# Introduction

Artificial Intelligence powered autonomous weapons capable of selecting and engaging targets without human involvement have become a very debated topic in global security. Governments and private companies continue developing systems that are faster, more accurate, as well as becoming more independent from human involvement. While developers dispute that these systems can reduce military casualties and improve precision, many scholars worry that autonomy creates serious technical vulnerabilities, ethical dangers, and geopolitical risks. This paper examines the following research question: “What are the major challenges of AI-powered autonomous weapons? To answer this question, I draw from these 3 disciplines computer science, ethics, and public policy. Computer science is essential because autonomous weapons rely entirely on algorithms, training data, and machine learning systems. Ethics contributes to understanding the moral implications of delegating life and death decisions to machines. Public policy is necessary because the risks of autonomous weapons extend beyond individual systems and into questions of regulation, safety standards, and public accountability. An interdisciplinary approach is needed because no single discipline can explain the full problem. Only by combining technical insights, moral reasoning, and policy analysis can we clearly understand why autonomous weapons pose such a danger.

# Key Terms

Autonomous weapons are systems capable of selecting and engaging targets without human control or intervention.AI decision making refers to computational processes that allow machines to analyze data and act independently, often using complex cryptographic and algorithmic structures that shape how autonomous systems behave (Alagic et. Al., 2024). A responsibility gap occurs when no person can be held morally or legally accountable for actions taken by an autonomous system. Public accountability refers to the obligation of governments to ensure transparency and proper oversight when deploying emerging technologies, especially those that affect privacy and security (Brower & McCray, 2024). These definitions outline how each discipline approaches the dangers posed by autonomous weapons.

# Computer science

Computer science research reveals that autonomous weapons carry significant technical risks rooted in unpredictable data limitations and algorithmic flaws. Machine learning systems can behave unpredictably when expose to unfamiliar inputs because their decision-making patterns rely heavily on training data, and cryptographic models such as ML-KEM demonstrate how even advanced algorithms must be carefully tested to remain secure in new environments (Alagic et. Al.,2024.)

Another risk is susceptibility to adversarial manipulations. It is shown that even small, carefully designed visual or infrared changed can confused AI powered systems and cause them to misclassify targets, A hostile actor can possibly trick an autonomous weapon into firing at civilians and or ignore legitimate threats, Algorithmic bias also presents a major danger. Bias may arise when the data used to train targeting systems contains imbalances or reflects real world inequalities, In real events, the possibility of misidentification of certain groups or inaccurate assessments. Even with improvements in AI safety, such vulnerabilities cannot be eliminated due to the nature of machine learning. Computer science research further shows that bias can emerge when training data reflects existing social or structural inequalities, leading to skewed AI decisions in critical systems (Liu & Moody, 2024)

Another major concern highlighted in computer science research involves the limitations of sensors and real-world data collection. Autonomous weapons rely heavily on cameras, radar, thermal sensors, and GPS, but each of these tools can fail under environmental

stress. Dust, smoke, low lighting, weather changes, and electromagnetic interference can distort sensor input, causing the Ai to make incorrect decisions. Advanced military prototypes have experienced failures during field tests when environmental conditions differed from laboratory settings. These failures show that autonomous systems struggle to generalize outside controlled environments. When AI powered weapons are deployed in active combat zones with areas filled with unpredictable circumstances, the chance of technical failure increases dramatically. This further supports the computer science perspective that unpredictable machine behavior brings a very serious risk.

# Ethics

Ethics research raises questions and concerns that extend past technical limitations. One of the central issues is the responsibility gap. (Mosa et al., 2024) explains that governments and private sector developers must be held accountable when autonomous technologies create harm, yet these systems often operate without clear lines of responsibility. Programmers, commanders, and manufacturers cannot foresee and predict every possible circumstance and scenario, and the machine cannot be morally accountable for its actions. This creates a problem of whose to be accountable and creates a lack of responsibility in situations involving innocent civilians or wrongful targeting.

Another major ethical challenge involves the absence of moral judgement. Mose et al. (2024) note that AI systems lack the ability to interpret human context, intention, or emotional nuance, which makes them incapable of making the right and informed decisions in life-or-death scenarios. Decisions about who lives and who dies require complex human thinking and emotions that include empathy, restraint, and ethical reasoning. Qualities that AI does not simply possess, and even if AI becomes more accurate, it will never be truly capable of more deliberation.

Ethicists also warn that autonomous systems introduce new risks to civilians' safety. Abelson et al. (2024) shows that algorithmic tools can be wrong and misinterpret human behavior or produce harmful decisions when operating in unpredictable scenarios, especially when background software behaves in ways the human oversight cannot control, such as civilians running from danger or surrendering. Without human oversight, the risk of wrongful deaths is very likely to occur. Ethics therefore show that the dangers of autonomous weapons are not simply technical as they raise deep moral concerns over responsibility, human dignity, and the protection of innocent lives.

Ethical scholars also raise concerns related to international humanitarian law. Because autonomous weapons cannot interpret intent or surrender gestures, as they risk violating principles such as distinction and others, which are fundamental in armed

conflict. (Mosa et al., 2024) emphasizes that AI systems lack the ability to interpret human context or moral nuance which increases the likelihood of inappropriate or excessive force because machines cannot weigh human emotion and decision making. Another ethical issue is psychological distance: When humans are removed from the act of killings, moral not being acknowledged becomes easier which reduces empathy for civilian populations. Abelson et. Al (2024) warns that when automated systems are operating without human judgement, their hidden background processes can lead to wrong and harmful outcomes that distance operators even further from the moral weight of the violence that occurs. Scholars argue that delegating lethal authority may normalize a detached and dehumanized approach to warfare. These concerns reinforce ethical argument that autonomy undermines moral responsibility and human dignity,

# Public policy

Public policy highlights another dimension of danger: the lack of regulation and oversight. Current laws are not keeping pace with advances in AI technologies, creating policy gaps where autonomous weapons operate without clear rules. These gaps include accountability, transparency, testing standards, and international coordination.

