Integration of Artificial Intelligence in Operation Swords of Iron

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WRITING ASSIGNMENT

Abstract

The rapid advancement of technology, particularly artificial intelligence (AI), is reshaping modern warfare and intensifying global competition for military superiority. Although the United States and China are commonly viewed as leading actors in AI development, other states, including Israel, are increasingly integrating AI systems into military operations. Operation Swords of Iron offers an example of AI enabled warfare, demonstrating how AI tools can enhance situational awareness, decision-making, and reduce human cognitive load. This writing assignment examines the role of AI in military operations by analysing its integration through the OODA Loop (Observe–Orient–Decide–Act) during Operation Swords of Iron. The analysis identifies how AI supported the Observe, Orient, Decide and Act phases, improving operational speed, precision, and efficiency while also introducing new risks and vulnerabilities. The findings highlight both the transformative potential and the emergent challenges of AI driven decision-making, providing insight into the future of AI integration in armed conflict.

Keywords: *Artificial Intelligence in Warfare, OODA Loop, Operation Swords of Iron, Israeli Defence Force (IDF), Israel.*

Introduction

The rapid evolution of technology is not only influencing our everyday lives, but also transforming modern warfare. Artificial intelligence (AI) is already recognized as one of the most transformative innovations in history. Furthermore, it is becoming a strategic necessity for armed forces worldwide. As Russian President Vladimir Putin declared 'Whoever becomes the leader in this sphere [artificial intelligence] will become ruler of the world' [9]. This statement highlights already existing competition for AI technology dominance linked to military superiority, which could be compared to the Cold War race to the moon.

While the United States and China are seen as global leaders in AI, many other countries and organizations, such as NATO, are also investing heavily in this field. One of these countries is Israel, which has already demonstrated the use of AI technology in its military operations. One of the clear examples is Operation Swords of Iron, which has demonstrated a significant level of AI integration into combat processes. This operation revealed how AI tools could overcome human limitations and help us accelerate the decision-making process by integrating AI tools into the OODA Loop (Observe-Orient-Decide-Act), leaving only the Act phase to human beings while also introducing new risks.

This writing assignment will investigate the role of AI in modern military operations by analysing Operation Swords of Iron through the OODA Loop. Firstly, to facilitate further analysis, the framework of the OODA Loop will be explained by highlighting its key steps and importance in the military context. Secondly, it will explore which and how AI tools were used in each phase of the loop during Operation Swords of Iron. Furthermore, the analysis will address the advantages of AI integration, including enhanced speed in reacting to threats, precision and efficiency, as well as the risks associated with this new technology. Finally, the writing assignment will conclude by emphasizing the future of AI-driven decision-making for military operations.

John Boyd's OODA Loop and Military Decision-Making

The OODA Loop theory was developed by Colonel John Richard Boyd, who served in the United States Air Force. Boyd's Loop was specifically designed for fighter pilots in order to help them make rapid and effective decisions during combat, but nowadays its utility has expanded far beyond that. Today, we can find the OODA Loop being used in tactical, operational or even strategic levels to shape military organizations and their process. The abbreviation OODA stands for:

- **O**bservation – observing the environment and collecting data;
- **O**rientation – analysing and evaluating the data by applying additional facts, assumptions;
- **D**ecision – making suggestions for actions and making a decision on it;
- **A**ction – executing on the preferred decision.

It represents the continuous cycle of decision-making (Figure 1) in a dynamic and rapidly changing environment.

