



Military Application and Integration of AI: Implications for South Asian Security Paradigm

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Abstract

This paper explored South Asian security in the light of military applications and integration of Artificial Intelligence (AI), focusing particularly on India and Pakistan. Various sectors have been transformed by the advent of emerging technologies such as AI. This study also examined the transformation effect of AI-based systems on military strategy, framework of operations and security architecture in a region fraught with geopolitical tensions and conflicts—South Asia. Through an extensive literature review and case studies, the author analysed the current status of AI in military operations as well as its potential for future development. This study investigated the risks and challenges involved with its implementation. It provided evidence of the rise of AI from its earliest inception to today's applications in autonomous systems, cybersecurity and intelligent decision-making processes. The research also examined the strategic competition between India and Pakistan: how AI technologies shape their defence capabilities, and what kind of impact these have on regional stability. The findings emphasized the importance of responsible AI deployment and getting a broader grasp on its implications for security in South Asia. This research enriched the ongoing dialogue about warfare and emerging technologies by aggregating valuable data regarding the ways that AI can enhance military capacity while also changing landscape of security in South Asia.

Keywords: Artificial Intelligence (AI), Emerging Technologies, Warfare, Pakistan, India

1. Introduction

At the dawn of digital revolution, the concept of emerging technology redefines the very fabric of our existence and leads us towards an unexplored realm. Emerging technology is precisely a term used for the futuristic advancement and innovation of cutting-edge inventions in the high-tech industry. (Stephen J. Andriole, 2022). It is widely considered as an immature technology at its development stage, having the potential to modernize the course of defence and military affairs. Some of the emerging technologies such as Autonomous systems and robotics, Artificial Intelligence (AI), cyberspace, and communication and sensors fall under the category of newly developing tech which integrates with existing technology and enhance the proficiency of battle-space. These inventive technologies are presumed to have a revolutionary impact in warfare in such a way that it would revise the advanced characteristics of war-fighting with more effective capability, precision and accuracy, for instance, leading to minimizing the amount of aircrafts for attacking targets and replacing the heavy bombers with light-weight fighter-bombers. (Andrew, 2016). Also, it would lessen the weight of military supplies of fighters, enhance mobility, fortify warriors' strength, increasing the chance of their survivability as well as improve human performance at times of confrontation. (Paul, 2016)

The advent of contemporary technologies such as AI, machine learning, and cyber-attacks has brought about significant changes in the realm of warfare. In particular, AI was initially recognized as a system that acts or behaves like an intelligent human. Later on, the definition evolved as an autonomous, interactive and self-learning mechanism which performs the tasks that require human intelligence and intervention to make it happen. (Idam, 2018). AI centres on creating systems which imitate human intelligence and decision-making process, attained by consuming “big data”, and thereafter analysing, processing, and drawing earlier experiences to optimize its future performance. The period of the 1950s and onwards marked a time in history when a significant interest arose in the field of AI. Alan Turing's publication, “Computer Machinery and Intelligence”, provided a benchmark for assessing computer intelligence. This era also witnessed the coining of the term “Artificial Intelligence” and its widespread adoption coined by John McCarthy in 1955. AI further evolved between the late 1950s through the 1960s representing a rapid growth of innovation, development of programming languages, and bringing AI to mainstream recognition. Development of the first computer bot and autonomous vehicle also happened during this time. Additionally, challenges for AI research and limited interest and financial support by the US government were also observed. The 1980s showed a rapid interest and growth in AI with the age widely known as the “AI boom”. This age showed breakthroughs in research and got the govt funding to assist the researchers. The first vehicle to drive autonomously was also created by Ernst Dickmann and his fellows. The popularity of “Deep Learning Techniques” also became eminent which allowed computers to learn from errors and make autonomous decisions. The late 1980s and early 1990s were the period of ‘AI Winter’ when research on AI came to a standstill. Government and private investors lost interest in AI which gave it a setback.

