

Empowering U.S. National Security with *Artificial Intelligence Capabilities*

by **Shannon L. Gorman**

If we fail to adapt... at the speed of relevance, then our military forces... will lose the very technical and tactical advantages we've enjoyed since World War II.

— **Secretary of Defense James N. Mattis**
National Defense Magazine
"Mattis: More Engagement Needed with Industry, Allies"
by *Vivienne Machi*

The National Geospatial-Intelligence Agency (NGA) is the principal Department of Defense (DoD) intelligence agency that possesses and processes “Geospatial” information. The agency is aggressively pursuing innovative solutions regarding artificial intelligence (AI)-based enhanced capabilities, automation, and human-machine teaming augmentation. The NGA will use these advancements to “automate routine [geospatial intelligence] tasks and corporate business processes and invest in technology-transfer opportunities from commercial or nontraditional sources as appropriate.”¹

The NGA has the proper organizational cultural vision, goals, and mindset, to pursue creative public-private sector partnerships in innovation while adapting to change in an ever increasingly abstruse and technological world. The DoD sister-service components can emulate NGA’s model and further their advanced-based initiatives by contributing data and using the agency’s epistemological organization to remain viable. In a time, where there is significant peer rivalry across the competitive continuum of technological advancement from China and Russia that is challenging the United States National Security interests, there needs an adequate model and framework for governmental entities to use AI-based technological advancements to empower senior policy-makers and the warfighter in sound timely decision-making.

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NGA Using Advanced Methods to Meet National Security Interest in 2030

According to the *National Security Strategy 2017* and the *National Defense Strategy 2018*, the national security interests, competitive advantage, and prosperity are to ensure the nation's power projection continues to propagate in the decades to come in an oppositional, competitive volatile operational environment from peer and near-peer adversaries. *National Defense Strategy* highlights are:

- Defend the homeland from attack;
- Sustain Joint Force military advantages, both globally and in key regions;
- Deter adversaries from aggression against our vital interests;
- Enable U.S. interagency counterparts to advance U.S. influence and interests;
- Maintain favorable regional balances of power in the Indo-Pacific, Europe, the Middle East, and the Western Hemisphere;
- Defend allies from military aggression and bolstering partners against coercion, and equitably sharing responsibilities for the common defense;
- Dissuade, prevent, or deter state adversaries and non-state actors from acquiring, proliferating, or using weapons of mass destruction;
- Prevent terrorists from directing or supporting external operations against the United States homeland and our citizens, allies, and partners overseas;
- Ensure common domains remain open and free;
- Continuously deliver performance with

affordability and speed as we change Departmental mindset, culture, and management systems; and

- Establish an unmatched twenty-first century National Security Innovation Base that effectively supports Department operations and sustains security and solvency.²

Revolutions in military affairs is described as “the assembly of a complex mix of tactical, organizational, doctrinal, and technological innovations in order to implement a new conceptual approach to warfare or to a specialized sub-branch of warfare.”³ The proper integration and synchronizing of advanced technology can promote the achievement of national interests of the United States, whether the world is currently in Revolutions in military affairs in the twenty-first-century warfare.

In order to achieve the strategic, operational, and tactical objectives based on national interests, the intelligence community needs to work more coherently and intelligently with our allied and multinational partners to achieve and maintain superiority in a multi-domain environment, such as the electromagnetic spectrum, information, air, land, sea, space, and cyberspace domains. Further, we need to look at the unclear concurrent battlefield from a multi-dimensional perspective. To achieve the nation's interests, we need to employ all capabilities available to project our influence and national power on our adversaries in the next decade.

The National Geospatial-Intelligence Agency is one of seventeen intelligence components across the intelligence community. The NGA “delivers world-class geospatial intelligence (GEOINT) that provides a decisive advantage to policy-makers, warfighters, intelligence professionals, and first responders. NGA is the lead federal agency for GEOINT and manages a global consortium of more than 400 commercial and government relationships.”⁴

The NGA's expertise of geospatial

intelligence known as “GEOINT is the exploitation and analysis of imagery and geospatial information to describe, assess and visually depict physical features and geographically referenced activities on the Earth. GEOINT consists of imagery, imagery intelligence and geospatial information.”⁵

The NGA’s Strategy 2025 describes the agency’s overall mission is to “provide GEOINT for our nation’s security.” The agency is able to complete its mission and remain viable by being committed to areas of data integration and relentless innovation.⁶

Assisting its customers across the full spectrum in the range of military operations, as well as providing senior policy-makers with pertinent information, GEOINT brings significant attributions in time and space. NGA employs the full force of GEOINT capabilities through working with government and allied partners, industry, and academia. The nation can achieve its objectives by establishing opportunities across the strategic, operational, and tactical application levels that provide actionable intelligence to leadership, which allow them to make informed, sound decisions at every level of the decision-making spectrum and increasingly rapid response.

Due to emerging technologies and threats by our various adversaries, the nation must adapt and adjust accordingly. Adversaries at all levels have developed sophistication in various realms, such as, in the electromagnetic spectrum and cyberspace realm, firepower and range capacities, accuracy and precision progress, and informational warfare headways, to name a few. To respond accordingly, the national interests must adapt and adjust by providing information to our customers in a more timely fashion. So how does the nation move from the current operating demands to future operating demands to deter or defeat the enemy? The focus should be on the element of time. Time is the element in which we can best defeat our enemy in the

various competitive domains during any future engagements. That is, providing customers with sound data and information, to be used at the appropriate level to allow customers to execute their mission requirements successfully.

National Technical Means and commercial platforms provide data and information to customers at the senior military and policy-makers level to assist in formulating a national strategy. Likewise, various information is provided to the elements at the tactical level which support their level of operations. The NGA will need to provide the customer, who works in a time-constrained, ambiguous and chaotic environment, with timely data and information. Further, in order for the customer to maintain a position of relative and decisive advantage, both

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senior leaders and the warfighter must maneuver significantly quicker (speed of decision-making, the speed of action, operational tempo and momentum, the agility of action, quality and competency of an interdependent joint force) than the adversary. How will the nation accomplish this? This task can be accomplished by the proper incorporation of robust automation and AI-enabled capability integrated into the daily practices of the GEOINT processes.

The DoD has established the Joint Artificial Intelligence Center. The purpose being the “overarching goal of accelerating the delivery of AI-enabled capabilities, scaling the Department-wide impact of AI, and synchronizing DoD AI activities to expand Joint Force advantages.”⁷ Overall, the purpose of this agency inaugurates new collaboration across the Joint DoD Community and ensures proper “execution in

AI that includes the tools, shared data, reusable technologies, processes, and expertise to enable rapid delivery and Department-wide scaling of AI-enabled capabilities.”⁸

To meet DoD advanced-enabled capability needs, NGA’s commercial components established a focus on “emphasizing innovation in the face of a rapidly advancing technological landscape. The strategy focuses on partnerships, information assurance and the integration of commercial GEOINT with automation and artificial intelligence.”⁹ The key to the strategy is the assimilation of partnerships interrelated in governmental and non-governmental areas, as well as, ensuring the quality and accuracy of information provided by the entities. The established of these areas will safeguard the guarantee that “strategy meets the advancing operating environment and reflects the priority of sustaining American leadership through research, technology, and innovation outlined in the National Security Strategy.”¹⁰

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Consequently, it is imperative NGA’s calculus ensures the future of incorporating the vitality of AI-enhanced initiatives that will improve customer success, in addition to maintaining the customer’s strategic and tactical competitive advantage in a multi-domain fluid environment. However, the amount of data that will be available for the NGA team to analyze will be insurmountable. According to the previous director of the NGA, “6 million imagery analysts [are needed] to keep up with that kind of [data] flow” from both classified government satellites and unclassified commercial satellite systems.¹¹

It is imperative to appreciate the problematic context and related issues concerning big data.

