The Perils and Promise of Artificial Intelligence for the Defence Forces

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All modern Armies will try to ensure superiority over their adversary at all times. This is possible by a country by constantly adopting/developing technical expertise and encouraging new scientific inventions that can be adopted for use in the defence forces. Artificial Intelligence (AI) today stands out as a leading method of gaining technical and, hence, military superiority over one's adversary. But these technologies may not be available off the shelf or from one's allies and partners. Cutting edge technologies like AI will, hence, need to be developed in-house.

AI can be simply defined as the simulation of human intelligence processes by machines, especially computer systems. These processes include the acquisition of information and rules for using the information or learning to use these rules to reach a conclusion or reasoning and improvement or self-correction. AI can also be understood as the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages. Considering the stages of evolution and development of AI in the past few decades, it is clear that AI represents a broad technology with the potential to influence a number of applications in the society and certainly in the way that nations ensure peace and prepare to fight war. However, it is still to be seen what pace of innovation we shall see in the future and so AI may develop to be more

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of an enabler in doing things previously done by human intervention than a piece of computing system or equipment that would take over the functions of war-fighting.

AI has taken numero uno position in all discussions. These discussions span governments, business bodies and academic institutions the world over. AI is being considered as the next panacea for all difficulties. It is also true that a large number of people equate AI in the military context with automated robots that in huge numbers will overwhelm the enemy. These concerns have led to sections in the society looking at AI as a trigger for the start of the next World War. A large number of nations, their leaders and militaries are today looking at leadership in AI being essential to be a global power in the 21st century. It is obvious that in the Indian Army, we need to move beyond the rhetoric of words and consider actual implementation of applications of this technology in the military context. The potential to improve the speed of doing work, the accuracy as also the ability for handling vast amounts of data holds great promise of AI being able to drive the status of our military might to the zenith. AI applications in the military also offer the potential and ability to disrupt the military edge of our adversaries. However, we must keep in mind that the industry's focus in AI is more towards economic competition and technical leadership and will need to be steered for adoption in the defence forces.

Employment of AI in the Defence Forces

The defence forces will be the major beneficiary for any applications of AI that can be developed and deployed to improve effectiveness in the entire gamut of fields such as autonomous weapons, intelligence gathering, data analysis and improved situational awareness. These benefits, besides giving a technological edge over rival military powers, also offer nations the advantage of engaging in military conflict from a stand-off distance with no or substantially lesser human cost and risk. With public opinion driving policy and decisions in countries and growing averseness to own casualties, AI is seemingly a technology that can impel countries toward autonomous weapon systems.

We can divide the ways that AI can help the defence forces in overcoming the challenges of modern warfare into three subsets. These three areas broadly define the current direction that available research is being channellised in to assist militaries in getting an edge over their rivals.

Firstly, *AI could be employed in improving situational awareness*. Considering the plethora of inputs, some precise, while others partially accurate, in different formats and at times of different vintages, AI can be an enabler that provides in real time actionable inputs that help the man in the forwardmost position to take the most appropriate and coordinated action. With the use of algorithms and communication systems, the pilot, rifleman, tankman or artillery operator can timely, accurately and optimally engage multiple targets as they come up within range. The greater the fog of war, the more useful shall AI technology be in directing, coordinating and employing military assets.

This leads us onto the second subset *where AI can assist in handling enormous amounts data* that are available and need to be sifted, and from which actionable intelligence needs to be derived. A number of commercial enterprises are actively involved in large data analytics. Technologies are being constantly improved to speed up the data interpretation process, freeing manpower for monitoring tasks and higher decision-making. This is especially useful in more timely interpretation of imagery from satellite and drone surveillance feeds. AI could, thus, help militaries to more accurately and quickly interpret information, which could lead to better decision-making.

Thirdly, *in terms of the assistance AI provides in shortening the OODA (Observe, Orient, Decide, Act) loop*. With the increase in both the speed of the battle and the depth of the battlefield, there is an ever growing necessity to automate systems that can coordinate and direct battle processes at faster speeds. Speed can provide a great advantage in modern wars and especially speed in decision-making; like in the technology being used by Israel in the air defence cover provided by the Iron Dome.

AI backed systems can effectively be used to overcome situations such as where the reflexes of human operators are overwhelmed by a saturating attack of missiles. Also autonomous systems or remotely-piloted systems/aircraft using AI could remove the immense risk and prolonged fatigue faced by human pilots.