The late 1990s marked some notable research in AI research. The period of early 2000 and onwards introduced image recognition algorithms, voice-activated personal assistant (Siri), facial recognition systems and the concept of deepfakes and space robots to help astronauts. (Rockwell Anyoha, 2023). The present time witnesses the creation of humanoid robots, fully automated nuclear weapons, more advanced deep learning codes, and AI outperforming humans and systems capable of human-like and code processing. The increasing prevalence of small swarm drones, AI-based battlefield robots (often referred to as Killer Robots), and the integration of AI in defence technologies is a major transition. The military is undergoing a massive transformation due to advancements in AI such as developing unmanned aircraft, ground vehicles,

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robots, and other technologies. Researchers are intensively exploring this field and aim to develop intelligent machines that go beyond human abilities. Nevertheless, it is still under discussion as to whether AI would truly attain or surpass such a level of cognition and decision-making capability. (Camino Kavanagh,2019)

In recent times, the application of military capability extended to AI, Robotics, Cyber-tech, Hypersonic Systems and many more, holds the potential for alarming consequences. The world may not be cognizant of the repercussions of these techs until now but scholars are widely showing concerns about its unpleasant outcome (Michael T. Klare,2018). Several analysts are of the view that AI and Robotics will revolutionize the concept of warfare similar to the technologies that transformed the characteristics of World Wars (I - II) in the first half of 20th century with the advent of armoured vehicles, nuclear weapons, aircraft, explosives and chemical weapons. Some nations are actively involved towards the development of autonomous military drones, unmanned ground vehicles and cyber warfare. AI has also become a concerning debate due to its potential nature towards the escalating conflicts. It plays a crucial role in enhancing the efficiency of armed forces, military logistics, intelligence analysis and predictive maintenance. Thus, AI in military affairs is gaining momentum with the growing emphasis on autonomous and intelligent systems.

This paper will explore the AI-powered systems, its capability, operational strategies, limitations and implications and how it is going to impact South Asia mainly the two nuclear states, i.e., India and Pakistan. As South Asian region has been a centre for geopolitical tensions and conflicts, AI is likely to add a new dimension in warfare which is essential to be explored. Both countries are engaged in the development and deployment of AI technologies such as UAVs, intelligence analysis, surveillance and reconnaissance system etc. Moreover, the paper will also navigate the role of technologies with disruption capability Vis-a-vis the competition between India and Pakistan with respect to its implications in military domain.

2. Evolving Nature of AI

At present, AI has become a readily accessible source with the capability of imitation of human cognition. AI encompasses several subfields, including natural language processing, statistical machine learning, machine inference, and robotics. In some sub-disciplines, such as deep machine learning or machine inference, the need for human involvement in complex decision-making is steadily decreasing. Analysts are speculating that it might lead to a superintelligence which could surpass human intelligence entirely.

The emerging technologies are evolving with self-operating systems blended with AI such as visual understanding, speech recognition, facial identification and decision-making tools. (Omri Gillath et al, 2016). This will enable them to perform multiple tasks like air interdiction, amphibious ground assaults, long-range strikes, and maritime operations without the involvement of human supervision and intrusion generally known as “loitering munitions” or “suicide drones”. (James S. Johnson,2016)

Countries like the US, China and Russia are heavily investing in AI generative tech for several settings like ground, aerial, underwater and naval operations with the benefits of reduced manpower, high performance, better survivability and tactics that are challenging for human-controlled systems. As a matter of fact, several autonomous systems still require human involvement and use military personnel to operate the system. However, the autonomy of unmanned systems will likely become dominant and human involvement will become increasingly less in military actions. The fully autonomous systems are likely to be impractical as they would limit tactical flexibility and develop safety concerns whereas human supervision of self-operating systems poses other challenges like consequences or negative outcomes and memory limitations. Hence, the prospect of a paradigm shift adapting to a future military environment is vague yet possible where numerous manned and unmanned armoured vehicles will collaborate. Nonetheless, the inclusion of AI in the military domain is not inevitable and continually evolving driven by innovation and adaption to the prominent threats and challenges. Though AI offers efficiency and effectiveness it also raises ethical and security concerns that are required to be addressed as its role in military affairs is unfolding.

3. Emerging Technologies in South Asia

Emerging disruptive technologies are making far-reaching alterations and modifications in the context of defence affairs. These technologies are likely to bring a radical change and a major transition in military strategy. Disruptive technology comprises Data, Artificial Intelligence, Autonomy, Space Technologies, and Hypersonic Systems. These technologies are being developed for military purposes mainly by the US, Russia, China and other countries. This predicts another arms race at a global level with the uncertainty of its repercussions.² More countries are advancing worldwide in the field of AI. (Aamna Rafiq,2021). It is also widely and progressively prevailing in South Asia. China has launched advanced unmanned combat aerial vehicles (UCAVs) such as Sea Eagle and Soaring Dragon with medium to high altitude endurance. Another Chinese achievement in the field of AI-integrated weapons is the development of “Sea Whale 2000” which is an autonomous underwater vehicle (AUV) that has the capacity to work 2000 meters underwater for 40 days with long endurance missions.