“Today’s worldwide geospatial data production is measured in exabytes—a single exabyte equals one million terabytes. For context, digitizing every book within the Library of Congress would produce about 10 terabytes. The sheer volume of geospatial data—much of it relevant to NGA’s national security mission—highlights how large a big data problem it poses.”¹² The amount of GEOINT data an intelligence agency would work with would be voluminous. To deal with this problem-set, NGA has initiatives that establish offices and hire the best and brightest talent in the Silicon Valley area to assist the agency with the issue.¹³

There is still the element of deception that the NGA will need to prepare for by letting the AI systems conduct analytics of imagery for the agency. Case in point, according to Valerie Browning, Director of the Defense Sciences Office at the Defense Advanced Research Projects Agency (DARPA), “It’s important that we understand the limitations of where AI is today,” she said on a panel discussing the relationship between technology and human analysis. “There are numerous examples of where the current state of the technology can be very easily fooled and unfortunately, we don’t really quite understand the mechanisms. We have some hints.”¹⁴

This article will focus on United States DoD initiatives, with an in-depth focus on the NGA’s AI-enhanced capabilities and initiatives, as well as, the *NGA Strategy 2025*. Additionally, the article will compare and analyze China’s aggressive approach to be the world leader in AI by 2030, investigate leaders in the AI industry (such as Google’s DeepMind AI Alpha variants initiative), and look at the implications of using AI enhancements and the ethical considerations involved. The primary purpose of this examination is to explore the research question: should the various governmental agencies and DoD sister-service components, which lag in AI innovation and adaptation, profitably use the

NGA's AI-initiatives as a lead model, partner with NGA in AI development, and contribute their data to unified AI efforts using the Agency's epistemological and organizational advantages to assist them to remain apace?

Artificial Intelligence-based Capabilities

There are many differentiating opinions of what is AI. Corporations are pushing smart-enabled devices such as Apple HomePod, Apple Siri, Google Home, Amazon Alexa, and the Amazon Echo as AI-advanced devices. However, for the context of this article, the author will use the Intelligence Community's definition of AI.

According to the Office of the Director of National Intelligence's Augmenting Intelligence Using Machines Initiative, which is the Intelligence Community's strategic focus for the augmentation of intelligence using machines. The community's definition of AI is:

“the branch of computer science focused on programming machines to perform tasks that replicate or augment aspects of human cognition,” a term coined in the 1950s. At that time, scientists began to harness nascent computer capabilities to perform advanced information manipulations much more rapidly. In particular, it was realized that computers could be used not only to perform calculations on numbers, but also to perform inference on other types of information such as symbols, data, and text. This popularized the idea of a “thinking machine” that could, if filled with all the right knowledge and rules for access and retrieval, simulate a human response.¹⁵

The examination of the author's research pertains predominantly on AI-based capabilities, machine learning, and human-machine augmentation teaming. The Office of the Director of National Intelligence and the Intelligence Community include “Technologies and research areas generally considered to be sub-domains to

AI,” such as automated planning and scheduling, computer vision, decision support, predictive analytics and analytic discovery, distributed AI/agent-based systems, human language technologies, identity intelligence, machine learning, process modeling, as well as robotics/autonomous systems.¹⁶ The future success of ensuring the U.S. maintains its overmatch in the competitive and conflict continuums, as well to promote the National Security Strategy interests, is to adequately and succinctly incorporate these advanced-based technologies appropriately across the governmental spectrum.

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The National Geospatial-Intelligence Agency to Harness Data-Centric Technology

Various components of the private sector and government agencies at all levels are enthusiastic about the prospects of using AI-based enhancements, as well as other closely related technological advancements. Advances of these technologies in the private sector are proliferating, and will eventually affect society, military, and the government at various levels. Major Christopher Telley's item in the Land Warfare Paper, titled “The Influence Machine: Automated Information Operations as a Strategic Defeat Mechanism,” highlights an established AI expert, Andrew Ng, who explains “[j]ust as electricity transformed almost everything 100 years ago, today I actually have a hard time thinking of an industry that I don't think AI will transform in the next several years.”¹⁷ Leaders within the intelligence community are implementing many bold initiatives about their agency.

The National Geospatial-Intelligence Agency Director Richard Cardillo would like to use machine learning to more effectively and

efficiently analyze the vast increase amount of imagery data to enable the NGA analysts to accomplish more pertinent advanced geospatial-intelligence analytics. That is “Instead of analysts staring at millions of images of coastlines and beachfronts, computers could digitally pore over images, calculating baselines for elevation and other features of the landscape.” The NGA’s automation and AI-enhanced initiatives have greater determination and expectations for the agency to achieve “NGA’s goal, which is to establish a ‘pattern of life’ for the surfaces of the Earth and be able to detect when patterns change, rather than looking for specific people or objects.”¹⁸

The NGA leadership has the mindset that

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the use and integration of human and machine interaction will propel innovation. The agency is establishing public-private sector relationships with companies, including Concurrent Technologies Corporation, HRL Laboratories, Raytheon, and Soar Technology, Inc., which are focusing on the initiative of AI-enhancements and automation.¹⁹ A senior analyst at the agency indicated, “This research provides NGA with great opportunities to explore how humans and machines can team together to sift, sort, and process in a data rich environment.”²⁰

Each of the aforementioned four public-private partnered companies will specialize in a specific area regarding automation and AI. The various areas of research are:

1. Advance an interdependent human-machine network concept designed to enable task automation and management;
2. Will identify correlations between analysts’ interactions and automatically share relevant data across like-user groups;
3. Autonomously provide workflow recommendations and suggested courses of action to help analysts become aware of unconscious bias when making key judgments; and finally,
4. Provide automated mining of streamed data to alert analysts to anomalous activity that could be of interest.²¹

These initiatives are part of a broader three-year enterprise established in 2016 by NGA. The boarder initiative by NGA established a working relationship, with both academia and the private sector, to provide feedback by gauging the impact of the value of its products and services to NGA’s various customers. NGA’s campaign is named the Boosting Innovative GEOINT Broad Agency Announcement. The three main areas of the Boosting Innovative GEOINT Broad Agency Announcement deal with optimizing “value” for the customer, AI-enhancements, and automation, and lastly “Area 3 is classified and titled ‘Synthetic Aperture Radar Image Formation.’”²²

The NGA has a public-private partnership contract with Commonwealth Computer Research, Inc., which used “machine learning and neural networks to identify GEOINT user communities and characteristics of GEOINT data that contribute most to the success of each user community.”²³ The objective is to determine what is of importance and value to those that use the NGA’s services and assist customer’s knowledge gaps to “steer users to specific GEOINT data that has the highest likelihood of providing value to the user.”²⁴

The NGA is seeking additional and more robust collaboration in the arenas of data to further its successes with the aforementioned initiatives.²⁵ Essentially, many agencies and private sector companies understand that

future success will come down to a proper understanding of the volume and propagation of data. The data will need to be characterized in a coherent and structured framework in which the analytical system, whether autonomous or AI-enhanced, can process, comprehend, and exploit for accurate and precise useable analysis. The NGA additionally solicits ideas from areas of academia and the private sector for its Boosting Innovative GEOINT Broad Agency Announcement Topic Area 10, Amendment 10, regarding Structured Observation Management Automation, which is a focus area of data structure.²⁶