Problems in Effectively Employing AI in the Defence Forces

Adoption of AI by the defence forces faces challenges in terms of both technology and organisational requirements which affect some vital aspects of reliability in adverse environments as existing in battlefields. The intrinsic nature of narrow AI systems is that they are programmed to execute/perform very particular tasks, whether language translation or

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interpreting images. In warfare, however, the environment shifts rapidly due to a large number of inputs and possibilities. If the situation or the input pattern for a particular AI system changes, AI based systems may be unable to adapt to this change and may give erroneous outputs. This fundamental lack of reliability or assurance of fail safety, thus, becomes a risk in the deployment of an AI-based system. AI systems, when facing each other in a battlefield, could generate complex outcomes that are beyond the ability of the other system to reasonably comprehend and may lead to a breakdown of the system responses and an increased probability of unmanageable outcomes.

Defence systems operate on Standard Operating Procedures (SOPs) to ensure all that entities are on the same grid and interoperability is possible. People manning control stations work on trust and common training to know what their co-workers are doing and are likely to do. With self-thinking systems that will programme themselves envisaged to be developed under AI-based projects, commanders will not know exactly what AI will do in a given situation. This will make operations unpredictable and infinitely complicate planning and coordination, making accidents more likely.

As the very basis of AI means a machine that is learning from inputs and reprogramming itself so that it is determining the best action and taking it, it may make it hard for controllers to predict the behaviour of AI systems. A popularly quoted example is of AlphaGo who defeated Lee Sedol, one of the best Go players in the world. In this incident, AlphaGo made a hithertofore novel move such that Sedol was left stunned for over 15 minutes and unable to consider what to do next. It turned out that the move was simply something that no human player had considered before, but the machine had figured it out. That shows the unique unpredictability of AI and, hence, the fear of deploying it in the self decision-making processes.

The necessity and also challenge of programming an AI system for every conceivable contingency can also undermine the reliability of the system. Further, AI-based games developed in research labs have trained or reprogrammed themselves to pause the game to avoid losing. These behavioural abnormalities shown by AI systems will certainly be a challenge for the defence forces and inhibit their deployment. It is important that defence systems work strictly within laid down parameters and provide

a strong sense of reliability. The threat to reliability comes also from enemy actions of hacking into AI systems. "Poisoning" of input data from surveillance feeds to vulnerabilities created by disrupting operations will be a potentional threat to the reliability of these systems. Hardening and securing of systems will, however, have an operational effectiveness issue by making the systems slower, bulky and less efficient. These systems must also provide "explainability" to their actions and cannot be perceived as arbitrary, sudden or at variance with laid down parameters.

Employment Dilemma for the Forces

AI systems under research cover the entire gamut from autonomous systems to decision control systems. At present, most AI systems are in the stage between technology development and system testing. The time gap between prototype production and deployment for active use may still be long. And this gap is because of the need for the defence forces to be confident that the AI systems are better than the existing systems. As we have seen in the past, issues of safety, reliability and coordination in battlefield conditions test the endurance of systems to their limits, and need time for glitch fixing before they can be deployed in operational implementation. This is not, however, reason enough for the present fervour of AI research to slow down. But these safety and reliability concerns will certainly influence the types of AI systems developed, as well as their pace and scale of integration into "regular" military operational planning. The potential promise of improved effectiveness, lower risk to human soldiers, and lower cost will compete with the challenges of safety and reliability to influence how militaries deploy AI systems.

AI and the Future of War-Fighting

The all-pervasive employment of AI in the world of tomorrow seems a forgone conclusion. And the same seems the case of its use in the defence forces around the world. The shift of processes to become autonomous and automated will have a tectonic impact on national economies and on society at large. While most nations have not committed AI to do the actual killing in a war zone, it may just be a matter of time for nations to take that step seeing the potential promise of AI-backed systems. Already, intelligence branches and even logistics and operational branches are adopting AI systems to improve the speed and reliability of processing data and managing operations, while putting fewer combatants at risk.

China has unleashed a massive drive of investment in AI in academic, commercial and military circles. Other developed and developing countries are also playing catch-up to ensure the superiority of their militaries, with the conviction that technological changes could influence military superiority without guaranting success.

We cannot be certain of the consequences of AI for defence forces around the world, given the uncertainty of technology and research being able to reach the stage of deployment, and keeping in mind the challenges of ethics, safety and reliability, it is possible that like so many potential technologies developed in the past, analysts will recall the AI fad after a few decades. But given its possibilities as a technology, as compared to anything before and the degree of commercial interest and investment in AI, it seems more likely that the age of AI is likely to shape the next generation of defence forces.

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