In India, the debate to expand the relevance of AI from the experimental to the operational stage commenced in 2019 by the Defence AI Council (DAIC). In India, a task force is established to explore various pathways in order to become an AI power in South Asia. The task force comprises representatives from the Defence Research and Development Organisation

(DRDO), the Atomic Energy Commission, the Indian Space Research Organisation (ISRO) as well as the National Cyber Security Advisor (NCSA), and other academic and research institutions. DRDO and CAIR (Centre for Artificial Intelligence and Robotics) also undertook projects with knowledge-based and combined electronic warfare systems which focus on multi-agent robotics, creating AI algorithms for SLAM (Simultaneous Localization and Mapping), drone swarms and decision support systems, together with data mining and intelligence, surveillance, and reconnaissance (ISR) robots. Indian Government is joining other states to trade AI technology and LAWs. Israel, for instance, is extensively supplying UAVs to the Indian armed forces.³ Projects related to the employment of AI-augmented technology in warfare by the Indian military in defence strategy is a deliberate attempt directed towards Pakistan for a mechanised warfare preparing to execute within the next five years.⁴

The military application of AI in Pakistan is relatively limited. The Pakistan Air Force has introduced tactical unmanned aerial vehicles (UAV) and “maritime patrol aircraft” to improve the intelligence, surveillance and reconnaissance capabilities of the Fleet. (Patrol Aircraft,2020). Pakistan has also upgraded the previously made military armed drone namely, “Burraq” integrated with “Selex Galilio Technology” in 2019 which has the capability to eliminate targets from a height of 15,000 feet.⁵ The government of Pakistan successfully established the National Centre of Artificial Intelligence (NCAI) in 2018 which focuses on scientific research and training in the AI. Having nine research labs in different universities emphasizes to solve AI problems.⁶ Another research faculty in Pakistan namely ‘Sino Pak Centre for AI’ is promoting research and development with separate labs including deep learning, intelligent system designs, computer vision, robotics and applied neural interface. The centre aims to take the lead in AI development along with fostering its integration into PAF operations. Primarily, they focus on advancing sensor fusion technology which involves merging data from various resources for instance, radars, lidars and cameras to create a unified model. CENTIAC will also explore several other domains like big data, machine learning, deep learning, predictive analysis and natural language processing (NLP). The development and progress will have an impact on fifth-generation stealth aircrafts, medium-altitude long endurance (MALE), UAVs and other advanced weaponry in Project Azm. (Web Desk,2020).

Within these labs their tasks are to research on cutting-edge robotic systems for instance, UAVs, autonomous robots, swarm robotics, self-supervised learning, prediction, object and face detection, recommendation and speech recognition. Several leading universities in Lahore have initiated AI Research hubs like NUST (National Centre of Robotics and Automation (NCRA) which will provide researchers and scientists to technologically promote Pakistan.⁷ UET Centre of Intelligent Systems and Networks in Peshawar, NUST National Centre of AI in Islamabad, UET AI Research Lab in Lahore, and AI Lab at IBA in Karachi are few leading universities that are providing platform for Youth interested in AI. Pakistan, being a developing country offers opportunities for exploring and innovating in the field of AI to make it a rapidly increasing sector for the country.(Admin,2023)

Many nations have demonstrated keen interest in AI, spanning from advancing their research and development sector to substantial investments, all the way to enhancing their corporate structures, economies, and national security strategies. The rise of AI has undeniably posed a substantial challenge to the global arms control framework. Nowhere is this challenge more pronounced than in the South Asian region, where countries like China and India are vigorously modernizing their armed forces. Both nations are committing significant resources to the integration of AI technologies within their military operations, further complicating the setting of international arms control.

4. Potential Applicability of AI in Military Operations

With the integration of AI, the military operations will radically change with the capacity to enhance the decision-making process and improve intelligence-gathering capabilities. Its optimized performance in the military system will ensure national security and lower the risk of security dilemma. With the help of AI algorithms, the armed forces can not only process but analyse big data pertaining to maintenance, equipment, ammunition and other systems to make prudent decisions and improve operational efficiency. AI is also used in the realm of cyber-security to detect and reduce the likelihood of threats and vulnerabilities. Situational awareness can also be improved by analysing the real-time data through AI systems. (Bianca Torossian et al.2020)

Autonomous systems, which have the potential to do tasks on their own in terms of sensing, perceiving, analysing, planning and decision-making will be used in the battlespace for specific missions. These self-operating systems will be accessible to a majority of state and non-state actors in the near future. With the advent of autonomous systems, humans are going to get free to focus on the more critical tasks of command and control such as logistics, resource allocation and data processing.

