entire IC, once the IC has an interconnected infrastructure.

4. Make AI and ML programs worked by Air Force organizations visible to all. Airmen are called to be innovative and this data sharing can provide its members with ideas and new ways of solving problems.

### *Conclusion*

“Artificial intelligence will change the character of military operations...and there is much work to be done,” said the DoD’s Chief Information Officer Honorable Dana Deasy at the 2020 DoD AI Symposium and Exposition.<sup>26</sup> True AI and ML systems are still in their infancy, even though the terms have been around for decades. Developing and implementing these complex systems takes talent and costs time and money up front, but the right tools will save money over time. Once operational, the proposed systems herein could be scaled to any of the future cloud computing services and could benefit many people, not just in the Air Force, Department of Defense, or even US Government, but also industry, academic, and allied partners.

## Appendix A: Tools Reviewed

More than fifty AI/ML applications were surveyed for their feasibility to accomplish data mining, conversion, and information retrieval. Additionally, each tool was reviewed for instantiations that already work in the cloud. Finally, attaining approval to operate on a DoD information system takes a considerable amount of time, so already operating on government systems should reduce the time to deploy a new system. *Table 1* shows a listing of the most compelling commercial-off-the-shelf (COTS) applications. No demonstrations were conducted to determine the efficacy of the applications; therefore, no recommendations can be made.

Table 1: Summary of Reviewed Tools and Their Capabilities

<i>Vendor</i>	<i>Data Mining</i>	<i>Translation</i>	<i>Speech-to-Text</i>	<i>File Conversion</i>	<i>Federated Search</i>	<i>Cloud or Local</i>	<i>In Government Use</i>
<i>Alteryx</i> ( <a href="#">link</a> )	Yes	Not natively	Not natively	No	Yes	Both	
<i>AWS</i> ( <a href="#">link</a> )	Yes	Yes	Yes	Yes	Yes	Cloud	Yes
<i>Brainspace</i> ( <a href="#">link</a> )	Yes	No	No	No	Yes	Local	Yes
<i>Elastic</i> ( <a href="#">link</a> )	Yes	No	No	No	Yes	Both	Yes
<i>Google Machine Learning</i> ( <a href="#">link</a> )	Yes	Yes	Yes	Yes	Yes	Cloud	
<i>IBM Watson Studio</i> ( <a href="#">link</a> )	Yes	Yes	Yes	No	Yes	Both	
<i>Microsoft Azure</i> ( <a href="#">link</a> )	Yes	Yes	Yes	Yes	Yes	Cloud	Yes
<i>Novetta</i> ( <a href="#">link</a> )	Yes	No	No	No	Yes	Cloud	Yes
<i>RapidMiner</i> ( <a href="#">link</a> )	Yes	Not natively	No	No	Yes	Both	

<i>Vendor</i>	<i>Data Mining</i>	<i>Translation</i>	<i>Speech-to-Text</i>	<i>File Conversion</i>	<i>Federated Search</i>	<i>Cloud or Local</i>	<i>In Government Use</i>
<i>Rosette</i> ( <a href="#">link</a> )	Yes	Yes	No	Txt/csv	Yes	Both	
<i>SAP</i> ( <a href="#">link</a> )	Yes	No	No	No	Yes	Both	
<i>SAS</i> ( <a href="#">link</a> )	Yes	Not natively	Not natively	No	Yes	Both	
<i>Sonix</i> ( <a href="#">link</a> )	No	Yes	Yes	No	No	Cloud	
<i>SYSTRAN</i> ( <a href="#">link</a> )	No	Yes	No	No	No	Both	Yes
<i>US Army MFLTS</i>	No	Yes	Yes	No	No	Both	Yes



## EndNotes

<sup>1</sup> Director, National Intelligence, “2019 National Intelligence Strategy of the United States of America” (Office of the Director of National Intelligence, January 2019), 22, [https://www.dni.gov/files/ODNI/documents/National\\_Intelligence\\_Strategy\\_2019.pdf](https://www.dni.gov/files/ODNI/documents/National_Intelligence_Strategy_2019.pdf).

<sup>2</sup> Viktor Mayer-Schönberger and Kenneth Cukier, *Big Data: A Revolution That Will Transform How We Live, Work, and Think*, First Mariner Books edition (Boston: Mariner Books, Houghton Mifflin Harcourt, 2014), 9.

<sup>3</sup> Amir Husain, *The Sentient Machine: The Coming Age of Artificial Intelligence*, First hardcover edition (New York London Toronto: Scribner, 2017), 16.

<sup>4</sup> Husain, 20.

<sup>5</sup> Mayer-Schönberger and Cukier, *Big Data*, 199–200.