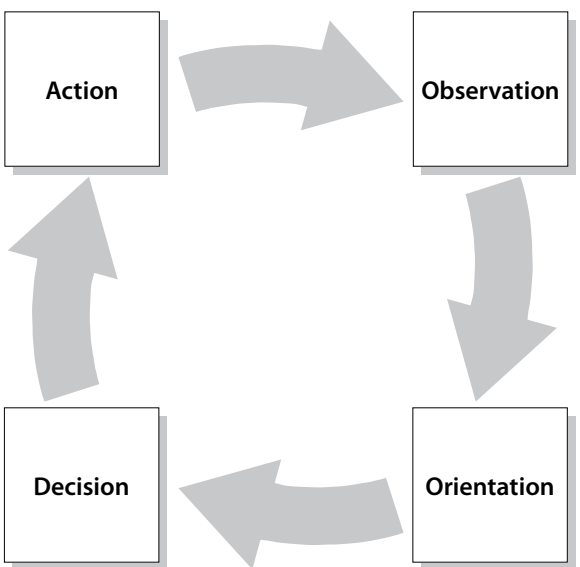

Figure 1. Simplified drawing of the OODA Loop [7]

The key principle and the rule of success for the OODA Loop is that whoever can cycle through this process faster and more effectively than the opponent will gain a decisive advantage [7]. This Loop underlines that success in combat often depends not only on strength, but on the ability to disrupt or outpace the opponent and gain the initiative in the battle.

AI capabilities align very well with the OODA Loop by offering automation and acceleration of each phase of this cycle. In the Observation phase, AI is able to enhance intelligence, surveillance and reconnaissance (ISR) by rapidly processing data from different sources (satellites, sensors, CCTVs, social media, unmanned aircraft systems, etc.). During Orientation, AI can filter, analyse and categorize information by our given criteria (features). In the Decision phase, AI can generate recommendations and propose COAs, also simulate them and predict outcomes. Finally, in the Action phase, AI could assist with precision targeting. Integration of AI in all of these steps could give a significant advantage in modern conflicts by accelerating decision-making.

AI in Operation Swords of Iron through the OODA Loop

Operation Swords of Iron started immediately after the Hamas-led attack on Israel on 7 October 2023. This operation was foreseen as an intensive combat operation within the Gaza Strip, which was led by the Israeli Defence Force (IDF) (The Knesset (Israeli parliament) web page) [10]. The operation highlighted how modern warfare increasingly depends on the ability of AI tools to process vast amounts of information, prioritize threats or targets, allocate resources effectively, and optimize operational planning. To address these challenges, the IDF has integrated advanced AI tools – Lavender, Gospel, Where's Daddy, and Fire Factory, which collectively transformed the tempo and precision of this military operation [11, 5, 3]. These system roles can be best understood when linked to the OODA Loop, which helps to illustrate how AI reshaped each phase of decision-making during Operation Swords of Iron.

The observe phase traditionally relies on intelligence, surveillance, and reconnaissance (ISR) assets to collect raw data. In the Gaza Strip, during long-lasting conflict, the IDF employed a wide network of sensors, including CCTVs, satellites, radars, and drones. Additional data inputs were collected from open sources and other government organisations' databases. This data revolution produced massive amounts of information that human analytics were no longer physically capable of sorting without creating delays. For this reason, the IDF increased usage of AI systems, such as Lavender and Gospel, which managed to process and organize incoming data in real time. According to reports, the Gospel system had already been used in previous operations in 2021, but Lavender appeared for the first time [2]. These systems filtered information by detecting and flagging patterns of suspicious activities, irrelevant noises, changes in terrain, connections with already known Hamas operatives (watchlists) and other factors. The Gospel was used to identify locations and facilities that could potentially be qualified as military objects, while Lavender was employed to identify individuals [3]. Therefore, the success of the observation phase depends on the amount and variety of data, which form the foundation for all following analytical and decision-making processes.

Orientation is the next phase where raw data is interpreted, analysed, and transformed into an operational picture. During Operation Swords of Iron, this stage was where AI played a significant role in automating the identification of potential targets or individuals suspected of cooperating with Hamas operatives. Lavender was trained using already confirmed profiles of Hamas members, enabling the system to learn their characteristics, which could later be applied to the identification of new suspects within the general population [11]. Another crucial feature of this targeting model was analysis of communication patterns: who called whom, the frequency and timing of calls, the locations from which calls were made, participation in WhatsApp groups with Hamas operatives, and frequent changes of mobile devices. One more important feature was the cross-linking of surveillance imagery

with watchlist entries and intelligence reports. For example, linking new faces with already known Hamas leaders, identifying associated vehicles, or mapping visits to sensitive locations and participation in incidents or activities.

