

Digital Policy Hub – Working Paper

A Blueprint for AI Integration in the Canadian Armed Forces

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Key Points

- Canada's military is falling behind its allies in terms of developing and adopting an artificial intelligence (AI) implementation strategy. To remedy this, an action plan needs to be released immediately. Any delay will put the Canadian Armed Forces (CAF) further behind in the AI race.
- Personnel should be at the forefront of any policy development, with key areas of improvement including increased educational opportunities, professional development, skill enhancement, recruitment processes, greater use of reserve forces and regulations on the application of these emerging AI tools.
- Data is a critical resource for the CAF and should be prevalent in the strategy. Other recommendations include reorganized data procedures, increased data sharing, employing anonymization techniques and using insights from other departments.
- The final pillar of the implementation tactic should be the establishment of a strong governance framework, with an emphasis on collaboration with government institutions and defence partners, ensuring the accuracy and dependability of data, and implementing teamwork.

Note: This working paper was completed just prior to the April 2024 release of the Artificial Intelligence Strategy by the Department of National Defence (DND) and CAF.

Context

AI is playing a larger role in conflicts (Department of Defense [DoD] 2023; Ministry of Defence [MoD] 2022). Although AI is not new — the first neural network is believed to have been created in the early 1950s (Britannica 2023; Government Communications Headquarters [GCHQ] 2023) — its applications in conflicts have revealed new ambiguities (Araya and King 2022). The incorporation of AI in warfare represents a revolution in military affairs, providing advantages in areas such as autonomous systems, data analysis and decision making (DoD 2023; MoD 2022). However, AI also poses substantial challenges, which are exacerbated by the lack of laws controlling its use (Araya and King 2022; National Security Commission on Artificial Intelligence [NSCAI] 2021).

Countries worldwide are increasingly expressing concerns regarding the threats posed by AI to their national security, economy and democratic foundations (Comiter 2019; European Parliament 2020). Despite differing views among nations, there is a shared recognition of AI's dual-use potential. Russian President Vladimir Putin has emphasized the unanticipated risks associated with AI while acknowledging its revolutionary potential for humanity (Vincent 2017). Putin further stressed the importance of leadership in the AI space and implied that the nation that achieves dominance in this area will rule the world (ibid.). Echoing this sentiment, the United Kingdom has

stated that the outcome of future battles will hinge on the rapid and effective use of AI technologies (MoD 2022).

To address the escalating concerns around AI, DND is currently formulating an implementation strategy for the CAF (Reevelly 2023). Given that AI has the potential to provide a strategic and operational edge, the Government of Canada is encouraged to aggressively pursue this technology. The achievement of this goal must be made while respecting the standards, norms and values of the society AI serves and exhibiting dependability. This working paper intends to provide guidance for this endeavour by highlighting tactics that have previously been used by other countries and providing insights into practical approaches that the Government of Canada could use to navigate the complex terrain of a military AI policy.

Background

AI is a collection of adaptable technologies that allow machines to carry out jobs that have traditionally been done by humans or require human-like intellect (Britannica 2023; GCHQ 2023; NSCAI 2021; MoD 2022). It has had a significant impact on numerous fields and is considered a powerful force for change. The use of AI in armed conflicts gives rise to intricate ethical, legal and strategic concerns (Piteira, Aparicio and Costa 2019; Rhim and Park 2019; Sanclemente 2022), especially in the realm of information warfare, where AI has the capability to manipulate data to sway public opinion (Jensen, White and Cuomo 2020).

The task of regulating AI in armed conflict on an international scale is made more difficult by the requirement to maintain ethical standards and adhere to international law (Rhim and Park 2019). International humanitarian law establishes a systematic structure for governing the development and use of weapons, prioritizing the outcomes rather than the technical details (Schuller 2017). Nevertheless, the swift integration of AI into military tactics also gives rise to apprehension regarding an AI arms race and the imperative for worldwide collaboration to alleviate the accompanying hazards (Wang et al. 2020).

The emergence of AI is causing a substantial shift in the geopolitical landscape, comparable to past developments such as nuclear weapons and biotechnology (Harris and Raskin 2023). The swift advancement of AI is surpassing the speed at which other technologies were previously adopted, requiring a re-evaluation of conventional defence strategies (MoD 2022). The ability of a nation to comprehend and adjust to developments caused by AI is becoming crucial for both national security and economic well-being (DoD 2022).