The superior flexibility and enhanced innovations of the free market enterprise and academia, allows NGA to use their creative capacities to ensure foundation GEOINT data is adequately characterized and structured in an understandable format. In September 2018, NGA awarded seven new contracts regarding foundation GEOINT data and advanced geospatial analytics.²⁷

The NGA is focusing on enhancing and bolstering the agency's data, information, analytics, products, and its services by establishing various areas of research on the "Characterization of Geospatial Data," by using contracted academia and private sector machine learning, deep learning capabilities, structured spatiotemporal inference, and automation incorporation. A portion of seven contracts components deal with the following areas to improve foundation GEOINT data:

1. "panchromatic electro-optical imagery for land use characterization and agricultural crop assessment" to bolster NGA's crop analytics;
2. Processing of spectral datasets into an understandable categorized structure and into a big-data database by using machine learning;

3. Site activity monitoring large temporal spans and methods that identify temporal variations, trends and spatial correlation; and finally,
4. Provide automated geospatial product generation including, "images and point clouds collected using any sensor," and the "discovery and classification of foundation data," thereby improvements of geolocation accuracy, as well as validation of terrain surface models.²⁸

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These advanced initiatives are using cooperation and collaboration between NGA, the private sector and, academia, in hopes that the initiative will bolster the NGA's foundation GEOINT data in a more accurate and timely manner; as well as, "measuring the value of GEOINT content delivered to diverse customers in a cloud environment."²⁹

Case in point, an October 2018 NGA press release announced the "Release 7" of the ArcticDEM Project, a collaborative effort of NGA, the private sector, and academia to develop 3-D digital elevation models of the Arctic with a resolution of 2-meters. The 2-meter resolution is five times the original release.³⁰ This is a powerful example of the productivity and capability of incorporating three enterprises of public-private-academic sector partnerships.

The NGA continuously announces various welcoming White Papers for its Boosting Innovative GEOINT efforts.³¹ The agency is seeking ideas for Boosting Innovative GEOINT Broad Agency Announcement Topic Area 1 pertaining to "value." NGA continues to seek

the positive impact regarding how working and partnering with the private sector and academia can propel the agency's utility. Not only in production but actual worth of value to the agency's various customers. Further, the agency is promoting and encouraging "White Papers from collaborations of entities (industry and industry, industry and university, university and university, etc.) because research in multidisciplinary Topic Areas may require forming teams with strengths in multiple science and engineering fields."³²

The NGA leadership's ultimate goal and vision is to simplify the time that it takes the NGA analysts to do repetitive responsibilities.

The NGA's robust initiatives are providing opportunities and challenges for the agency with regards to what analysts are asked to do and the ever-increasing amounts of data impacting NGA. Former NGA Director Cardillo's perspective, AI and automation will only empower the analyst and not replace them, which various analysts had raised concerns about.³³ However, these new methodologies will allow the NGA's analysts to do even more advanced analytical work. Cardillo explained, "automation 'isn't to get rid of you—it's there to elevate you.... It's about giving you a higher-level role to do the harder things.'"³⁴ The NGA leadership's ultimate goal and vision is to simplify the time that it takes the NGA analysts to do repetitive responsibilities. Thus, the push is to enhance practitioners to be unencumbered to complete advanced projects, as well as analytics such as pattern of life and activity-based intelligence examination, which require much more multifariousness.

Activity-based Intelligence is an intelligence discipline that emerged during the Iraq and Afghanistan campaigns against insurgents and

terrorist. Unlike the military footprint signatures, insurgents and terrorists have a different smaller signature. Their signatures would include computer and cell phone footprint data. Further, activity-based intelligence expert Gregory F. Treverton explains, "[activity-based intelligence] disrupts that linear collection, exploitation, dissemination cycle of intelligence. It is focused on combining data—any data—where it is found."³⁵ The important aspects of activity-based intelligence analysis will be the NGA using the components of automation, algorithms, and AI-advancements simultaneously that will use more significant quantities of data to assist in fostering faster, as well as more accurate and precise practitioner analytics.

Next, the vast amount of data will present NGA with great opportunities and challenges. Data will be produced from various platforms and algorithms, ranging from commercial smallsats to the utilization of machine learning. This will be accomplished by establishing a standard or baseline from which algorithms can automatically analyze the substantial increase of imagery instead of analysts continuing with mundane exploitation. Ultimately, the utilization of these advances of AI-enhanced capabilities will assist NGA's goals to "establish a 'pattern of life' for the surfaces of the Earth to be able to detect when [the] pattern changes, rather than looking for specific people or objects."³⁶

Consequently, the empowerment of AI capabilities and technological advances will assist decision-makers across the strategic, operational, and tactical spectrum. Sound timely decisions can be fostered with more exactitude. By harnessing AI-advancements, machine learning, deep learning, automation, and human-machine collaboration, the "NGA will evolve GEOINT from providing authoritative observations of recent activities to delivering models and modeling capabilities that satisfy customer needs, such as strategic warning, mission forecasting, and humanitarian

preparations.”³⁷ Further, these technological capabilities will assist the NGA practitioners to recognize, prepare, and organize for pattern shifts regarding human migration, humanitarian concerns, and environmental complications, catastrophic weather crises such as tornadoes, hurricanes, floods, mudslides, and wildfires.

Artificial Intelligence Global Initiatives

Looking at AI-enhancements from a macro global perspective, nations have understood the significance to pursue research and development in this arena of advancements. China has taken the lead and to date has dominated the race of AI advancements, with the United States a distant second place.³⁸ There are significant factors that explain why China is leading.

First, in 2017, China’s President, Xi Jinping, conveyed the nation’s strategic establishment of their desire to be the technological dominant rising power in the world, when China communicated its nation’s New Generation AI Development Plan.³⁹ China’s national strategic goals include a desire to be a global “science and technology superpower” by 2030. These areas include aerospace, fifth generation wireless technological advancements, offensive and defensive cyber technology, and quantum information sciences (e.g., quantum communications and quantum computing), emergent technologies such as nanotechnology and biotechnology, and leveraging AI, the internet, and big data. Jinping’s regime’s desire is to be the premier world leader in AI by 2030 by investing and supporting research and development of next-generation AI advanced technologies, such as “brain-inspired neural network architectures and quantum-accelerated machine learning.” China further realizes “that innovation is a critical determinant of national power and competitiveness.”⁴⁰

Second, expansions in AI-based enhancements are happening at such a rapid

rate, nations struggle with the “ability to structure governance and growth frameworks around” various industries.⁴¹ The reason for success in peer-to-peer competition in AI dominance and growth has to do with factors such as innovation cycles and national level structural improvements, according to a Boston Consulting Group study titled “Mind the (AI) Gap: Leadership Makes the Difference.” Chinese success is due to a shorter innovation cycle than their near-peers. Next, the Boston Consulting Group found that the national level involvement plays a significant role for growth in AI, by investing in “data infrastructure, in research hubs and networks, and higher education for IT and data-related fields.”⁴²

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So why is China dominating compared to its various near-peer competitor’s regarding AI-enhanced competition? The Boston Consulting Group study highlights three areas for China’s success in the AI race for success.