4.1. Command and Control

In Command and Control, the potential for the application of AI in military operations encompasses the following aspects in strategic decision-making to provide commanders in delivering timely information. Firstly, AI can assist with Data

Fusion and Analysis where it will gather, combine and analyse vast amount of data obtained from various sources such as satellites, social media, and communication networks. AI then would be able to spot the patterns, trends and unusual things in this data that may not be apparent to human operators. Secondly, with predictive algorithms, AI can also forecast potential developments and outcomes. Similarly, targets can also be identified and detected through AI via image recognition and computer vision in order to reduce certain risks and incidents. For Example, it can predict the movement of enemy, how resources could be used, and the impact of different tactical choices which will help commanders to make smart decisions. Thirdly, AI operating in real-time would help for an immediate access of critical information. This would help in crisis response and battlefield operations. Additionally, AI enhances situational awareness by providing a comprehensive overview of the operational environment, and it assesses risks related to different actions. AI optimizes resource allocation, promotes human-machine collaboration, and continually learns, improving its analytical capabilities over time.

4.2. Cyber-Security

AI is likely to reinforce the cyber-security domain by protecting significant military networks and communication systems through pinpointing and countering cyber threats in real-time operating systems. It does this by quickly spotting and stopping potential attacks as they happen. It can also help with planning how to protect against these attacks and even practice what to do if there's a problem. This helps make sure that the military's important information stays secure and that they're prepared to handle any cyber challenges that come their way. So, AI not only protects but also helps the military get better at dealing with cyber threats.

However, there are some concerns pertaining to the ethical and legal use of AI in military operations. Using AI in the military raises ethical and legal concerns for several reasons. First, there are worries about autonomous weapons, which can make life-and-death decisions without human control, potentially leading to accidental harm and misuse. Bias in AI systems can lead to unfair targeting or discrimination. Accountability for AI-induced errors is unclear, and AI's lack of transparency and privacy issues further complicate matters. The arms race in AI military development can escalate conflicts, and the absence of international regulations adds to the challenge. Striking the right balance between AI's benefits and ethical and legal compliance is essential. The appropriate use of autonomous weapons is highly questioned and its probability of any unintended consequences. Thus, implementing AI in a military context can be crucial, therefore, adherence and consideration to international laws and ethical standards should be maintained and executed.

4.3. Global Competition

The intensifying global competition in AI is grounded in compelling factors. Nations and industries recognize the potential for AI to drive economic growth, achieve technological leadership, and enhance national security. This competition is fuelled by the quest for top AI talent, valuable data, and critical resources, crucial for innovation and staying competitive. AI's cross-industry impact further propels the race, as it promises to disrupt traditional sectors like healthcare and finance. The ever-evolving nature of AI innovation requires continuous efforts to remain relevant and influential in the dynamic AI landscape, making this competition increasingly fierce. The US National Security Commission on AI considers that AI has epoch-making impacts, and they further speculate that it will be the root of massive power for states and corporations for those controlling it. (Christopher Gorman, 2022). In 2017, Russian President Vladimir Putin stated that "whoever becomes the leader in [artificial intelligence] will become the ruler of the world." The People's Republic of China also aspires to become the world champion of AI by 2030. Similarly, AI-augmented technologies will likely affect the strategic stability of South Asian region as well.

4.4. Evolution of Warfare: AI generated Cutting-Edge Technologies

The debate over the changing nature of warfare entered a new era of uncertainty where scholars are actively debating whether the traditional nature of war is changing or not. As of the nature of war, it has always been violent, and aimed at destroying the will of the adversary to retaliate. While the character of war has been in the continuous transformation. In simpler term the primary motive of fighting a war is to overpower the will of an adversary for achieving political goals and for that states resort to maximum conventional military power. Contemporarily, in this modern era of technological advancement dual-use technologies such as AI, machine learning and cyber-attacks on states' digital infrastructure forcing military scholars to rethink about the traditional nature of war because the war waging tactics are also been shifting from violent to non-violent yet vastly of devastating nature. The 2016 US presidential election is the most suitable case in comprehending such a trend where inculcation of generative AI in social media sites utilized as weapon to manipulate the public opinion in favor of Donald Trump.