Countries must respond thoroughly to the difficulties and opportunities presented by the integration of AI into armed conflict (Wasilow and Thorpe 2019; MoD 2023). Nations may appropriately manage the risks and maximize the advantages of integrating AI into military operations by implementing proactive measures. However, appreciating the revolutionary capabilities of AI requires a fundamental change in military tactics and approach rather than just small-scale improvements (Center for Security and Emerging Technology 2020; Reevelly 2023). To sustain a strategic edge, states must prioritize technological adaptation and consider ethical, legal and cooperative factors (Araya and

King 2022; Harris and Raskin 2023; Horowitz et al. 2018). It is likewise imperative for governments to make the development of AI a top priority, allocate funds for research, encourage innovation and establish regulatory frameworks to ensure national security (Goldfarb and Lindsay 2021; MoD 2022).

Canada is confronted with a crucial decision when it comes to embracing revolutionary technologies such as AI: either adjust and thrive or face the possibility of lagging behind its allies and rivals (Hachey, Libel and Partington 2020). It is important to adopt a daring and decisive approach, using frameworks such as the “AI hierarchy of needs” to effectively guide strategic endeavours (DoD 2023, 7).

Benefits

AI offers numerous advantages, such as enhanced decision making, operational efficiency and military efficacy (DoD 2023). The applications of this technology in the armed forces range from bolstering network security to automating dangerous operations, hence protecting soldiers (MoD 2022). AI exhibits exceptional aptitude in efficiently and precisely resolving intricate issues, surpassing human performance in activities that would otherwise be arduous or practically impossible (GCHQ 2023). AI uses existing data to improve scalability, decrease expenses and enable accurate decision making in various fields (Hall and Pesenti 2017).

In the future, AI is expected to greatly transform military operations by providing a wide range of capabilities in several areas.¹ AI-enabled mobile command units will facilitate precise decision making through extensive data analysis, while machine learning will assist in detecting illegal activities such as nuclear trading (MoD 2022). The potential of AI encompasses improving the efficiency of supply chains, safeguarding vessels and boosting cybersecurity, holding the promise of sustained productivity gains and the ability to adapt to fight emerging threats in a complex global environment (GCHQ 2023; NSCAI 2021).² With appropriate integration and strategic planning, AI has the potential to completely transform military capabilities, enhancing security and adaptability in a constantly evolving world.

Threats

Approximately 50 percent of AI researchers predict a 10 percent or higher probability of human extinction due to our limited ability to manage AI (Harris and Raskin 2023). Referred to as “zero day”³ for humanity, similar to an undiscovered weakness in computing, the use of AI in military tactics presents growing hazards (ibid.). It is anticipated that both state and non-state adversaries could take advantage of AI capabilities, resulting in increased dangers in both conventional and unconventional conflicts (Canadian Centre for Cyber Security 2023; Center for Security and Emerging Technology 2020). These opponents may utilize AI for military strategizing, cyber activities and decision making, which could potentially violate legal, ethical and safety protocols (Comiter 2019; Jensen, Whyte and Cuomo 2020). In addition, the combination

1 See www.csis.org/programs/international-security-program/defense-industrial-initiatives-group/projects/understanding.

2 Ibid.

3 See https://csrc.nist.gov/glossary/term/zero_day_attack.

of AI and cyberthreats increases the potential dangers, as AI-driven systems can quickly detect and take advantage of weaknesses on a large scale (Bécue, Praça and Gama 2021).

For example, AI amplifies misinformation campaigns by deploying advanced chatbots that disseminate conspiracy theories with the appearance of heightened credibility, hence undermining traditional methods of verification (Hsu and Thompson 2023). To illustrate, according to OpenAI (2024), the North Korea-affiliated malicious actor known as Emerald Sleet has used their service with the likely goal of creating spear-phishing campaigns.

Moreover, there are adversaries that seek to obtain Canadian AI technology and intellectual property, threatening Canada's technical dominance and national security (Jensen, Whyte and Cuomo 2020; Bronskill 2023). All the while, the proliferation of AI technology democratizes its use, hence enhancing the capacity for asymmetric warfare and allowing non-state actors to carry out targeted strikes with the use of readily accessible AI-enabled tools (Carlini 2020; Kunertova 2023). As a result, the frequency of proxy threats is increasing, as non-state actors adapt commercial technology to enhance their capabilities.

Furthermore, the unintentional spread of potentially hazardous information, such as AI systems that can autonomously acquire advanced expertise in chemistry, poses risks to national security (Harris and Raskin 2023). The increased availability of harmful information amplifies the dangers, which are exacerbated by the independent learning capacities of AI models (ibid.).

Challenges

The incorporation of AI presents complex issues in different fields, each requiring thoughtful analysis and creative solutions. An important obstacle involves assessing the appropriateness of AI for various jobs, as not all assignments may benefit from AI systems, considering criteria such as cost effectiveness and the complexity of the problem (GCHQ 2023; Harris and Raskin 2023). Furthermore, AI faces constraints in its ability to remember information and accurately forecast future events. All the while, AI may also “hallucinate,” creating an answer that is fabricated or incorrect. These limitations pose challenges when dealing with complicated and uncertain situations, especially in cases where there is insufficient training data, such as in counterterrorism operations (MoD 2022; GCHQ 2023).