First, the study found that of seven countries, including 2700 managers, a very high percentage of the companies in China are active participants (AI piloting or AI adopting) in the field of AI, compared to the other six countries, surveyed in Boston Consulting Group’s December 2018 study. China’s overall participants totaled a significant 85 percent, whereas the U.S. totaled 51 percent, and France and Germany were next at 49 percent. The survey explains that China’s domination in this area is due to the national strategic plan introduced in 2017, which empowered Chinese companies to “adopt AI into some existing processes” or assists companies to generate “pilot initiatives.”⁴³

The second significant takeaway of the Boston Consulting Group study is that China's 2017 New Generation Artificial Intelligence Development Plan empowered and impacted Chinese managers approach regarding AI-based innovation. Consequently, Chinese initiatives are across and dominate all industries, whereas, the United States and the other countries are strong in "one or two particular industries."⁴⁴

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Lastly, the Boston Consulting Group study indicates that there are four significant factors that empower AI success pertaining to adaption and piloting initiatives. Success in adaption and piloting initiatives are dependent on technical infrastructure, available skills, execution of speed and responsiveness, as well as support from upper management. According to this study, the U.S. has an edge regarding its start-up companies due to the "small engineering and R & D teams comprised of highly skilled and talented technical professionals and can move much faster than their larger competitors." Thus, the United States' success is in the start-up of companies that have "tax incentives in new technologies," investments in AI activity in the digital realm, which business participants are conveying a 90 percent success rate.⁴⁵

National Security, Ethics, and Big Tech Ties to State-Controlled Authoritarian Regimes

It is apparent that the national strategic strategy regarding China's 2017 New Generation Artificial Intelligence Development Plan, has been considerably successful and it has taken the Western world by surprise. According to the *National Defense Strategy 2018*, "The central

challenge to U.S. prosperity and security is the reemergence of long-term, strategic competition by what the National Security Strategy classifies as revisionist powers. It is increasingly clear that China and Russia want to shape a world consistent with their authoritarian model—gaining veto authority over other nations' economic, diplomatic, and security decisions."⁴⁶ Further, the *National Defense Strategy* goes on to convey that China uses "predatory economics to coerce" other countries nearby in the Indo-Pacific region and seeks "regional hegemony in the near-term and displacement of the United States to achieve global preeminence in the future."⁴⁷ However, China's strategic and military ambition is not limiting it to its Indo-Pacific region, but it is aggressively pursuing its AI initiatives in other global geographical areas as well.

Case in point, in March of 2018, the Chinese state-controlled artificial-intelligence company, CloudWalk Technology, entered into a deal with the Republic of Zimbabwe's government.⁴⁸ The Republic of Zimbabwe has approximately sixteen million people and has been an unstable nation. For example, the country's army led a *coup d'état* in November 2017.⁴⁹ A result of unstable nations permits China strategy to "take advantage of the weak legal systems and low privacy standards of developing nations." The benefit and advantage of these types of agreements between China and other countries, allows China's state-owned CloudWalk Company, to expand its facial data and thereby improving its AI algorithms; whereas, the Zimbabwean authoritarian regime, gains superfluous empowerment by "an advanced facial-recognition system that it can use to identify, track, and monitor citizens." An ethical consideration here, is it moral to monitor citizens via facial recognition; more importantly, is it ethical to surveil citizens and give them a social score based on behavioral patterns regarding citizens "social and economic performance[?]"⁵⁰

The vision of China's plan for the Social Credit System to monitor its 1.3 billion citizens was announced in June of 2014, by the State Council of China.⁵¹ Since then, China started implementing digital algorithm recordings, and this allowed the generation of a credit score for its citizens, which will determine entitlements or potential blacklists of services. Services included that may impact the Chinese citizenry are components such as insurance premiums, access to essential social services, banking loan rates and loan amounts, traveling abroad out of China, school admission and university scholarships, access to boats, planes, and high-speed trains, access to social media and internet services, and eligibility for work, particularly governmental jobs.⁵²

China's authoritarian President, Xi Jinping, further conveyed his push for "social governance" and his state-owned government's vision of the utilization that "Algorithms would use a range of data to calculate a citizen's rating, which would then be used to determine all manner of activities, such as who gets loans, or faster treatment at government offices or access to luxury hotels."⁵³

The communist party is pushing their ethics, values, and morality by controlling their peoples' every move through establishing and enforcing the social-credit system, which is to "allow the trustworthy to roam everywhere under heaven while making it hard for the discreditable to take a single step."⁵⁴ Establishing a defined algorithm that determines whether a citizen is compliant with "government-mandated social behaviors" and then can impose government "sanctions and penalties," hence is an ethical topic of coercion or conformity that needs to be addressed by humanitarian organizations, western countries, and like-minded liberal governments.⁵⁵

It is of interest to the United States' National Security, as well as, our various allies' national interests, to pursue an aggressive counter AI-enhanced strategies posture and incorporate

methodologies of competitiveness contrary to China's social governance of control. Those who believe in liberty, freedom, and the democratic or republican form of governance must be vigilant and act against repressive authoritarian regimes. For if the United States and the West delay "dire consequences will follow for global democracy."⁵⁶ A former Ronald Regan Administration Assistant, Under Secretary of Defense for Policy Planning, Mr. Michael Pillsbury, conveys that much of the Chinese philosophy and strategy to replace America's superpower status is built upon the ideology that "Chinese states prized deception above all as they jockeyed for supremacy."⁵⁷ Additionally, Pillsbury explained that a former Chinese Dictator and Mao's successor, Mao Zedong, conveyed "hide your brilliance and bide your time."⁵⁸ The United States and the Western allies need to be vigilant against these tactics in the era of technological evolution and AI-advancements.

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In order for a nation to be successful, it needs to work and collaborate with those of AI enhanced technical means and understanding. The United States Department of Defense has the Algorithmic Warfare Cross-Functional Team, to work on a project named Project Maven.⁵⁹ The goal of the DoD initiative is to incorporate big data, AI, and machine learning and to service the "Project Maven to Deploy Computer Algorithms to War Zone by Year's End." The Pentagon's project would assist the United States' allies to maintain its competitive advantage over the "capable adversaries and competitors" by accomplishing more precise actions in a more timely manner, which should assist in limiting collateral damage.⁶⁰

According to the DoD News, Defense Media Activity, in July 2017, Project Maven uses computer vision, which is “an aspect of machine learning and deep learning—that autonomously extracts objects of interest from moving or still imagery.”⁶¹ Further, the addition of “Biologically inspired neural networks” will assist in the project’s goal to free up time and allow analysts to complete additional tasks for effective efficiency. Additionally, the Maven Project integrates analysts, software engineers, algorithm developers, and a data-labeling company to properly label data, and “prepare it for machine learning.” Lastly, the design and development of an AI and human operators interface will be established on government platforms, and thereby the AI will “compliment the human operator” during its deployment to the war zone.⁶²

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However, in June of 2018, there was a Pentagon setback when Google had announced it would not renew a contract regarding the Maven Project.⁶³ Google had approximately 4,000 employees sign a petition or “resign in protest” due to the Pentagon Google Cloud business contract.⁶⁴ The employees’ concerns were in regards to the use of AI technology by “Google’s work” as well as the use of AI “software to improve the sorting and analysis of imagery from drones, and some drones rely on such analysis to identify human targets for lethal missile shots.”⁶⁵ The employees and AI researchers were protesting and concerned that the “contract was the first step toward using the nascent technology in advanced weapons.”⁶⁶ Subsequently, Google conveyed that its newly established AI principles preclude “the use of

A.I. in weaponry.”⁶⁷ Thus, the organization made a cognizant withdrawal from assisting the United States from pursuing its competitive advance in the realm of AI advancements, which impacts the U.S. national security interests.⁶⁸

