Artificial Intelligence in Military Operations: Technology and Ethics Indian Perspective

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Abstract

Artificial Intelligence (AI) technologies hold great promise for facilitating military decisions, minimising human causalities and enhancing the combat potential of forces. This article focuses on development and fielding of Lethal Autonomous Weapon Systems (LAWS) against the backdrop of rapid advances in the field of AI, and its relevance to the Indian security scenario. It gives a broad overview of the possible military applications of this technology and brings out the main legal and ethical issues involved in the current ongoing debate on development of LAWS. Further, international as well as Indian perspectives are given out on the development and deployment of LAWS. It reviews the status of AI technology in India, assesses the current capability of the Indian Army (IA) to adapt to this technology, and suggest steps which need to be taken on priority to ensure that Indian defence forces keep pace with other advanced armies in the race to usher in a new AI-triggered Revolution in Military Affairs (RMA).

Introduction

Artificial Intelligence (AI) has become a field of intense interest and high expectations within the defence technology community. AI technologies hold great promise for facilitating military decisions, minimising human causalities and enhancing the combat potential of forces, and in the process dramatically

changing, if not revolutionising, the design of military systems. This is especially true in a wartime environment, when data availability is high, decision periods are short, and decision effectiveness is an absolute necessity.

The rise in the use of increasingly autonomous unmanned aerial vehicles (UAVs) in military settings has been accompanied by a heated debate as to whether there should be an outright ban on Lethal Autonomous Weapon Systems (LAWS), sometimes referred to as 'killer robots'. Such AI enabled robots, which could be in the air, on the ground, or under water, would theoretically be capable of executing missions on their own. The debate concerns whether artificially intelligent machines should be allowed to execute such military missions, especially in scenarios where human lives are at stake.

This article focusses on development and fielding of LAWS against the backdrop of rapid advances in the field of AI, with special emphasis on legal and ethical issues associated with their deployment. It also reviews the status of AI technology in India, assesses the current capability of the Indian Army (IA) to adapt to this technology, and suggest steps which need to be taken on priority to ensure that we do not get left behind other advanced armies in the race to usher in a new AI-triggered Revolution in Military Affairs (RMA).

AI – Current Status of Technology

AI – A Maturing Technology- A general definition of AI is the capability of a computer system to perform tasks that normally require human intelligence, such as visual perception, speech recognition and decision-making. Functionally, AI enabled machines should have the capability to learn, reason, judge, predict, infer and initiate action. In layman's terms, AI implies trying to emulate the brain. There are three main ingredients that are necessary for simulating intelligence: the brain, the body, and the mind. The brain consists of the software algorithms which work on available data, the body is the hardware and the mind is the computing power that runs the algorithms. Technological breakthroughs and convergence in these areas is enabling the AI field to rapidly mature.

AI, Machine Learning and Deep Learning - Year before last, in a significant development, Google DeepMind's AlphaGo program defeated South Korean Master Lee Se-dol in the popular board game Go, and the terms AI, Machine Learning, and Deep Learning were used to describe how DeepMind won. The easiest way to think of their inter-relationship is to visualise them as concentric circles, with AI the largest, then Machine Learning, and finally Deep Learning - which is driving today's AI explosion - fitting inside both.[1] AI is any technique that enables computers to mimic human intelligence. Machine Learning is a subset of AI, which focuses on the development of computer programs that can change when exposed to new data, by searching through data to look for patterns and adjusting program actions accordingly. Deep Learning is a further subset of Machine Learning that is composed of algorithms which permit software to train itself by exposing multi-layered neural networks (which are designed on concepts borrowed from a study of the neurological structure of the brain) to vast amounts of data.

AI Technologies - The most significant technologies which are making rapid progress today are natural language processing and generation, speech recognition, text analytics, machine learning and deep learning platforms, decision management, biometrics and robotic process automation. Some of the major players in this space are: Google, now famous for its artificial neural network based AlphaGo program; Facebook, which has recently announced several new algorithms; IBM, known for Watson, which is a cognitive system that leverages machine learning to derive insights from data; Microsoft, which helps developers to build Android, iOS and Windows apps using powerful intelligence algorithms; Toyota, which has a major focus on automotive autonomy (driver-less cars); and Baidu Research, the Chinese firm which brings together global research talent to work on AI technologies.