Data-related issues are a significant problem, particularly due to the huge amount of data needed to train AI models. This aspect makes them vulnerable to data-poisoning attacks in which mistakes are deliberately introduced into the training data sets. These inaccuracies then result in systemic errors during the training process (MoD 2022; Canadian Centre for Cyber Security 2023). In addition, the application of AI is hindered by limitations and discrepancies in data; this data requires significant effort to prepare and label to ensure effective AI usage (MoD 2022; GCHQ 2023).

Deterioration of AI systems over time is an important factor to consider, as their performance may decline without regular upgrades and alterations to accommodate changing environments and tasks (MoD 2022; Mauri and Damiani 2021).

In addition, the presence of discrimination in AI systems raises ethical issues, as biases, susceptibility to manipulation and flaws in data sets may result in discriminatory outcomes based on criteria such as gender, race or other variables (MoD 2022; DoD 2023). For example, Google's Gemini program has recently come under fire for its delivery of erroneous historical photos depicting racially diverse US senators from the 1800s (Gordon 2024).

Accountability problems come from the intricate nature of AI decision-making processes, particularly in operational settings such as cyber defence, where prompt responses are vital (GCHQ 2023; MoD 2022). The black-box dilemma, whereby AI systems employ advanced techniques such as deep learning to generate predictions that are difficult or impossible for humans to comprehend, adds another layer of complexity to the question of accountability in AI systems (Harris and Raskin 2023).

The issue of privacy is multifaceted, with discussions around the balance between potential violations of privacy and the potential benefits of AI's ability to protect and eliminate the need for human scrutiny of personal data (Pich 2020; Center for Security and Emerging Technology 2020). The synergy across numerous AI systems increases the overall vulnerability to unauthorized access, highlighting the intricacy of safeguarding privacy in the AI era (GCHQ 2023).

Personnel

To successfully launch an efficient AI implementation strategy, it is important to consider various aspects, including personnel leadership, education and training programs, career advancement, skill enhancement, recruitment procedures, reserve forces, initiatives for advanced education, updates to the Canadian Forces Aptitude Test (CFAT), and promoting diversity, equity and inclusion.

Effective personnel leadership plays a crucial role in spreading the AI implementation strategy across the CAF (DoD 2023; MoD 2022). Senior commanders must have a comprehensive grasp of AI strategy, while middle-level executives need targeted solutions to improve organizational readiness. Furthermore, education and training programs should be given top priority at all levels to ensure that staff are equipped with essential skills and knowledge (MoD 2022; GCHQ 2023). In addition, career advancement trajectories, influenced by successful frameworks such as the United Kingdom's Data Science Accelerator, should accommodate both those with broad expertise and those specializing in AI within the CAF (MoD 2022).

Incorporating upskilling activities, based on best practices, is essential to create a skilled workforce that can effectively use AI technologies (MoD 2022). When it comes to hiring, it is important to prioritize the acquisition and development of talented individuals by focusing on recruiting high-quality personnel and offering incentives such as AI pay premiums (ibid.). The MoD (2022) has enlisted specialist reservists to enhance their capabilities — a practice that could be replicated in the CAF.

Implementing advanced educational programs, including an AI conversion course and placement programs for AI master's students, is crucial for cultivating a skilled group of AI experts within the CAF (ibid.). Similarly, the CAF should consider either updating the

CFAT to identify individuals who have the ability and potential to work on AI or identify a recognized certification, in the field, as a benchmark to find promising candidates.

Structure

Data is a vital resource and should be prioritized second only to CAF members (MoD 2022). Thus, it is essential to promptly reorganize data procedures, as highlighted by both the DoD (2023) and the MoD (2022). Viewing data as an asset, such as in the approach described by the DoD (2023), requires the creation of carefully selected data sets and strong governance and management systems.

In line with the practices of the DoD's VAULTIS strategy (making data *visible, accessible, understandable, linked, trustworthy, interoperable* and *secure*), the CAF should prioritize the implementation of systems that similarly guarantee these elements of data (ibid.). The CAF should implement comparable strategies to the United Kingdom's Digital Strategy for Defence and Data Strategy for Defence, aiming to remove digital silos and build standardized data architectures and exploitation platforms (MoD 2023). It is essential to prioritize the development of sophisticated and secure platforms for sharing complex data (ibid.), which would greatly enhance data accessibility and facilitate collaboration among stakeholders.