Basically, both AI systems (Gospel and Lavender) complied, connected, and cross-referenced different layers of information from a wide variety of databases by providing suggestions on objects or individuals. For this reason, systems in order to function effectively and accurately require being 'fed' with as many different human-selected features as possible, which later serve as reference points for analogy with newly generated data. Also speaking about the cross-referencing aspect, the Lavender system was employed not only to spot potential operatives, but also to rank them on a scale of 0 to 100, based on assessed features of their relations with Hamas [8]. Scaling, in other words, could be called the prediction of how likely a picked target (how many features/data points that had given value were linked with a suspect) could be a possible Hamas operative. The benefit of the AI orientation stage is speed and focus. Before, manually cross-referencing data allowed Israeli institutions to typically produce from 50 to 100 targets a year, and it required humans to spend numerous hours getting targets. From the moment AI was integrated, the number of generated targets increased to 100 per day [3]. This significant shift in targeting demonstrates that AI systems could easily overtake human-driven processes in both speed and scale.

At the decision stage, the impact of AI was most visible, but provoked a lot of controversial discussions, which will be analysed later in the risks part. The IDF, at this stage, has used several systems to accelerate and optimize all processes:

- Where's Daddy? – this system worked along with Lavender and Gospel. Its main task was to live track and monitor the movements of identified Hamas fighters in their private residences. The moment a target entered their home, the IDF officers were alerted, and subsequently a strike was carried out [11].
- The Fire Factory – led this process one more step further by

generating and organizing strike packages. This included selection of ammunition type, ammunition load calculations, prioritization, and allocation of targets to available aircraft, drone, or artillery assets. As well, it proposed execution timings and schedules [5].

The mentioned AI systems significantly reduced the time required for operational planning and as well enabled courses of action (COA) to be generated within minutes rather than hours or days. And by achieving it, we are coming to the point which was stressed by John Boyd, that we need to process the OODA Loop faster and outpace our opponent in order to gain that decisive advantage in operations [7]. Also, in this process, the human role has shifted from being the creator of plans to the commander, who now only has to approve AI-generated, fully detailed execution plans. This shift of roles allowed the IDF to sustain a rapid operational tempo of Operation Swords of Iron, ensuring that all strikes were conducted with the principle of unpredictability for Hamas operators, as the extremely short time window between detection (targeting) and execution by leaving little opportunity for Hamas to get information that their operatives had been spotted.

The final step of the OODA Loop – act, remained mostly in control of human hands: artillery operators, ground units, or pilots executing strikes that commanders authorized. However, acceleration of the earlier mentioned stages come to a point where the time given to the commander's decision often occurred under severe time compression. As execution timings and schedules were already proposed and targets were already in 'kill zone', when decisions were required. As a result of it, decisions had to be made instantly, leaving limited time for human control and deliberation of AI proposals or for deeper analysis of potential collateral damage. These aspects of limitations were especially blurred by the Fire Factory system, which automated tasking and timing of strikes. At this point, human operators were executing not just commander intent, but AI-structured and developed plans. So that shows that maybe this stage is mostly human-driven, but significantly influenced by AI-generated outputs.

Advantages and Risks of AI Integration in Military Operations

Operation Swords of Iron has already shown that AI integration into modern warfare not only brings new opportunities but also risks. One of the most critical advantages is speed, which allows reducing the time required for each decision-making cycle step and it enables commanders to react faster than adversaries. Another important advantage – precision. During Operation Swords of Iron, it was found that Lavender's generated target lists had 90 % accuracy in identifying an individual's connections with Hamas. Also, it reduced human error in targeting by cross-referencing multiple data sources and recognizing patterns invisible for human analytics [11]. Precision minimized waste of resources, because AI systems delivered efficiency by automating the most time demanding processes like imagery analysis. Previously, it required teams of analysts to spend over a couple of hours, which has now been done in minutes. It alleviated the cognitive burden and fatigue that appeared as human limitations in this process, allowing personnel to be used for other, more important tasks.