<sup>6</sup> Rachel S. Cohen, “Roper Argues for More Artificial Intelligence Collaboration, Funding,” *Air Force Magazine*, September 10, 2020, <https://www.airforcemag.com/roper-argues-for-more-artificial-intelligence-collaboration-funding/>.

<sup>7</sup> Husain, *The Sentient Machine*, 21.

<sup>8</sup> Paul J. Springer, *Outsourcing War to Machines: The Military Robotics Revolution* (Santa Barbara, CA: Praeger Security International, 2018), 10.

<sup>9</sup> “Artificial Intelligence Easily Beats Human Fighter Pilot in DARPA Trial,” *Air Force Magazine* (blog), August 20, 2020, <https://www.airforcemag.com/artificial-intelligence-easily-beats-human-fighter-pilot-in-darpa-trial/>.

<sup>10</sup> Husain, *The Sentient Machine*, 21.

<sup>11</sup> Bernard Marr, “What Is Unstructured Data And Why Is It So Important To Businesses? An Easy Explanation For Anyone,” *Forbes*, accessed October 31, 2020, <https://www.forbes.com/sites/bernardmarr/2019/10/16/what-is-unstructured-data-and-why-is-it-so-important-to-businesses-an-easy-explanation-for-anyone/>.

<sup>12</sup> Director, National Intelligence, “2019 National Intelligence Strategy,” 5.

<sup>13</sup> Department of Defense, “Summary of the 2018 Department of Defense Artificial Intelligence Strategy: Harnessing AI to Advance Our Security and Prosperity,” 6, accessed September 27, 2020, <https://media.defense.gov/2019/Feb/12/2002088963/-1/-1/1/SUMMARY-OF-DOD-AI-STRATEGY.PDF>.

<sup>14</sup> Mayer-Schönberger and Cukier, *Big Data*.

<sup>15</sup> Department of Defense, “Summary of the 2018 DoD AI Strategy,” 6.

<sup>16</sup> Terri Moon Cronk, “DOD Cloud Has Leading Uses For Warfighter, Officials Say,” U.S. DEPARTMENT OF DEFENSE, August 10, 2019,

<https://www.defense.gov/Explore/News/Article/Article/1931289/dod-cloud-has-leading-uses-for-warfighter-officials-say/>.

<sup>17</sup> Tejenderkaur Harlalsingh Sandhu and Abhijit Itkikar, “Machine Learning and Natural Language Processing – a Review,” March 2018, 582–84, <https://doi.org/10.26483/ijarcs.v9i2.5799>.

<sup>18</sup> Robert O. Work, “Project Maven DSD Memo 20170425.Pdf,” April 26, 2017, <https://dodcio.defense.gov/Portals/0/Documents/Project%20Maven%20DSD%20Memo%2020170425.pdf>.

<sup>19</sup> “Use Automatic Captioning - YouTube Help,” accessed September 28, 2020, <https://support.google.com/youtube/answer/6373554?hl=en>.

<sup>20</sup> Michael Doney, “Army Language Translation System Assists Soldiers’ Readiness,” [www.army.mil](http://www.army.mil), June 5, 2017, [https://www.army.mil/article/188830/army\\_language\\_translation\\_system\\_assists\\_soldiers\\_readiness](https://www.army.mil/article/188830/army_language_translation_system_assists_soldiers_readiness).

<sup>21</sup> Thomas H. Davenport and Shivaji Dasgupta, “How to Set Up an AI Center of Excellence,” *Harvard Business Review*, January 16, 2019, <https://hbr.org/2019/01/how-to-set-up-an-ai-center-of-excellence>.

<sup>22</sup> major, NASIC Chief Data Officer, September 28, 2020.

<sup>23</sup> DoD Chief Information Officer, “2020 Department of Defense Artificial Intelligence Education Strategy” (Department of Defense, September 2020), 2, 5, [https://www.ai.mil/docs/2020\\_DoD\\_AI\\_Training\\_and\\_Education\\_Strategy\\_and\\_Infographic\\_10\\_27\\_20.pdf](https://www.ai.mil/docs/2020_DoD_AI_Training_and_Education_Strategy_and_Infographic_10_27_20.pdf).

<sup>24</sup> Terri Moon Cronk, “DOD Cloud Has Leading Uses For Warfighter, Officials Say.”

<sup>25</sup> “Artificial Intelligence for the American People,” The White House, accessed September 27, 2020, <https://www.whitehouse.gov/ai/executive-order-ai/>.

<sup>26</sup> “DOD CIO Remarks at DOD Artificial Intelligence Symposium and Exposition,” <https://www.defense.gov/Newsroom/Speeches/Speech/Article/2342193/dod-cio-remarks-at-dod-artificial-intelligence-symposium-and-exposition/>.