The smartphones connected with internet play a significant role in hybrid warfare as they allow online agencies to collect user data and enables access to classified facilities effortlessly. However, this is achieved by the identification and activation of strategically positioned microphones and cameras with a simple click of a button. With the incorporation of AI in smartphones, social media has emerged as the primary instrument for conducting Information Warfare and exerting influence over an individual's thoughts, behaviours, and strategic decisions. (Marcus Comiter, 2019)

AI should be regarded as a collection of enabling technologies that hold substantial potential for application across various domains within the military sector. Nevertheless, the integration of AI-powered systems into military weaponry is a process characterized by heterogeneity and varying levels of efficiency. Achieving consistent and universally applicable predictions in AI is challenging due to its integration with other technological domains, leading to intricate interactions. (Niklas Masuhr, 2019)

In the contemporary landscape, the world stands at a pivotal juncture where emerging technologies are reshaping the future of warfare. AI-driven small swarm drones and AI-based battlefield robots, often referred to as Killer Robots, are poised to redefine the nature of warfare. (Leehe Friedman,2016). Furthermore, the infusion of AI into the technological domain represents a revolutionary transformation. The saturation of AI in diverse sectors, ranging from smartphones to aircraft, thereby possessing a competitive edge to major global powers in the adoption of this technology within their defence apparatus. While Unmanned Aerial Vehicles (UAVs), Unmanned Ground Vehicles (UGVs), and robotics may currently occupy a nominal presence, they imply a significant leap forward in the evolution of the military landscape.

4.5. Integration of AI in Warfare

The traditional concept of fighting a war has continually been to subdue the enemy or enemy's will to fight. (Sun Tzu,2021). However, the phenomenal technological advancement in military realm in the past decade or two has brought a huge shift in the means of fighting a war. The modern contemporary means of fighting a war are not limited to artillery or armoured, instead it has actively been shifting to non-conventional means such as manipulative use of social and electronic media, cyber-attacks on governmental assets as well as use of artificially intelligent UAVs in targeting long-distaned targets. The induction of AI in the modern military hardware has been revolutionizing the conventional notion of battlefield. Major global powers US, China and Russia are three of the few nations that are heavily investing in AI based technologies. In 2019, the US established National Security Commission on Artificial Intelligence (NSCAI) tasked to conduct feasible study on the militaristic use of AI. In addition, the US has also established Joint Artificial intelligence Center (JAIC) in order to carry out various AI related learnings in social, economic and military. In the fiscal year 2023-24, the US has allocated 1.1 billion dollars only for AI.

The deployment of AI powered military hardware will not alter the basic nature of warfare, rather it will significantly modify the battlefield strategies and tactics. The decision-making capability will be enhanced at the same time risks are also associated with this concept because machine learning despite quite accurate could malfunction or could be overpowered through cyber-attacks.

The integration of AI in the military technologies has the potential to enhance the operational capability of troops. AI can efficiently be used for detection, precision, speed, battlefield decision making and for surveillance purposes. AI enabled technology plays a crucial role in augmenting military situational awareness by facilitating the processing of extensive data sets, integrating data from diverse sensors, and monitoring dynamic developments across several domains of combat.

4.6. AI in Detection

AI plays a crucial role in the detection of submerged objects through the utilization of several approaches, including active sonar, ambient noise analysis, and non-acoustic sensors. Furthermore, it aids in the process of seabed mapping and facilitates the tracking of ocean currents, so enhancing the level of transparency in the marine environment. AI is employed for the purpose of analysing satellite imagery, with the objective of detecting and discerning various aspects related to military activities. (Phil Stewart ,2018). These include the identification of military infrastructure development, tracking the movement of mobile launchers, and monitoring alterations occurring within military sites. Nevertheless, the implementation of enhanced detection systems, namely in the naval and aerial sectors, may pose a potential challenge to state's current existing security apparatus. (Keir A,2017)

4.7. AI in Precision

AI enhances the accuracy of target selection and tracking, particularly when both the weapon and the target are in motion. This improved precision significantly increases the effectiveness of conventional weapons. While these AI-enhanced conventional weapons may not possess the same destructive power as nuclear weapons, their precision compensates for this limitation. (Gregory,2014) This precision has relevance in counterforce operations, allowing for the targeting of fortified nuclear launch sites without the need for nuclear weapons. Furthermore, the enhanced accuracy in engaging moving targets extends to anti-submarine warfare, enabling engagements at greater distances than previously feasible. (Bryan Clark,2014). As a result, the strategic significance of conventional weapons, especially when integrated with other technologies like hypersonic, has grown, thereby influencing the conventional-nuclear balance.