Google’s AI principles and ethical considerations were the final determining factors for its withdrawal the Pentagon’s AI Maven initiative; however, the company has determined it’s fine to work conscientiously with Beijing’s research center.⁶⁹ Google’s principles do not restrict it from working with the Chinese government, which actually “convert consumer technologies to military applications” and incidentally help to potentially thrust Chinese dominance in a variety of technological progressions, including global AI-advancements.⁷⁰

Google, Silicon Valley, and other big tech organizations have significant influence and promote the technological direction regarding AI-advanced capabilities. These companies are advancing AI-enhancements that potentially will transform society and the world. AI advancements are an “optimization technology, meaning it carries out defined tasks as efficiently as possible” in countless industries, which the big tech companies hold the “intellectual property” to advance the methodologies.⁷¹ The DoD would like to work and collaborate with these companies. However, these enterprises “have opaque chains of ownership often tied to Chinese or Russian interests,” which is problematic to the DoD.⁷²

The reason that these organizations, particularly ones such as Google, have interrelated interests ultimately boils down to money. Nevertheless, there have been recent global governmental concerns and humanitarian backlash, particularly the United States and other western democracies, against the giant tech organizations.⁷³

Case in point, in 2018, Google was getting significant attention from both the United States

government and the European Union partners. In December 2018, the United States Congress called Google’s CEO, Sundar Pichai, to testify about a variety of issues such as political bias, privacy, and congressional interest of Google’s project, Project Dragonfly, and their “concerns over it launching a censored search product in China.”⁷⁴

Additionally, the European Union passed the General Data Protection Regulation, which restricts the use of “consumer data for research.” As a result, Google is pursuing investments in countries that do not have this type of governmental oversight towards its companies’ initiatives and sadly “where illiberal values dominate.”⁷⁵

The significance of Google’s Project Dragonfly, eventually terminated in July 2019,⁷⁶ is how it would have further empowered the Chinese government and the Communist Party. In August of 2018, a Google employee leaked the project’s details, which were subsequently reported by the news organization, the Intercept. The Intercept’s reporting explained that Google’s Project Dragonfly would assist the Chinese government in blocking and blacklisting various websites from the Chinese citizens. Project Dragonfly would also block various word searches that a free republic or democracy would possess, such as, “student protests” or “human rights.” More importantly, the Dragonfly initiative would link phone numbers and the searches of a user for the expressed purpose of government exploitation, “meaning that [their] searches could be tracked and traced.”⁷⁷

Conversely, Google decided not to work with the Pentagon’s AI Maven Project. However, it was willing to work on initiatives, such as the Dragonfly Project, that assist in the linkage of personnel to their online search history and ultimately assist the Chinese government in having greater control of their citizenry.⁷⁸ As a result of the backlash of Google’s employees pertaining to the AI initiative with the Pentagon,

during the summer of 2018, Google published seven principles for its use of AI:

1. Be socially beneficial;
2. Avoid creating or reinforcing unfair bias;
3. Be built and tested for safety;
4. Be accountable to people;
5. Incorporate privacy design principles;
6. Uphold high standards of scientific excellence;
7. Be made available for uses that accord with these principles.⁷⁹

Interestingly, Google conveyed that “they won’t pursue weapons or tech that are likely to cause harm, and that they’ll avoid surveillance that violates internationally accepted norms and human rights.”⁸⁰ Google’s AI initiatives (the Maven Project and Project Dragonfly) and its seven principles seem to conflict with each other. As such, Google’s employees and humanitarian organizations such as Amnesty International, are establishing initiatives like the “global day of action against” these inconsistencies.⁸¹

...it is likely that Google and the DoD will find partnerships in future initiatives...

However, it is likely that Google and the DoD will find partnerships in future initiatives with regards to the “military in other domains.” More significantly, the DoD and the companies in Silicon Valley all gain from the “substantial cross-pollination of investment and research and development,” as in the case of “CIA’s venture capital fund In-Q-Tel.”⁸² In-Q-Tel is a non-profit organization that focuses on research and development, which is “useful to the CIA mission of intelligence gathering.”⁸³ This type

of interrelated cooperation between government and the private sector has brought technological advancements such as Google Maps and is developing potential capabilities like “scanners to create 3-D printed objects.”⁸⁴

There are implications of the U.S. government working with industry that is essential to national security. Even though China may be the aggressor in the AI-advanced initiatives, other powerful authoritarian governments know its potential power. As Russian President, Vladimir Putin, conveyed the power that produces AI mastery shall “become the ruler of the world.”⁸⁵

China is pushing aggressively to be the world leader not only in AI supremacy but other cutting-edge based advancements...

Consequently, Western nations need to ensure there is a proper balance between national security technological advancements in AI and ethical standards when super-intelligence algorithms are considered, analyzed, developed and eventually established for use. Former leaders such as Henry A. Kissinger, former National-Security Advisor and Security of State, was not too impressed with AI, until 2015, when he was introduced to the facts surrounding how various computer algorithms, that were not “preprogrammed,” but how algorithms were able to acquire understanding, by playing “games against itself, learning from its mistakes and refining its algorithms accordingly.”⁸⁶ Shortly thereafter, AI-advanced algorithms AlphaGo would go onto beat the human Go players “decisively.”⁸⁷

Due to his astonishment of the AI achievements, Kissinger went on to write a lengthy piece in the *Atlantic*, in June 2018, titled “How the Enlightenment Ends,” where the former National-Security Advisor believes

that AI is of national security concern. Additionally, AI needs to be a “major national project” analyzing AI’s “full scope,” possible implications of AI implementation, and analyzing the “process of ultimate learning.” Furthermore, Kissinger expressed concerns that the President and Congress should establish “a presidential commission of eminent thinkers to help develop a national vision.” Ultimately, Kissinger’s concerns that we as a society consider the possible ramifications of the AI-superintelligence revolution; moreover, societally, have we considered the magnitudes of the “culmination may be a world relying on machines powered by data and algorithms and ungoverned by ethical or philosophical norms.” Thus, Mr. Kissinger highlights the importance of AI-superintelligence as a United States national security concern, but the ethical components are essential throughout the process of implementation. Lastly, from his perspective, the technological revolution should be “given a high national priority, above all, from the point of view of relating AI to humanistic traditions.”⁸⁸

The United States of America’s national security interests are at stake due to authoritarian regimes like China and Russia, which have state-owned organizations giving the governments more control and power. These nations’ governmental structure allows them more flexibility and ability to be more intrusive globally. Big technology companies, for example Google, assisting them should be a significant concern regarding America’s national security, as well as the security of its like-minded allies.

China is pushing aggressively to be the world leader not only in AI supremacy but other cutting-edge based advancements such as the fifth generation communications improvements, known as 5G, which will have ramifications to bolster the communist’s interests of dominance and surveillance globally. Additionally, other invasive regimes, such as Russia, are constantly using military invasions, false

information campaigns, propaganda, technology encroachments, and social media to continuously push the boundaries of war in countries such as Georgia, Crimea, Ukraine to improve its competitive advantage. Russia is using the previously stated technologies to destroy their enemy in ways that have not been observed before.

Lastly, the U.S. government needs to analyze the ramifications of big technology organizations' support to totalitarian regimes and the promotion of desires other than U.S. national security interests, as well as its impact on U.S. and U.S. allies' objectives to preserve ethics, freedom, liberty and the rule of law. The proper development of a strategy and use of AI-based advancements can assist in maintaining those aspirations.