In addition, conducting research on automatic anonymization techniques with the support of a Canadian counterpart to the United Kingdom's Defence Artificial Intelligence Centre might effectively tackle privacy concerns and promote the development of AI applications (MoD 2023). It is equally important to create a decentralized network connecting data suppliers and consumers' aims to improve the quality of data and encourage collaboration across different functions (DoD 2023). By considering data as a commodity and promoting responsibility and openness, the CAF can enhance their decision-making processes by relying on data and reducing unnecessary repetition (MoD 2022).

For successful decision making, it is crucial to prioritize a federated infrastructure for data, analytics and AI, as implemented by the MoD (2023). The CAF should evaluate this infrastructure by considering the level of difficulty in implementing it and the extent to which the outcomes are shared, to find the best balance between platforms and services (DoD 2023). To fulfill computational needs and enable effective data flow, it is necessary to fill the current gap for Canada and develop cloud-hosting capabilities across different classification levels (DoD 2023; DND 2021).

Gaining knowledge from many sectors, namely, the finance industry, can offer useful perspectives on how to effectively incorporate AI into various systems and processes (MoD 2022). By drawing on the knowledge and experience of industries that have effectively used AI, as realized by the MoD (2022), the CAF can create customized protocols and standards. This approach will ensure that AI technology is applied in military operations in a thoughtful and efficient manner.

Governance

Establishing a strong and comprehensive governance framework is of utmost importance for the CAF to efficiently harness the potential of AI (MoD 2022; Wasilow and Thorpe 2019). The data governance strategy from DND/CAF (2022) provides a baseline that could be extended to include responsible AI development for AI governance. By implementing rigorous protocols and an AI ethical code of practice, as executed by the MoD (2022), one may guarantee adherence to ethical principles and security benchmarks.

Effective collaboration with government entities and defence partners — including private sector allies — is essential for resolving policy considerations that span multiple areas (DoD 2023). This approach includes promoting robust communication channels, as advocated by GCHQ (2023), that would cultivate an environment of transparency and accountability in the field of AI development (MoD 2022). Similarly, the MoD highlights the importance of guaranteeing the precision and reliability of data, optimizing agreements for sharing data and creating an operational task force for AI (ibid.).

The DoD (2023) promotes the adoption of a human-machine teaming method to maximize the advantages of AI by combining human moral judgment with the computational capability of machines, which should be replicated by the CAF. The United Kingdom's MoD employs a meticulous approach to safeguarding vital technology by conducting thorough assessments of their dependencies and vulnerabilities. This strategy involves making a clear distinction between “AI now” technologies and “AI next” technologies (MoD 2022). While commercially available, dual-use “AI now” technologies are deemed suitable for global competition, the exploitation or custom development of advanced AI technologies falling under “AI next” may require enhanced protection (ibid.). This process could include assured onshore access in situations where operational independence is paramount (DoD 2023).

Promoting ingenuity and adaptability in the procurement process, drawing inspiration from UK methods, enables the prompt implementation of AI technologies (MoD 2022). By incorporating AI-driven intelligent supply chain solutions, one may guarantee the robustness and effectiveness of supply chain management (ibid.). Similarly, the CAF should be engaging with AI vendors and streamlining procurement processes to foster responsible innovation and prompt integration of AI technologies (DoD 2023; Kazim et al. 2021; MoD 2022).

Conclusion

Ultimately, the CAF is confronted with a complex and diverse environment as it formulates AI regulations for the armed forces. The urgency of tackling ethical, technical and policy concerns is heightened by global rivalry, particularly with China and Russia. Although AI has the potential to bring about significant changes, its deployment without proper oversight can lead to hazards. Developing a sophisticated policy framework is crucial to safely leverage the advantages of AI. It will be essential to find a middle ground between fostering innovation and upholding ethical standards. Through this approach, the CAF may assume a responsible leadership role in the international AI landscape, guaranteeing both ethical integrity and progress in military capabilities.

Recommendations

- **It is imperative to promptly release an AI action plan, as any delay will result in the CAF falling further behind its allies.** This extended period of inaction, at the level of political direction, will result in a widening of capability between Canada and the rest of the world.
- **The primary focus of policy development should be on personnel.** Key areas for improvement include expanding educational opportunities, professional development, skill enhancement, recruitment processes and the use of reserve forces. The policy should likewise regulate personnel's use of AI to mitigate the risk of data being disclosed.
- **Data is an essential asset for the CAF and should be treated as such in the plan.** Suggested enhancements include the reorganization of data methods, revamping how data is shared, the implementation of anonymization techniques and the use of insights from other departments.
- **The last component of the implementation strategy should involve the creation of a robust governance system.** The importance of working together with government institutions and defence partners, ensuring the precision and reliability of data, and promoting collaboration among individuals is emphasized.

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