4.8. AI for Speed

The third notable characteristic of AI is its remarkable speed, underscoring the ability of AI-driven devices to exhibit far quick/shorter response time compared to human counterparts i.e., the application of Automated Target Recognition (ATR) in air defence systems such as Aegis and Patriot. (Jams,2011). Although there are expectations that AI will bring about gradual enhancements to current air defence capabilities, it is improbable that it will fundamentally alter strategic relations within this particular area. The potential ramifications of AI speed could have a notable influence on conventional weaponry. (Jams,2013) This scenario presents the potential for a future in which only autonomous weapons possess the requisite speed to effectively counter other autonomous weapons.

4.9. AI in Decision Making

The integration of AI in military operations has far-reaching implications for decision-making processes. In particular, the use of AI in military logistics and planning software has demonstrated the ability to significantly reduce the time required for deploying forces, as evidenced during the First Gulf War in 1990-91 where precision guided munition drew a wider attention of the military planners and strategists. (Adrienne,2013) Similarly, the enhanced speed in military responses allows for quicker decision-making and the availability of military options within an exceptionally short timeframe.

However, this increased pace of conflict leaves limited time for consultation and input from civilian decision-makers, potentially hindering the thorough consideration of strategic actions.

AI can be harnessed to create highly convincing counterfeit images, such as fabricated satellite imagery depicting activities like the construction or transportation of mobile launchers. These fabricated visuals have the potential to deceive both military authorities and the public, leading to widespread outrage and demands for retaliatory action. This may be exacerbated by the widespread dissemination of misleading information through extensive bot networks, creating a false perception of the scale of outrage. While AI is not the root cause of such crises, it can worsen the challenges associated with navigating them within the existing information ecosystem. The combination of expedited decision-making processes and decisions influenced by misinformation can escalate crises at an increasingly rapid pace, thereby creating a hazardous strategic environment, potentially on a global scale.

4.10. Disruptive/Enabling Military Technologies

The potential impact of AI and Machine Learning (ML) on the military and the future wars are complex and multifaceted subjects that defy straightforward categorization or prediction based on limited keywords or generalized patterns. The European Union identified six emerging disruptive technologies: quantum-based technologies; AI; robotics and autonomous weapons systems; big data analytics; hypersonic weapons systems and space technologies; and new advanced materials. However, the revolutionary trend has been observed in AI, autonomous weapons developments and hypersonic weapons as far as the militaristic aspects of these technologies are concerned.

The utilization of autonomous robots, such as robotic cavalry or Unmanned Aerial Systems (UAS), in military operations raises concerns regarding the potential disadvantage faced by developing countries with limited access to equal technology.⁸ AI has significantly impacted the conventional automobile sector, leading to the advancement of a novel breed of self-driving vehicles. The incorporation of self-driving technology serves as a paradigm for the advancement of autonomous vehicles in the context of military applications. Comparable technologies are being employed in UAVs, robotic systems, and autonomous maritime vehicles. (David,2014)

In the designated realm of military operations, the integration of AI necessitates careful and deliberate calibration. The armed forces encounter a unique challenge in determining the appropriate scope and speed at which traditional organizational structures and ideologies should yield to technology-centric methodologies. This challenge is further compounded by the intricate nature of the problem and the absence of a clear-cut historical precedent in military history for guiding this transitional process.

5. Application and Implication of AI in Military Technologies: Case Study of India and Pakistan

The application of AI in the military domain has been extensively debated in the above headings, but the parallel arguments in the context of South Asian region involve complexity and criticality because of the nuclearization of the region. Therefore, due to the limitations of the research paper, case study of only two influencing states, India and Pakistan have been discussed in the context of AI development, deployment and employment in different fields.