Google's DeepMind Artificial Intelligence Research and Development Initiative

The ultimate goal of artificial intelligence experts is to create or design "an algorithm that learns, *tabula rasa*, superhuman proficiency in challenging domains."⁸⁹ According to *Merriam-Webster*, "*tabula rasa*" means "the mind in its hypothetical primary blank or empty state before receiving outside impressions."⁹⁰ *Tubula rasa* is a sixteenth-century concept and gained prominence due to British philosopher, John Locke, who promoted and advocated for the concept in the "*Essay Concerning Human Understanding* in 1690 that the term gained widespread popularity in our language."⁹¹ Moreover, today's AI promoters like to endorse the idea of *tabula rasa*; however, even though recent results in AI progressions have been phenomenal advancements, the algorithm(s) did not exactly start at a "blank state."⁹² According to a December 2018 PBS and NOVA Next's article, AI-based capabilities and actual true intelligence, "Programmers are still feeding it one crucial morsel of human knowledge: the rules of the

game it is about to play. 'It does have far less to go on than anything has before,' ... 'but the most fundamental thing is, it's still given rules. Those are explicit.'"⁹³ Thus, technology is moving incredibly fast, and with every new day and with various AI projects, there seem to be significant advances since the prior year. Following is a look at initiatives in recent years and what noteworthy advancements were achieved.

Scientists and researchers have used AI platforms to challenge individual gaming champions for years. One of the most monumental accomplishments of AI advancements happened in 1997 when International Business Machines (also known as IBM) designed and developed a supercomputer, named Deep Blue, which subsequently "beat the world chess champion Garry Kasparov."⁹⁴

The ultimate goal of artificial intelligence experts is to create or design "an algorithm that learns..."

Fast-forward, a score of years later, the story of computer programs AlphaGo Lee, AlphaGo Fan, AlphaGo Master, AlphaGo Zero, and AlphaZero, which exemplifies the astonishing advancements, and potential of the implementation of technology and AI. These algorithmic computer programs use the complicated game of "Go," a "two-player strategy game" which was invented 3,000 years ago in China and is still very popular in East Asia.⁹⁵ The game of Go is difficult and challenging conceptually due to the number of possible strategic movements during each of the opponent's moves. Google's DeepMind AI Project, developed a computer program named AlphaGo, which integrates machine learning processes into a computer program that plays the game Go.⁹⁶

First, DeepMind's programmers used

an AlphaGo variant named AlphaGo Fan to challenge Mr. Fan Hui, a Go master and European Champion of the game Go. In October of 2015, this AlphaGo variant, AlphaGo Fan, was the first computer “program to achieve superhuman performance in Go.”⁹⁷ Subsequently, in March of 2016, the computer program went up against another one of the world’s greatest players of the game and beat “South Korean Go master Lee Se-dol—was viewed as an important test of how far research into artificial intelligence has come in its quest to create machines smarter than humans.”⁹⁸ This time the DeepMind programmers used an AlphaGo variant, named AlphaGo Lee, to challenge and defeat Lee Se-dol. The chief executive and founder of Google’s AI Team of DeepMind, Mr. Demis Hassabis, conveyed that AlphaGo’s victory over Lee Se-dol was a “historic moment,” moreover, the computer program’s “central advantage of AlphaGo was that ‘it will never get tired, and it will not get intimidated either.’”⁹⁹

...the DeepMind AI Project’s programmers adjusted the computer program to play against itself and learn from these processes.

Between 2015 and 2016 the two AlphaGo variants, Fan and Lee, were programmed similarly by the DeepMind programmers. In an October 2017 article, published by *Nature*, the DeepMind Team explained in detail how the AlphaGo variants were designed:

AlphaGo Fan used two deep neural networks: a policy network that outputs move probabilities and a value network that outputs a position evaluation. The policy network was trained initially by supervised learning to accurately predict human expert moves, and was subsequently refined by policy-gradient reinforcement learning.

The value network was trained to predict the winner of games played by the policy network against itself. Once trained, these networks were combined with a Monte Carlo tree search to provide a look ahead search, using the policy network to narrow down the search to high-probability moves, and using the value network (in conjunction with Monte Carlo rollouts using a fast rollout policy) to evaluate positions in the tree.¹⁰⁰

Subsequently, the computer program significantly matured in one year. During May 2017, in Wuzhen, China, a Go summit had taken place, however, interestingly the conference was censored to Chinese citizens.¹⁰¹ Furthermore, the government had websites blocked to ensure all broadcasts were expurgated to its citizenry. The significance of the event was that the AlphaGo Program would beat the Chinese national, Mr. Ke Jie, the Go master and world champion of the game Go. Ke Jie explained that when he played a previous version the year before, it was “still quite humanlike.” However, he went on to convey that due to the astonishing strategic moves that AlphaGo made, “this year, it became like a god of Go.” Further, other various Go players “have praised the technology’s ability to make unorthodox moves and challenge assumptions core to a game that draws on thousands of years of tradition.”¹⁰²

The way the AlphaGo Computer Program had learned to play the game of Go is that the DeepMind AI Project’s programmers adjusted the computer program to play against itself and learn from these processes.¹⁰³ Moreover, the significant development of AlphaGo was due to the programmers’ adjustments to improve the “algorithms’ efficiency and potential to be generalized across a broader set of problems.”¹⁰⁴ The big take away from this event between the AI Computer Program and Go’s Champion, Ke Jie, is that “AlphaGo showed yet another way that computers could be developed to perform

better than humans in highly complex tasks, and it offered a glimpse of the promise of new technologies that mimic the way the brain functions.”¹⁰⁵

Successively, DeepMind’s programmers developed AlphaGo Zero. Four components differentiate Zero against the predecessor AlphaGo variants. According to the October 2017 article published in *Nature*, the four components are:

First and foremost, it is trained solely by self-play reinforcement learning, starting from random play, without any supervision or use of human data. Second, it uses only the black and white stones from the board as input features. Third, it uses a single neural network, rather than separate policy and value networks. Finally, it uses a simpler tree search that relies upon this single neural network to evaluate positions and sample moves, without performing any Monte Carlo rollouts. To achieve these results, we introduce a new reinforcement learning algorithm that incorporates lookahead search inside the training loop, resulting in rapid improvement and precise and stable learning. Further technical differences in the search algorithm, training procedure and network architecture are described in Methods.¹⁰⁶

DeepMind’s programmers have matched AlphaGo Zero against the earlier versions of AlphaGo variations, “which were trained from human data using handcrafted futures, by a large margin.”¹⁰⁷ When matched against the variant, AlphaGo Master, which is similar to the Lee and Fan variants and additionally beat the world best players in January of 2017 60-0, the Zero variant of AlphaGo would beat the Master variant eighty-nine games to eleven games. Consequently, DeepMind’s research concluded “that a pure reinforcement learning approach is fully feasible” and what is needed is only a couple of more hours to train for the game

properly; additionally, this “achieves much better asymptotic performance, compared to training on human expert data.”¹⁰⁸

The significant difference between its predecessors, the AlphaGo variants, is that AlphaZero can play chess, shogi, as well as Go, simultaneously.¹⁰⁹ These are impressive advancements of scientists, researchers, programmers, and innovators to reach the objective of AI computer superintelligence. However, there is much innovational improvement that needs to be accomplished in regards to the amount of energy consumed to conduct these AI computational tests: “This intensive regimen also used 5,000 of Google’s proprietary machine-learning processor units, or TPUs, which by some estimates consume around 200 watts per chip. No matter how you slice it, AlphaZero requires way more energy than a human brain, which runs on about 20 watts.”¹¹⁰

...AlphaZero requires way more energy than a human brain, which runs on about 20 watts.