Despite these potentials of AI, the usage of it in Operation Swords of Iron exposed severe concerns of compliance with International Humanitarian Law (IHL) principles: distinction, proportionality and accountability. As the Lavender system produced target lists of around 100 suspected Hamas operatives per day, the IDF analytics were no longer able to verify them. It was reported that the IDF did not see the point of allocating manpower to verify targets. Verification was carried out only for senior commanders of Hamas and was limited to check whether a target was female or male. For this verification, IDF analytics were given only 20 seconds per target [11]. Consequently, misclassification occurred when Lavender had identified persons who in the past were in Hamas, but no longer were, and the system still treated them as Hamas operatives [6]. These findings show that the IHL requirement of distinction between civilians and combatants was not seriously taken into consideration. The principle of proportionality, in short,

concerns collateral damage and assessment of the effect of attacks on civilians and civilian objects. The IDF used the Gospel system not only to identify military objects but also to calculate collateral damage estimates by providing information on expected numbers of casualties before attack. Some of the IDF officials were interviewed and stated that 'in practice, the principle of proportionality did not exist' [6]. This happened, not only for senior ranking Hamas commanders, because the IDF authorised attacks against them that tolerated to kill more than 100 civilians, while for low ranking targets it tolerated killing between 15 to 20 civilians. Also, there were cases when bombings were carried out when Hamas commanders were present together with their families at home [11]. Finally, it blurred accountability, because of the distribution of responsibilities which went across system developers, analytics and commanders. For this reason, it complicates attribution of responsibility for war crimes. Analysis of these risk factors shows that the use of AI in the Israeli case eroded IHL requirements and underscores the need for strong and meaningful human control.

Another critical risk that requires consideration for the future – escalation. While AI integration accelerates our decision-making cycles, it also compresses the time available for reflection and critical judgment, potentially making our future conflicts more unpredictable. Escalation of conflicts could occur way earlier, before commanders have sufficient time to apply critical thinking or problem-solving skills. The same speed that provides a decisive advantage over adversaries, limits opportunities for de-escalation through diplomatic or political channels. Furthermore, it is essential to consider that adversaries will seek to develop countermeasures to neutralize AI created advantages. AI systems are increasingly vulnerable to electronic and cyber warfare attacks, where opposing forces may attempt to infiltrate or disrupt our operational networks. Additionally, we can face deception and sabotage operations, where data or files in our system are poisoned and it could lead to the malfunctioning of AI systems [1]. For these reasons, it is not only necessary to advance AI systems, but also to ensure their security and resilience to threats.

Conclusion

Operation Swords of Iron illustrates both the power and peril of AI in modern warfare. The OODA Loop analysis shows that AI dominates in the observation, orientation and decision phases, while leaving the Act phase largely in human hands. AI systems like Lavender, Gospel, Where's Daddy, and Fire Factory compressed the traditional decision-making cycle from days to hours by automating target identification, prioritization, target tracking, and strike coordination. This acceleration provided a decisive advantage while allowing the IDF to sustain a high operational tempo and act faster than Hamas operatives.

However, the same speed that offered an operational advantage also generates significant risks. The compression of decision time limits commanders' critical judgment, forcing them to act within seconds and increasing the possibility of escalations or misidentifications. Moreover, the blurred accountability across developers, analytics, and commanders complicates compliance with IHL principles such as distinction and proportionality. Adversaries are also likely will try to exploit AI vulnerabilities through deception, disruption, or cyber attacks, further destabilizing future conflicts.

The further question – *Could AI fully replace humans in decision-making during warfare?* – it will still persist for a while. As Brigadier General Yossi Sariel noted in his book '*The Human-Machine Team*', we should focus more on human AI teaming, rather than concentrating only on fully autonomous systems [4].

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