5.1. India

India has been a prominent participant in the advancement of AI, with a particular emphasis on applications in both civilian and military sectors. The national AI strategy of India has undergone a shift towards a predominantly civilian sector prioritizing the utilization of AI for the purposes of fostering economic expansion, promoting social advancement, and ensuring inclusive progress. Nevertheless, India is actively endorsing research and development endeavours aimed at transitioning towards a military environment driven by AI. (Rahul,2014). In June 2018, the Department of Defence Production (DDP) under the Indian Ministry of Defence (IMoD) established the task force to study the future application of AI in defence sector. The official motive of this task force is strategic implementation of AI for National Security and Defence purposes. (Subhasish Sarangi ,2019).The AI Task Force presented its conclusive report, wherein it proposed that India assume a prominent role in the domain of AI within the military sector. The report specifically emphasized the need for India to establish itself as a formidable force in AI applications pertaining to aviation, naval operations, ground systems, cyber warfare, nuclear capabilities, and biological warfare. While there is presently a lack of definitive evidence supporting the direct integration of machine learning into mission-critical systems, it is important to acknowledge that such integration may become a possibility in the future advancement of military technology.

The Defence Research and Development Organization (DRDO) of India, responsible for the examination of the nation's military needs, has demonstrated certain advancements; yet it still faces significant challenges that lie ahead. The establishment of the Centre for Artificial Intelligence and Robotics (CAIR) signifies the creation of a research facility with a specific focus on AI. The research conducted by CAIR principally focuses on the fields of AI, robotics, and intelligent control systems, as indicated by its name. The AI for Network Centric Operations (AINCO) project, developed by CAIR, is a noteworthy achievement in the field of network centricity of the military operations. It encompasses a tailored set of technologies that enable the establishment of a knowledge base, receiving and management of semantic information, reasoning through inference, and correlation of events. Furthermore, there exists a proposal to develop a collection of advanced devices designed for the specific goal of Intelligence, Surveillance, and Reconnaissance (ISR) capability.

ISR capabilities are significantly augmenting situational awareness. This statement underscores the capacity of autonomy and machine learning to effectively gather and analyse data from diverse sources, with a specific focus on real-time monitoring in network-centric settings. The utilization of UAVs by India for the purposes of surveillance, border security, and marine patrol. These UAVs include Nishant, Lakshya, Rustom, and the autonomous Netra quadcopter. Furthermore, the data obtained from ISR operations, gathered through diverse methodologies, can be autonomously examined to yield more profound understandings. This has the potential to enhance human capacities or allocate additional time for individuals to focus on critical aspects of decision-making. The creation of the Command Information and Decision Assistance System (CIDAS) by CAIR aims to facilitate the storage, retrieval, processing, correlation, fusion, and visualization of tactical data with the primary objective is to offer commanders with efficient decision assistance.

Early-warning and control systems play a crucial role in the identification and notification of potential threats. An example of such a system is the Indian Himshakti electronic warfare system, which has been developed by the DRDO in 2019.⁹ This system serves the purpose of surveillance, analysis, interception, and disruption of communication and radar signals. The utilization of autonomy and machine learning has been suggested as a method to automate the process of threat identification and minimize cyberthreats, with the ultimate goal of protecting a nation's key assets. Aside from the supervision of resources and monitoring of inventories, these technologies have the capability to centralize the requirements for signal-based inspection and repair. The implementation of autonomous systems can be employed for the purpose of fault detection, diagnosis, and maintenance monitoring within weapon systems, thereby guaranteeing their operational preparedness.

Despite the notable progress made by India AI domain, the process of incorporating autonomy and machine learning into mission-critical systems is anticipated to be a time-consuming endeavour, necessitating a subsequent revolution in the field of AI. The comparatively slow adoption of new military technologies in India can be attributed to the country's risk-averse approach and adherence to existing protocols. Furthermore, the concept of autonomy and machine learning is commonly perceived as a collaborative approach to improve the effectiveness of current systems, rather than being seen as complete and standalone solutions.

5.2. Pakistan

Pakistan's AI vision prioritises economic, educational, and social progress. In the year 2019, Pakistan initiated the 'Digital Pakistan' campaign with the objective of integrating AI in technologies to promote the well-being of the general populace. The initiative comprises two key components, namely the 'Pakistan Institute of Artificial Intelligence and Computing (PIAIC)' and the 'National Centre for Artificial Intelligence (NCAI)', which aim to facilitate the progress and development of artificial intelligence inside the nation. The primary focus of the PIAIC lies in the domains of education, research, and commercial growth pertaining to AI and its associated disciplines. While the government is primarily determined to position Pakistan as a central hub for several cutting-edge technologies, including AI, data sciences, augmented reality, blockchain, edge computing, cloud-native computing, and the Internet of Things (IoT). The PIAIC has implemented three distinct one-year programs focused on the domains of AI, cloud-native computing, and blockchain technology.

