

Executive Summary:

- Establish a DoD center for studying artificial intelligence (AI) and machine learning (ML) and building expertise and capacity in these areas across the Department
- Harness the capabilities of AI and ML to ensure technological superiority the way DoD did with nuclear weapons in the 1940s and with precision-guided weapons and stealth technology afterward
- Expand exchange programs and collaboration with industry and academic experts in this field

Full Recommendation 5:

Proposal: Establish a DoD center for studying artificial intelligence and machine learning and building expertise and capacity in these areas across the department. Like the institutions established in the past to ensure the DoD's technological advantage in nuclear weapons, DoD now needs a centralized, focused, well-resourced organization to propel applied research in artificial intelligence (AI) and machine learning (ML). This center should coordinate research in these areas across the Department, and liaise with other labs in the private sector and universities, and should also conduct educational efforts to inform the Department about the implications of these advances for the Defense enterprise.

Comment: Across the broad landscape of information science and technology, two particular disciplines are maturing so rapidly that they will present transformational capabilities to the DoD: *artificial intelligence*, the capability for computational systems to execute tasks that are historically thought to require human methods, systems, and capabilities of reasoning; and *machine learning*, the capability for a computer system to grow its knowledge base without explicit pedagogical programming, and thereby extract information from large collections of data. After long periods of gestation, particularly for AI, and enabled by vast increases in computational capability, these two technologies are reshaping nearly every aspect of knowledge work in the private sector, from search to autonomous vehicles to pattern recognition for security applications.

The impact of AI and ML will be felt in every corner of the Department's operations, from critical tactical operations such as Intelligence, Surveillance, and Reconnaissance (ISR), targeting, cyber defense and autonomous land, air and sea vehicles; support operations such as personnel billeting, training, logistics, and threat analysis and war-gaming. These opportunities will be so ubiquitous and the adversary threat will be so competitive that it is critical the Department create and defend the asymmetric capability. Without exaggeration, the Board likens this situation to that which existed in the first (nuclear weapons) and second (precision munitions and stealth) offsets. Indeed, both AI and ML are key components of the Department's Third Offset thinking.

Against this backdrop, the Department should establish a DoD-wide center specifically dedicated to AI and ML. Such a construct should comprise research, experimentation, deployment, connection to global external private sector and academic expertise, and competitive threat analysis. Success will depend on having the necessary acquisition and retention tools to ensure the center is staffed by or has access to the highest quality scientific and technical expertise in these two fields. One model to consider are the dedicated nuclear weapons laboratories of the National Nuclear Security Administration (NNSA), but the Board does not suggest

that centralized “brick and mortar” centers are the only option. Many of the most significant advances in commercializing and applying AI and ML research are occurring in open source collaboration forums and virtual research networks.

DoD possesses data sets that no other university or company can access, and which would be immensely valuable, either commercially or intellectually. The center should grant access to DoD data strategically, in ways that further collaborative partnerships with external researchers. Provided the data can be secured appropriately and intellectual property rights respected, mutual beneficial arrangements could lead to significant advancement for all parties.

Based on interviews with AI and ML experts within DoD and the federal government, and academics, technologists, and researchers outside the government, the Board recommends that the Department consider the following functions for the center:

- Consolidate the management and enhance the visibility of DoD’s existing innovative and collaborative work on AI and ML. Focus on exploratory research by overseeing challenges and prizes, and strengthening DoD’s existing exchange programs and connections with the private sector and academia.
- Develop a robust, rapid prototyping and experimentation function for making AI and ML technologies more applicable to the users. The Services should take leading roles in this endeavor, with the center serving as a relationship broker and facilitator to DoD labs, academia, and the private sector. The center would act as a “nerve center” that would funnel projects to the Services to deploy technologies to the field more quickly.
- Enmesh itself in a larger segment of the acquisition process to ensure that warfighters not only receive prototypes of new capabilities, but also continue to receive upgraded versions of them. This would require the use of some alternative acquisition mechanisms in Recommendation 6 allowing new technologies to reach service members on a large scale, but not as slowly as the usual procurement process demands. The success of this approach will depend on a more robust integration with the associated training, maintenance, budget, and doctrine required to sustain a speedy capability delivery process at scale.

Background: AI and ML are fundamental components of growth for nearly every major company across a wide range of sectors, yet this field is still nascent in many ways, paving the way for new research institutions or initiatives outside the federal government. The Association for the Advancement of Artificial Intelligence, the Allen Institute for Artificial Intelligence, the Machine Intelligence Research Institute, and the Fairness, Accountability, and Transparency in Machine Learning program are just a few examples, some of which are sponsored by Fortune 500 technology companies.

Leaders in the technology and other sectors recognize that AI and ML will have a transformative impact on society, creating new jobs and upending traditional industries. These leaders also know that this technology can be used with malicious intent. A significant segment of the public views AI and ML as enablers of “killer robots” that DoD and others might deploy. DoD leaders acknowledge the theoretical risk of these scenarios, the broader societal implications of advances in AI, and the legal and ethical implications of this emerging technology. If DoD is to grasp a fuller

picture of this field, it is worth examining what the private and non-profit sectors are doing:

- OpenAI is a non-profit research company founded by Tesla's Elon Musk and others to showcase and research AI that benefits society rather than harms it. The company works with research institutions and individuals in an open-source environment, making its patents and research available to the public.
- In 2016, Amazon, Facebook, Google, IBM, and Microsoft launched the Partnership on Artificial Intelligence to Benefit People and Society, which aims to advance public understanding of AI and ML and develop best practices around the challenges and opportunities in the field.

The potential for transformative change from AI and ML – as well as misunderstanding its implications and applications in the military or other sectors – cannot be overstated, and DoD would do well to invest further in this field and collaborate where possible with outside expert researchers.