AI – Future Prospects -. Today, while AI is most commonly cited for image recognition, natural language processing and voice recognition, this is just an early manifestation of its full potential. The next step will be the ability to reason, and in fact reach a level where an AI system is functionally indistinguishable from a

human. With such a capability, AI based systems would potentially have an infinite number of applications.[2]

The Turing Test - In a 1951 paper, Alan Turing proposed the Turing Test to test for artificial intelligence. It envisages two contestants consisting of a human and a machine, with a judge, suitably screened from them, tasked with deciding which of the two is talking to him. While there have been two well-known computer programs claiming to have cleared the Turing Test, the reality is that no AI system has been able to pass it since it was introduced. Turing himself thought that by the year 2000 computer systems would be able to pass the test with flying colours! While there is much disagreement as to when a computer will actually pass the Turing Test, one thing all AI scientists generally agree on is that it is very likely to happen in our lifetime.[3]

Fear of AI - There is a growing fear that machines with artificial intelligence will get so smart that they will take over and end civilisation. This belief is probably rooted in the fact that most of society does not have an adequate understanding of this technology. AI is less feared in engineering circles because there is a slightly more hands-on understanding of the technology. There is perhaps a potential for AI to be abused in the future, but that is a possibility with any technology. Apprehensions about AI leading to end-of-civilisation scenarios are perhaps largely based on fear of the unknown, and are largely unfounded.

AI in Military Operations

AI – Harbinger of a New RMA? Robotic systems are now widely present in the modern battlefield. Increasing levels of autonomy are being seen in systems which are already fielded or are under development, ranging from systems capable of autonomously performing their own search, detect, evaluation, track, engage and kill assessment functions, fire-and-forget munitions, loitering torpedoes, and intelligent anti-submarine or anti-tank mines, among numerous other examples. In view of these developments, many now consider AI and Robotics technologies as having the potential to trigger a new RMA, especially as Lethal Autonomous Weapon Systems (LAWS) continue to achieve increasing levels of sophistication and capability.

"LAWS" – Eluding Precise Definition. In the acronym "LAWS", there is a fair amount of ambiguity in the usage of the term "autonomous", and there is lack of consensus on how a "fully autonomous" weapon system should be characterised. In this context, two definitions merit mention, as under:-

(a) **US Department of Defence Definition**. A 2012 US Department of Defence (DoD) directive defines an autonomous weapon system as one that "once activated, can select and engage targets without further intervention by a human operator." More significantly, it defines a semi-autonomous weapon system as one that, "once activated, is intended to engage individual targets or specific target groups that have been selected by a human operator". By this yardstick, a weapon system, once programmed by a human to destroy a "target group" (which could well be interpreted to be an entire army) and thereafter seeks and destroys individual targets autonomously, would still be classified as semi-autonomous![4]

(b) **Human Rights Watch Definition**. As per Human Rights Watch (HRW), "fully autonomous weapons are those that once initiated, will be able to operate without Meaningful Human Control (MHC). They will be able to select and engage targets on their own, rather than requiring a human to make targeting and kill decisions for each individual attack." However, in the absence of consensus on how MHC is to be specified, it concedes that there is lack of clarity on the definition of LAWS.[5]

Narrow AI – An Evolutionary Approach. There is a view that rather than focus autonomous systems alone, there is a need to leverage the power of AI for increasing the combat power of the current force. This approach is referred to as "Narrow" or "Weak" AI. Narrow AI could lead to many benefits, as follows: using image recognition from video feeds to identify imminent threats, anticipating supply bottlenecks, automating administrative functions, etc. Such applications would permit force re-structuring, with smaller staff comprising of data scientists replacing large

organisations. Narrow AI thus has the potential to help the Defence Forces improve their teeth-to-tail ratio.[6]

Centaur: Human-Machine Teaming. Another focus area on the evolutionary route to the development of autonomous weapons is what can be termed as "human-machine teaming", wherein machines and humans work together in a symbiotic relationship. Like the mythical centaur, this approach envisages harnessing inhuman speed and power to human judgment, combining machine precision and reliability with human robustness and flexibility, as also enabling computers and humans helping each other to think, termed as "cognitive teaming". Some functions will necessarily have to be completely automated, like missile defense lasers or cybersecurity, and in all such cases where there is no time for human intervention. But, at least in the medium term, most military AI applications are likely to be team-work: computers will fly the missiles, aim the lasers, jam the signals, read the sensors, and pull all the data together over a network, putting it into an intuitive interface, using which humans, using their experience, can take well informed decisions.[7]

LAWS – Legal and Ethical Issues

LAWS powered by AI are currently the subject of much debate based on ethical and legal concerns, with human rights proponents recommending that development of such weapons should be banned, as they would not be in line with international humanitarian laws (IHL) under the Geneva Convention. The legal debate over LAWS revolves around three fundamental issues, as under:-

(a) **Principle of "Distinction".** This principle requires parties to an armed conflict to distinguish civilian populations and assets from military assets, and to target only the latter (Article 51(4)(b) of Additional Protocol I).