However, the progress of Google’s DeepMind AI-initiatives and achievements cannot be denied. These DeepMind initiatives are achieving “A long-standing goal of artificial intelligence is an algorithm that learns, tabula rasa, superhuman proficiency in challenging domains.”¹¹¹

Limitations of Artificial Intelligence

In order for the full spectrum of IA-enabled capabilities to be fully realized, it is prudent to see where the private sector and academia are within the spectrum of AI capabilities, AI struggles, and AI limitations. According to Macy Bayern at Techrepublic, there are three limitations. The three areas of concern are (1) data, (2) bias, and (3) lack of process knowledge by employees.¹¹² Consequently, the big takeaway

is that data needs to be organized suitably in order to implement AI-based initiatives appropriately. Thus, the United States Congress needs to legislate and ensure that all GEOINT partners, from the NGA to various DoD partners, allied partners, and commercial partners develop and use a recognized standard of the organization and proper storage of data and information. This order of storage should start immediately to ensure that AI-based advancements, deep learning, and machine learning can be used rapidly to assist leaders in their decision-making processes.

...in order for the DoD to use AI-based advancements properly the data structure needs to be controlled and categorized in a format AI algorithms can comprehend.

Therefore, in order for the DoD to use AI-based advancements properly the data structure needs to be controlled and categorized in a format AI algorithms can comprehend. Case in point, if we analyze the English language and the Spanish language, the languages are structured differently. Consequently, an AI algorithm would be unable to understand the noise of unstructured data if the algorithms were only designed to understand the Spanish language, but not the English language. The AI algorithms need to be programmed with knowledge of items and nicely classified in a common language for it to work efficiently and effectively. That is the great challenge in order to incorporate AI-advancements properly.

Artificial Intelligence-based Initiatives in Government

The AI initiatives are proving to be extremely beneficial. In Phil Goldstein's article titled, "Air Force, NGA Embrace AI in Different

Ways," Goldstein explains that the United States' Air Force is unitizing AI enhancements to improve the DoD component's operations. In collaboration with the Defense Innovation Unit the Air Force is looking to save cost and time on its equipment's maintenance. Defense Innovation Unit's mission is "identifying highly relevant technology companies and matching them to Defense Department customers through collaborative, agile business processes." By providing data on a specific platform the Air Force "cut unscheduled maintenance time for aircraft by 30 percent, boosting the fleet's maintenance reliability rate."¹¹³

The AI-advanced initiatives are also ensuring security against various malicious attacks. In December of 2018, the Intelligence Advanced Research Project Activity announced a draft Broad Agency Announcement regarding its TrojAI Program to combat attacks on AI systems by various Trojans. Intelligence Advanced Research Project Activity-BAA-19-03 synopsis for solicitation number is explained as follows:

Using current machine learning methods, an artificial intelligence (AI) is trained on data, learns relationships in that data, and then is deployed to the world to operate on new data. For example, an AI can be trained on images of traffic signs, learn what stop signs and speed limit signs look like, and then be deployed as part of an autonomous car. The problem is that an adversary that can disrupt the training pipeline can insert Trojan behaviors into the AI. For example, an AI learning to distinguish traffic signs can be given just a few additional examples of stop signs with yellow squares on them, each labeled "speed limit sign." If the AI were deployed in a self-driving car, an adversary could cause the car to run through the stop sign just by putting a sticky note on it. The goal of the TrojAI program is to combat such Trojan attacks by inspecting AIs for Trojans.¹¹⁴

Thus, the overall goal of the TrojAI program is to protect AI systems from adversary's attempts to place malicious malware within the platform. The desire of Intelligence Advanced Research Project Activity would be "a system that can process about 1,000 AIs per day."¹¹⁵

An additional AI-based initiative that the DoD is working on is from the Defense Advanced Research Projects Agency (DARPA). DARPA is responsible for the improvement of evolving technologies for DoD. Their AI initiative, named Knowledge-directed Artificial Intelligence Reasoning Over Schemas, or KAIROS, will use "something called schema-based AI to better comprehend events around the world, specifically helping uncover complex events found in multimedia information and bring them to the attention of system users."¹¹⁶

The NGA has models of collaborative challenges similar to both DARPA and Intelligence Advanced Research Project Activity initiatives that offer "financial incentives to compel and inspire investment/innovation, promote diversity, and drive solutions in automation and GEOINT Assurance." The NGA is implementing a collaborative challenge approach, as well as ensuring appropriate Structured Observation Management for geospatial data, and incorporating new ideas such as the SpaceNet "Open data initiative with IQT Lab CosmiQ Works to foster innovation in automation of imagery analytic tasks. It brings a collaborative approach from machine learning analysis to commercial imagery and training data in order to develop algorithms to extract information." The use of the aforementioned GEOINT advanced-AI strategy processes will incorporate a unity of effort, build confidence and trust, promote innovation, enhance relevance, encourage anticipatory intelligence, and ensure the U.S. government will outpace the nation's near-peer and peer adversaries and maintain its competitive advantage in the future battlespace.¹¹⁷

Nevertheless, on October 27, 2018, on the Federal Executive Forum regarding technological advances in machine learning and AI in government, government principals from various agencies deliberated about the new technological advancements and their development for organizational implementation for AI initiatives. Participant Mr. William "Buzz" Roberts, the NGA representative, explained that the NGA problem set and GEOINT sphere is significantly more challenging and complex than initiatives such as Google's DeepMind AlphaGo project, albeit impressive that the latest AlphaGo variant can beat fifty players simultaneously.¹¹⁸ "NGA is an open-ended issue. Further, the NGA has to master a deluge of data which it sifts through and master the data as quickly as possible with increased accuracy, quantity, [and] persistence of results." Roberts explains that organizational leadership pursuing AI initiatives should ensure that there needs to be clarity of objectives operationally.¹¹⁹

...the NGA problem set and GEOINT sphere is significantly more challenging and complex than initiatives such as Google's DeepMind AlphaGo project...

In addition, Roberts clarified that there are three focus areas to ensure there is a proper understanding thereof. Those participants in AI initiatives need to focus on the comprehension of technology and advanced methods, ensure that data is structured adequately from partnerships (both indirect and direct), and finally get a proper understanding of the organization's domain.¹²⁰

Roberts expounded that the NGA's global mission set regarding the safety of navigation, impacts both aircraft and vessels globally. The NGA has to be accurate continuously and leverage what is emerging and then apply it to the NGA's problem set. The NGA must ensure

there is accurate data for all those making intelligence decisions and ensure adequate and accurate delivery.¹²¹

In order to successfully implement a proper AI-based initiative the data needs to be adequately structured. Consequently, data is the problem. AI-based initiatives need to properly understand the data to complete their algorithms' intended purpose. The process of conflation is the solution that can assist organizations to accurately and precisely categorized divergent datasets.

Humans have abilities in awareness, perception, and decision-making...AI is excellent at tracking and monitoring massive amounts of data, transactions, and components.

Citygate GIS has a methodology that is explained as “Conflation is the process of matching features between data sets created at different times and based on different levels of accuracy and precision. Once features have been matched the goal is often to transfer attribute data from one data set to the other.”¹²² Citygate GIS has a fully automated conflating system, named ConfleX, which is compatible to work with ArcGIS analyzing large data sets.¹²³ The process of conflation is able to assist the governmental components or other organizations ready to implement AI-based initiatives to overcome the problematic issues of unstructured or uncategorized data.