The NCAI, established in 2018 as part of the government's 'Vision 2025' initiative, seeks to promote and advance research in the field of AI within Pakistan. The objective is to establish itself as a prominent centre for innovation, scientific inquiry, information dissemination, and regional economic development in the field of AI and its associated disciplines. The project was granted a financing of PKR 1.1 billion over a span of three years. It successfully created laboratories at six prestigious universities in Pakistan, with a specific emphasis on exploring different facets of AI and intelligent technologies. The selection of these laboratories and their corresponding chief investigators was conducted through a rigorous procedure by the Higher Education Commission (HEC) and the Planning Commission of Pakistan.

The Pakistani military acknowledges the significance of AI technology and remains well-informed of its advancements, driven by the problems prevalent in its geopolitical context. In 2020, the Pakistan Air Force (PAF) inaugurated the Centre of Artificial Intelligence and Computing (CENTAIC) with the objective of incorporating AI into contemporary air combat strategies. The CENTAIC system fulfills dual functions, catering to both military and civilian needs, hence facilitating the integration of AI into the operations of the PAF.

The role of CENTAIC include the facilitation of worldwide cooperation in the field of AI, namely in the areas of research and development. Additionally, CENTAIC assumes a crucial function in the advancement of cutting-edge weaponry and fifth-generation stealth fighter aircraft, alongside the production of Medium-Altitude Long-Endurance (MALE) and UAVs under the framework of Project Azm. The utilization of AI in Project Azm encompasses the implementation of advanced algorithms for the guidance systems of missiles, the application of image processing techniques for Television/Infrared (TV/IR) seekers, and the ongoing development of Human-Machine Interfaces (HMI).¹⁰ CENTAIC plays a crucial role in maintaining the technological superiority and competitive edge of the PAF in contemporary air combat over the adversary holding an asymmetrical air prowess.

The government has implemented steps during the past two years with the objective of speeding up digitalization. However, it is crucial that these measures are implemented with unwavering commitment and resolve. The progress of the ICT business is impeded by the phenomenon of AI brain drain, necessitating a need for its resolution. The absence of domestic

hardware manufacture and little software control in Pakistan may result in a dependence on external sources to fulfil the country's cyber security requirements. Therefore, it is imperative for the country to expedite its collaboration with prominent international leaders in the field of AI, with a particular focus on China, to augment the processes of learning and system induction.

In the current circumstances, it is crucial for military forces to dedicate their resources to the creation and use of AI systems that are developed within their own country. This should specifically prioritise improving the protection of data and assuring reliable operational capacities. Pakistan houses some exceptionally skilled software firms that are leading the way in advancing artificial intelligence. Ensuring the upkeep, advancement, and dissemination of AI technical and theoretical expertise is essential for making substantial contributions on both national and global scales.

6. Conclusion

The Artificial Intelligence (AI) and other emerging techs have changed the course of warfare. The South Asian security perceived a paradigm shift in military affairs with the incorporation of AI in their weapons and technology. The significant evolution of AI along with its applicability ranges from command and control, cyber-security, decision-making, detection, precision and speed. In addition to its advancement and accomplishments, it raises ethical and legal deliberations regarding the risk of decision-making, accountability in self-automated systems and the possibility for mass surveillance. The AI generated automated robots have their potential disruptive nature in its applicability, having the expertise to kill the enemy autonomously, reducing manpower and surpassing human cognition on the frontline. In the case studies of India and Pakistan, it is evident that both nations continue to invest in AI capabilities and is rapidly advancing yet it is crucial for the regional powers to establish common standards and guidelines for the use of AI in warfare for strategic stability in South Asia. The urge to upgrade the defence sector with AI is emerging, expanding and being competed globally among the super-powers. The future of warfare is being documented in lines of code and it has become essential for the nations to adapt its advancement or risk being left behind.

The analysis presented in this research paper compels a declarative call to action, urging policy makers and military leaders to utilize the transformative power of AI and transform the course of South Asian security. In light of these findings, it is crucial for South Asian nations to prioritize the sensible development and deployment of AI in defence sector, ensuring that its benefits are controlled while mitigating its risks. The future of South Asian security depends on embracing the transformative power of AI, fostering regional cooperation, and promoting a culture of responsible innovation.

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