(b) **Principle of "Proportionality"**. The law of proportionality requires parties to a conflict to determine the civilian cost of achieving a particular military target and prohibits an attack if the civilian harm exceeds the military

advantage (Articles 51(5)(b) and 57(2)(iii) of Additional Protocol I).

(c) **Legal Review**. The rule on legal review provides that signatories to the Convention are obliged to determine whether or not new weapons as well as means and methods of warfare are in adherence to the Convention or any other international law (Article 36 of Additional Protocol I).

Marten's Clause. It has also been argued that fully autonomous weapon systems do not pass muster under the Marten's Clause, which requires that "in cases not covered by the law in force, the human person remains under the protection of the principles of humanity and the dictates of the public conscience" (Preamble to Additional Protocol I).[8]

"Campaign to Stop Killer Robots"- Under this banner, Human Rights Watch (HRW) has argued that fully autonomous weapon systems would be prima facie illegal as they would never be able to adhere to the above provisions of IHL, since such adherence requires a subjective judgement, which machines can never achieve. Hence, their development should be banned at this stage itself.[9]

Counter-Views- There is an equally vocal body of opinion which states that development and deployment of LAWS would not be illegal, and in fact would lead to saving of human lives. Some of their views are listed as under[10]:-

(a) LAWS do not need to have self-preservation as a foremost drive, and hence can be used in a self-sacrificing manner, saving human lives in the process.

(b) They can be designed without emotions that normally cloud human judgment during battle leading to unnecessary loss of lives.

(c) When working as a team with human soldiers, autonomous systems have the potential capability of objectively monitoring ethical behaviour on the battlefield by all parties.

(d) The eventual development of robotic sensors superior to human capabilities would enable robotic systems to pierce the fog of war, leading to better informed "kill" decisions.

(e) Autonomous weapons would have a wide range of uses in scenarios where civilian loss would be minimal or non-existent, such as naval warfare.

(f) The question of legality depends on how these weapons are used, not their development or existence.

(g) It is too early to argue over the legal issues surrounding autonomous weapons because the technology itself has not been completely developed yet.

Degree of Autonomy and Meaningful Human Control (MHC) – Central to the issues being debated are the aspects of degree of autonomy and MHC. LAWS have been broadly classified into three categories: "Human-in-the-Loop" LAWS can select targets, while humans take the "kill" decision; "Human-on-the-Loop" weapons can select as well as take "kill" decisions autonomously, while a human may override the decision by exerting oversight; and "Human-out-of-the-Loop" LAWS are those that may select and engage targets without any human interaction. Entwined within this categorisation is the concept of MHC, i.e., the degree of human control which would pass muster under IHC. Despite extensive discussions at many levels, there is no consensus so far on what is meant by full autonomy as also how MHC should be defined.[11,12]

Deliberations at the UN- Triggered by the initiatives of HRW and other NGOs, an informal group of experts from a large number of countries has been debating the issue of LAWS for three years now at the United Nations Office of Disarmament Affairs (UNODA) forum, Convention on Certain Conventional Weapons (CCW). In December 2016, countries agreed to formalise these deliberations, and as a result a Group of Governmental Experts (GGE) has been established, the first of which was held from 13-17 Nov 2017, chaired by Ambassador Amandeep Gill of India. Approximately 90 countries along with many other agencies participated in the meeting. Some of the

conclusions arrived at during the meeting are as follows: states must ensure accountability for lethal action by any weapon system used by them in armed conflict; acknowledging the dual nature of technologies involved, the Group's efforts should not hamper civilian research and development in these technologies; and, there is a need to keep potential military applications using these technologies under review. It was also agreed that a ten-day meeting should be scheduled in 2018.

AI In Military Operations – International Perspective

LAWS – Current Status of Deployment- As of now, near-autonomous defensive systems have been deployed by several countries to intercept incoming attacks. Offensive weapon systems, in contrast, would be those which may be deployed anywhere and actively seek out targets. However, the difference between offensive and defensive weapons is not watertight. The most well-known autonomous defensive weaponry are missile defense systems, such as the Iron Dome of Israel and the Phalanx Close-In Weapon System used by the US Navy. Fire-and-forget systems, such as the Brimstone missile system of the United Kingdom and the Harpy Air Defense Suppression System of Israel, are also near-autonomous. South Korea uses the SGR-A1, a sentry robot with an automatic mode, in the Demilitarised Zone with North Korea. One example of an offensive autonomous system likely to be deployed in the near future is Norway's Joint Strike Missile, which can hunt, recognize and detect a target ship or land-based object without human intervention.[13]