The concept of conflation is not new. Through collaboration efforts in 2015, the NGA entered into public-private sector partnership with DigitalGlobe in an unclassified initiative named Hootenany to “harness the power of the power of crowdsourced mapping for Geospatial Big Data Analytics.”¹²⁴

Thus, the NGA has incorporated the

process of conflation into its architecture. The NGA's technology and integration initiatives are leveraging advancements and incorporated automation, AI-based capabilities, and augmentation to improve the agency's processes. There are six focus areas including change detection, data utility and generalization, automated feature extraction and automated attribute population, data validation, as well as map finishing. The final focus area of mass data conflation and metadata tagging is significantly profound because it “conflates all vector and attribute types from multiple datasets into a ‘best of breed’ final dataset.”¹²⁵

The Future of Human, Machine, and Artificial Intelligence-Based Augmentation

According to AI expert Mr. Maurice Conti, society is moving into a new era when it comes to humanity working.¹²⁶ Conti explains that four major historical eras define how humans worked: the Hunter-Gather Age, the Agricultural Age, the Industrial Age, and the Information Age. Further, he explains that humans are “on the cusp of our next great era as a species,” which would be considered as the Augmented Age. There will be an interconnectional relationship between humans, robots, as well as AI-based capabilities to complete tasks and solve complex problems. Humans have abilities in awareness, perception, and decision-making, whereas, robotics are excellent at exercising instructions with perfect precision and repetitiveness. Finally, AI is excellent at tracking and monitoring massive amounts of data, transactions, and components.¹²⁷

Thus, Conti goes on to explain that our cognitive, physical, and perceptual abilities will be augmented and amplified by the advancements in AI-based abilities by assisting humans “to imagine and design new stuff, robotic systems are going to help us build and make things that we've never been able to make before.”¹²⁸

A 2016 project, named the HIVE, exemplified a cross-disciplinary collaboration experiment in which professionals across the spectrum of computer advancements, robotics, manufacturing, engineering, and design to develop a task working together.¹²⁹ “The project involved a 12’ tall bamboo pavilion that was built by attendees of the 3 day event, through a unique human, machine, and robot collaboration. With this multi-disciplinary project, we were exploring a number of future-of-design themes, such as emergent design, wearables, internet of things, and human-robotic interaction.”¹³⁰ Thus, the HIVE experiment demonstrated how the future would incorporate the working relationship of humans, robots, and AI-based advancements, which will control and monitor data, activity, and ensure components accurately and precisely applied.

Thus, AI-based advancements, automation, human-machine teaming will assist organizations by supporting with mundane labor skills to allow humans the freedom to focus on more consequential realms. Further, AI-based processes will be supplementary expedient since the innovation “thinks in ways that humans can’t. Algorithms that can monitor and process massive amounts of data, and make conclusions based on patterns in that data are poised to change every avenue of society.”¹³¹

Conclusions

Artificial intelligence technological advancements present numerous possibilities to empower and provide advantages to nations and non-state actors in the future, even though this innovation is only “one of the new battlegrounds for a technology-based arms race.”¹³² The NGA is the premier DoD intelligence agency that possesses and processes geospatial information, which assists customers to answer critical intelligences issues, challenges, and questions.

The NGA’s GEOINT provides products and services to enhance decision-making advantage

for senior policy-makers, warfighters, and various governmental and non-governments customers. As an indirect result of its evolution as the leader in geospatial competence, the agency is also positioned to provide the way forward in artificial intelligence-enhanced capabilities, machine learning, deep learning, automation, human-machine teaming, and material infrastructure for all other DoD and non-DoD government agencies, as well as state and local organizations. The agency models leadership by establishing research and development, as well as incorporating appropriate relationships across the spectrum of government, academia, and industry. Ensuring accurate and precise incorporation of advanced technologies of AI will ensure the national security interests and prosperity of United States are well-advanced and well-preserved, and the “NGA will propel the continued dominance of GEOINT to protect American interests.”¹³³

Ensuring accurate and precise incorporation of advanced technologies of AI will ensure [U.S.] national security interests and prosperity...are well-advanced and well-preserved...

Recent aggressiveness of the DoD’s apparatus regarding its AI-based implementation and strategies—the formation of the Joint Artificial Intelligence Center, the Office of the Director of National Intelligence’s introduction of the framework of the Augmenting Intelligence using Machines initiative, and the 2019 AI executive order by President Donald Trump—all assist enabling the United States of America to remain competitive in the technology advancement race and proliferation of technology against our competitors and adversaries, principally China and Russia. Additionally, these initiatives allow a strategic

framework in dealing with the private sector organization, which otherwise might hinder the U.S. government's competitive technological advantage; as well as guidance to ensure the government will not be reliant on any one major AI big-tech organization, such as Google.

Partnerships need to be promoted and established across the spectrum of the private sector, academic institutions, international community, federal and state and local civil governmental agencies, NGOs, as well as other partners to ensure sound data with standardization, and to enhance discoverability. The cross-disciplinary collaboration efforts between public-private-academic arenas with allied organizations, both domestic and abroad, will promote the aforementioned analytics and advancements amongst the U.S. government's partners.

Finally, the frameworks allow those who design AI-based initiatives to be well-focused on ethical considerations, protect against existential threats of the United States and its allies, and ensure rigorous preservation of the United States of Constitution, safeguarding America's norms, principles, and values are also well-preserved and well sustained.

Recommendations

For further study, future researchers should focus on ethical considerations pertaining to AI initiatives. Research should be examined by analyzing how authoritarian regimes will use high-tech innovations to control their populace, as well as pursue initiatives to strengthen their competitive and strategic advantage globally. Examination should explore the impact of the ease in which these advancements will be established, promoted, and implemented, in nations that are surveillance states and have state-owned businesses.

A second consideration for future research is to examine the ethical considerations in which various militaries will start to incorporate advanced technology, such as AI-based enhancements, machine learning, deep learning, autonomous machinery, as well as human-machine teaming within their organizations. The research should analyze the new technological advances noted above, as well as the human-in-the-loop notion with how military components will start to incorporate and use these progressions and examine what impact these technological advances have on the future battlefield.

The U.S. Army Command and General Staff College's Officers Course encourages officers to look at war through the prism of ethical apparatuses, such as the ethical triangle—a balance of principles-based, virtues-based, and consequences-based ethical decision-making¹³⁴—and the Just War Theory—a doctrine of military ethics that postulates that war, while terrible, is not always the worst option.¹³⁵ There should be further research on how future technological advancements can be tested by these and other ethical examination methods.

Another possibility for future research is to examine the big technology companies' positions regarding these new innovation and what is their working relationship with the U.S. government. In 2018, Google pulled out of the Project Maven AI initiative with the Pentagon's relating to the company's ethical issues. However, subsequently it was revealed that the Google organization was pursuing other AI initiatives to assist the Communist Chinese regime, which is to advance the totalitarian interests to control their citizenry.

Additionally, the research can explore how American citizens need to be vigilant to ensure they protect their constitutional and civil liberties as big technology evolves and becomes more intrusive in citizens' lives. Lastly, further examination is needed of authoritarian regimes' unrestricted freedom to capitalize on new advancements and how these regimes will use such technologies to enhance

their position globally, whereas Western democracies and Constitutional republics are subject to limitation such as varying laws, regulations, and political bureaucracy. **IAJ**

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