Another issue is secrecy. Much development occurs inside private defense companies where algorithms and testing data are not publicly shared. Policymakers often

lack access to essential information, making effective regulation difficult. Without transparency, even well intended legislation becomes hard to enforce.

Public policy experts also warn about inconsistent national standards. Some countries require strict human oversight for lethal decisions, while others pursue fully autonomous systems with minimal supervision. Wagner (2024) notes that this uneven regulatory landscape increases the risk of accidental escalation, unintended strikes, and irresponsible deployment. Without a shared international framework, states may race to build more advanced systems to maintain strategic advantage. This competition reduces transparency and increases the likelihood of violations and humanitarian norms. Public policy therefore shows that dangers arise not only from the weapons themselves but from the absence of unified global rules.

# Common Ground

Across the three disciplines computer science, ethics, and public policy. Several areas of agreement emerge. First, all three acknowledged that autonomous weapons involve significant unpredictability and risk, whether stemming from technical flaws, moral limitations, or regulatory gaps. Second, each discipline stresses the importance of human oversight, though for different reasons: computer scientists emphasize safety limits, ethicists emphasize accountability and morality, and policy experts emphasize legal responsibility. Finally, all disciplines agree that current safeguards are inadequate. Technology is only going to evolve into something greater than it is right now as it is

advancing faster than ethical standards or government policies, leaving society unprepared for the widespread use of autonomous weapons.

Public policy scholars warn that autonomous weapons complicate global stability. Several nations, including members of the United Nations, have pushed bans or more strict limitations on lethal autonomous weapons, but negotiations remain stalled. Casy Maslen (2025) explains that diplomatic debates often fail because powerful military nations resist restrictions that might limit their strategic advantage. This creates a dangerous geopolitical imbalance in which countries with advanced AI capabilities set global norms to default. Additionally, arms race dynamics motivate states to accelerate development before others do, even when safety testing is incomplete. History shows that when emerging technologies lack early regulation, they often spread faster than laws can adapt. With autonomous weapons, this creates a long-term risk that untested or poorly governed systems could proliferate across unstable regions. Public policy findings therefore show global governance gaps to magnify the dangers created by technical and ethical weaknesses.

# Disciplinary conflicts

Despite common concerns, The three disciplines conflict in important ways. Computer scientists argue that continued improvements in AI safety, such as more robust training datasets and stronger defenses against manipulation, can significantly reduce risks (Rani & Zeng, 2024). Ethicists disagree, asserting that no technical refinement can resolve the moral problems inherent in allowing machines to make lethal decisions (Nyholm, 2024). Public policy offers another point of tension: some policymakers believe strong regulations can manage these dangers, while ethicists counter that laws cannot replace moral judgement (Wagner, 2024). These differences show why interdisciplinary integration is necessary, since each discipline focuses on a different dimension of danger.

# Constructing a More comprehensive understanding

Repko and Szostak (2021) explain that interdisciplinary integration produces a deeper and more accurate understanding by combining insights from multiple disciplines. Using multicausal integration, the dangers of autonomous weapons can be understood because of several interacting factors rather than a single cause. Technical unpredictability in AI decision making combines with ethical responsibility gaps that arise

when no human can be clearly held accountable for a machine's lethal action. These risks are intensified by human cognitive tendencies such as overreliance on automation and by insufficient policy oversight, which leaves major regulatory holes unaddressed. When viewed together, these factors make a system much more dangerous than any single discipline predicts on its own. The integrated perspective shows that autonomous weapons are not merely flawed machines as they are the product of overlapping technical, moral, psychological, and governmental weaknesses that reinforce one another. Integrating these perspectives creates what Repko and Szostak (2021) describe as a "compound instability model," where interacting weaknesses across disciplines intensify one another. Technical errors become more dangerous when combined with moral responsibility gaps and weak regulation. This broader understanding also connects to the visual model created in workshop 4, where the overlap of each discipline illustrates how multiple forms of instability converge. The integrated insights suggest that autonomous weapons are dangerous not because of a single flaw, but because technical, ethical, and policy vulnerabilities reinforce each other in unpredictable ways.

# Reflecting On, Testing, and Communicating the Understanding

To test interdisciplinary understanding, researchers can and should analyze case studies of automated system failures or run simulations comparing human controlled and autonomous targeting outcomes.

Policymakers could implement pilot regulations and evaluate whether accountability improves. Communicating with this integrated understanding requires collaboration among computer scientists, ethicists, legal experts, and policymakers. Sharing findings with global regulatory bodies can also strengthen public awareness and guide responsible implementation.

# Conclusion

This interdisciplinary research shows that the dangers of AI powered autonomous weapons arise from technical flaws, ethical challenges, and weak policy frameworks. Computer science reveals the unpredictable nature of Ai through algorithms and susceptibility to manipulation. Ethics covers and highlights irresponsibility gaps and the absence of moral judgements, public policy exposes the lack of regulation transparency that allows these systems to advance without the right oversight, together these insights demonstrate that autonomous weapons pose a profound and multifaceted threat. Understanding this interacting danger is essential for developing policies that ensure

public safety, protect civilians, and maintain ethical standards as AI continues to reshape modern warfare.

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