US DoD Perspective and the Third Offset Strategy- The US has put AI at the centre of its quest to maintain its military dominance. In November 2014, the then US Secretary of Defense Chuck Hagel announced a new Defense Innovation Initiative, also termed as the Third Offset Strategy. Secretary Hagel modelled his approach on the First Offset Strategy of the 1950s, in which the US countered the Soviet Union's conventional numerical superiority through the build-up of America's nuclear deterrent, and on the Second Offset Strategy of the 1970s, in which it shepherded the development of precision-guided munitions, stealth, and intelligence, surveillance, and reconnaissance (ISR)

systems to counter the numerical superiority and improving technical capability of Warsaw Pact forces. As a part of its Third-Offset Strategy, the Pentagon is reportedly dedicating $18 billion for its Future Years Defense Program. A substantial portion of this amount has been allocated for robotics, autonomous systems, human-machine collaboration, and cyber and electronic warfare.[14,15]

Chinese Initiatives- China is also laying a huge focus to AI enabled autonomous systems. In August last year, the state-run China Daily newspaper reported that the country had embarked on the development of a cruise missile system with a "high level" of AI. The announcement was thought to be a response to the "semi-autonomous" Long Range Anti-Ship Missile expected to be deployed by the US in 2018. Chinese military leaders and strategists believe that the nature of warfare is fundamentally changing due to unmanned platforms. High-level support for R&D in robotics and unmanned systems has led to a myriad of institutes within China's defense industry and universities conducting robotics research. China's leaders have labelled AI research as a national priority, and there appears to be a lot of co-ordination between civilian and military research in this field.[16]

AI in Military Ops – Indian Perspective

Perhaps as a result of being preoccupied with the huge challenges being faced on operational and logistic fronts including issues related to modernisation, the AI/ robotics/ LAWS paradigm is yet to become a key driving force in the doctrinal thinking and perspective planning of the IA. The above discussion dictates that this needs to change. The following paragraphs shed some light on the relevance of AI and LAWS in our context and what we need to do in order to keep pace with 21st Century warfare.

Employment Scenarios- The Indian military landscape is comprised of a wide variety of scenarios where autonomous systems (AS), and more specifically LAWS, can be deployed to advantage. With the progressive development of AI technologies, example scenarios in increasing degree of complexity can be visualised as under[17]:-

(a) **Anti-IED Operations**. Autonomous systems designed to disarm IEDs are already in use in some form, although there is scope for further improvement. Such autonomous systems are “non-lethal” and “defensive” in nature.

(b) **Swarm of Surveillance Drones**. An AI-enabled swarm of surveillance drones (as against manually piloted Unmanned Aerial Vehicles (UAVs) or Unmanned Undersea Vehicles (USVs)) could greatly boost our surveillance capabilities. Such a system would be “non-lethal”, but could support both offensive and defensive operations.

(c) **Robot Sentries**. There is scope for deployment of Robot Sentries, duly tailored to our requirements, along the IB/LC, on the lines of SGR-A1. Such a deployment would be categorised as “lethal” and “defensive” in character.

(d) **Autonomous Armed UAVs/USVs**. We are currently in the process of procuring manually piloted armed UAVs. Future armed UAVs/USVs with increasing degrees of autonomy in navigate/ search/ detect/ evaluation/ track/ engage/ kill functions may be visualised. Such systems would be classified as “lethal” and “offensive”.

(e) **Land-Based Offensive Robot Soldiers**. Offensive or ‘Killer Robots’ deployed in land-based conventional offensive operations would require a much higher technological sophistication to become a feasible proposition.

(f) **Robot Soldiers in Counter-Insurgency (CI) Operations**. If Robot Soldiers are to be successfully deployed in CI operations, a very high AI technology threshold would need to be breached. In addition to a more sophisticated “perceptual” ability to distinguish an adversary from amongst a friendly population, qualities such as “empathy” and “ethical values” similar to humans would need to be built into such systems. As per one school of thought, such capability can never be achieved, while others project reaching such a technological “singularity” within this century.

India’s Stand at the UN

India's response in international fora has been to hedge against the future and, until such weapons are developed, attempt to retain the balance of conventional power that it currently enjoys in the sub-continent. At the Informal Meeting of Experts on LAWS held in Geneva in April 2016, India reiterated this strategy. Our permanent representative at the UN, Ambassador DB Venkatesh Varma stated that the UN CCW on LAWS "should be strengthened … in a manner that does not widen the technology gap amongst states", while at the same time endorsing the need to adhere to IHL while developing and deploying LAWS.[18]

India's Overall Strategy

International deliberations on legal and ethical issues related to LAWS is unlikely to slow the pace of their development and deployment by various countries. China is already well on its way to becoming a technology leader in this field, and Pakistan is expected to leverage its strategic relationship with China to obtain these technologies. India, therefore, needs to take urgent steps to ensure that it remains well ahead in this race. It can do this by leveraging the strengths of players from both the public and private sectors. The challenge for the Indian political leadership is to put together a cooperative framework where civilian academia and industry can collaborate with bodies like the Defence Research and Development Organisation (DRDO) to develop autonomous systems. Also, steps should be taken to ensure that the United States becomes India's strategic ally in autonomous technologies.[19]

R&D Initiatives by DRDO

The DRDO stated way back in 2013 that they are developing "robotic soldiers" and that these would be ready for deployment around 2023. Given DRDO's credibility based on past performance, these statements must be taken as an expression of intent rather than as the final word on delivery timelines. DRDO's main facility working in this area is the Centre for Artificial Intelligence and Robotics (CAIR), whose vision, mission and objectives all refer to development of intelligent systems/ AI/ Robotics technologies. CAIR has achieved some headway in making some prototype systems, such as "Muntra" UGV, "Daksh"

remotely operated vehicle, wall climbing and flapping wing robots, etc. It is now in the process of developing a Multi Agent Robotics Framework (MARF) for catering to a myriad of military applications. However, in order to keep in step with progress in the international arena, these efforts alone may not suffice.[21]

AI and Robotics – Perspective of the IA

The Indian Defence Forces, and the IA in particular, are still a long way off from operationalising even older generation technologies pertaining to Network Centric Warfare (NCW) and Information Operations (IO) in general and C4I2SR systems in particular.[20] As regards next generation technologies such as AI and Robotics, presently there appears to be a void even in terms of concepts, doctrines and perspective plans. Occasional interactions with CAIR and other agencies do take place, mostly at the behest of the DRDO. Despite good intentions, DRDO is not likely to be successful in developing lethal and non-lethal autonomous systems without the necessary pull from the IA. It is also worth noting that world-wide, R&D in these technologies is being driven by the private commercial sector rather than the defence industry. Unfortunately, Indian equivalents of Baidu, Amazon, Google and Microsoft, etc, are yet to rise to the occasion, despite the strengths of our IT industry. Clearly, much more needs to be done.

IA – Need for a Lead Agency

Given the very high level of sophistication involved in AI/Robotics technologies, together with the fact that our public as well as private sector defence industry is not too mature, our project management interface with R&D agencies cannot afford to be based on purely operational knowledge. Therefore, while the MO and PP Directorates, in conjunction with HQ ARTRAC, would necessarily be central to formulation of concepts and doctrines, it is imperative to institute, in addition, a lead agency which, while being well versed with operational requirements, has a clear grasp of these sophisticated technologies. Currently, MCEME is the designated Centre of Excellence for Robotics. Since AI is a sub-discipline of Computer Science, MCTE appears to be best placed to play the role of a lead agency for the development of AI-based autonomous systems, provided the Corps of Signals develops AI

as an area of super-specialisation. It would be prudent, at this juncture, to brainstorm this issue at the apex level and take urgent follow up action.

Conclusion

Given the extended borders with our adversaries on two fronts and the volatile CI scenarios in J&K and the North-East, it is well appreciated that having sufficient "boots on the ground" is an absolute must. At the same time, it is imperative that the IA keeps pace with the changing nature of warfare in the 21st Century, driven by rapid advances in technology on many fronts. AI/ Robotics technologies, after decades of false starts, today appear to be at an inflection point, and are rapidly being incorporated into a range of products and services in the commercial environment. It is only a matter of time before they manifest themselves in defence systems, in ways significant enough to usher in a new RMA. Notwithstanding the world-wide concern on development of LAWS from legal and ethical points of view, it is increasingly clear that, no matter what conventions are adopted by the UN, R&D by major players in this area is likely to proceed unhindered.

Given our own security landscape, adoption of AI based systems with increasing degrees of autonomy in various operational scenarios is expected to yield tremendous benefits in the coming years. Perhaps there is a need to adopt a radically different approach for facilitating the development of AI-based autonomous systems, utilising the best available expertise within and outside the country. As with any transformation, this is no easy task. Only a determined effort, with specialists on board and due impetus being given from the apex level, is likely to yield the desired results.

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