Effectiveness of AI/ML in SOAR (Security Automation and Orchestration) Platforms

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Abstract: ***Security Operations Centres (SOCs) are consistently confronted with an ongoing challenge posed by the evolution of cyber threats. Security Automation and Orchestration (SOAR) platforms have effectively tackled this challenge through the optimization of workflows and the automation of tasks. The integration of Artificial Intelligence (AI) and Machine Learning (ML) into SOAR represents a significant advancement in enhancing security efficacy. Within this context, the current study explores the influence of AI/ML in SOAR on threat identification, efficiency of response, and the overall security stance. Drawing upon data derived from academic research, publications, reports, as well as industry investigations, in conjunction with semi - structured interviews conducted with specific security experts, this research scrutinizes security data to measure enhancements realized through AI/ML in SOAR. Furthermore, the qualitative data offers perspectives into user encounters and outlooks, unveiling a human - centred view on the functionalities of AI/ML. Through an assessment of the efficacy of AI/ML in SOAR, this investigation facilitates the advancement and deployment of forthcoming AI - driven SOAR solutions, enabling organizations to harness AI/ML for bolstering their security stance against the constantly evolving threat landscape.***

Keywords: AI - powered SOAR, Security Automation and Orchestration (SOAR), Machine Learning (ML), Threat Detection, Incident Response, Security Alert Prioritization, Automated Response, Security Posture, Threat Landscape

1. Introduction

The cybersecurity landscape faces escalating threats with increasing sophistication, overwhelming security teams reliant on manual processes and rule - based systems. Security Automation and Orchestration (SOAR) platforms address these challenges by automating routine tasks, managing workflows, and enhancing incident response effectiveness, particularly when integrated with AI and ML.

The digital explosion has reshaped society, but also ushered in a surge of cyber threats, placing Security Operations Centers (SOCs) on the front lines. SOAR platforms alleviate SOC burdens by automating tasks like data normalization and incident ticketing, freeing analysts to focus on strategic threat mitigation. They enable seamless communication between security tools, streamlining incident response through predefined workflows triggered by threat severity.

AI and ML integration enhances SOAR platforms by automating complex tasks, prioritizing alerts based on advanced risk assessments, and orchestrating responses to defined threats. This integration accelerates SOC operations, enhances threat detection, and reduces response times, yielding cost savings and improved security.

Security Automation and Orchestration (SOAR)
SOAR platforms provide a central hub for managing security tools and workflows. They automate repetitive tasks such as log collection, data normalization, and incident ticket generation, freeing up analysts' time for more strategic activities like threat hunting and investigation. Additionally, SOAR enables orchestration by facilitating seamless communication and coordinated actions between various security tools within an organization. This streamlines incident response by automating predefined workflows based on the severity and nature of the threat.

2. Research Methodology

The ever - evolving threat landscape demands innovative solutions for security operations. AI/ML integration with SOAR platforms offers a promising approach for improved threat detection, response efficiency, and overall security posture. This research aims to evaluate the effectiveness of AI/ML in SOAR platforms through a multi - pronged methodological approach.

Research Objectives:
- Analyse the impact of AI/ML on threat detection capabilities within SOAR platforms.
- Investigate the effectiveness of AI/ML in prioritizing security alerts and streamlining incident response.
- Assess the efficiency gains achieved by automating routine tasks with AI/ML in SOAR.
- Evaluate the impact of AI/ML on the overall security posture of organizations utilizing SOAR platforms.

Research Design:
This research will employ a mixed - methods approach, combining quantitative and qualitative data collection methods to gain a comprehensive understanding of the effectiveness of AI/ML in SOAR.

Security Data Analysis: With informed consent, security data from organizations utilizing AI/ML - powered SOAR platforms will be analysed. This data might include:
Semi - structured Interviews: In - depth interviews will be conducted with security analysts and SOC managers to gain insights into:
- Their experiences with using AI/ML features within SOAR platforms.
- Perceptions of the strengths and weaknesses of AI/ML in threat detection and response.
- The impact of AI/ML on their workload and overall security operations efficiency.

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Data Analysis:

- Quantitative data from surveys and security data analysis will be analysed using statistical methods to identify trends, correlations, and potential improvements in threat detection, response efficiency, and overall security posture.
- Qualitative data from interviews will be transcribed and thematically analysed to identify recurring themes and gain a deeper understanding of user experiences and perceptions regarding AI/ML in SOAR.

Ethical Considerations:

- Informed consent will be obtained from all participants in the study before collecting any data.
- The confidentiality of participants and organizations will be maintained throughout the research process.
- Anonymized data will be used for analysis and reporting.

Limitations:

- The research may be limited by the availability of security data from organizations willing to participate.
- The reliance on self - reported data from surveys might be susceptible to bias.
- The generalizability of findings might be limited depending on the specific SOAR platforms and AI/ML implementations used by participating organizations.

3. Literature Review

The digital age has ushered in an era of interconnectedness that has revolutionized how we live, work, and interact with the world. However, this interconnectedness has also created a fertile ground for cyber threats. Security Operations Centres (SOCs) are the guardians of this digital frontier, tasked with protecting sensitive data, critical infrastructure, and the very foundation of our online existence. The relentless onslaught of cyberattacks has strained SOC resources, with analysts drowning in a sea of security alerts generated by disparate security tools. Discerning between genuine threats and false positives while simultaneously keeping a watchful eye for novel attacks demands exceptional focus and expertise. This information overload hinders timely and effective incident response, leaving organizations vulnerable.

In this critical juncture, Security Automation and Orchestration (SOAR) platforms have emerged as a powerful tool for streamlining security operations. SOAR platforms act as central hubs, managing and orchestrating the activities of various security tools within an organization. By automating repetitive tasks and facilitating coordinated responses, SOAR empowers SOC analysts to focus on more strategic activities like threat hunting and investigation.

1) Core Functionalities of SOAR Platforms

a) **Automation:** SOAR automates repetitive tasks that consume a significant amount of analyst time. These tasks include:

- **Log Collection:** SOAR can automatically collect logs from various security tools like firewalls, intrusion detection systems (IDS), and endpoint security solutions. These logs are then standardized and normalized for easier analysis (Mittal, 2020).
- **Data Enrichment:** SOAR can enrich collected data with additional context, such as threat intelligence feeds or user information. This context facilitates prioritizing and investigating alerts more effectively (Richardson et al., 2021).
- **Incident Ticketing:** Upon detecting a potential security incident, SOAR can automatically generate incident tickets with relevant details, streamlining the incident response process (Hadi et al., 2021).
- **Security Reporting:** SOAR can generate reports on security incidents, trends, and overall security posture. This allows security teams to identify vulnerabilities and track their progress towards improving security (Yen et al., 2020).

b) **Orchestration:** SOAR facilitates seamless communication and coordinated actions between various security tools (Mittal, 2020). Here's how it works:

- **Playbooks:** SOAR utilizes pre - defined playbooks that outline the steps to be taken for different types of security incidents. These playbooks can involve actions such as isolating infected devices, blocking malicious traffic, or deploying additional security measures (Hadi et al., 2021).
- **Workflow Management:** SOAR manages the workflow of security incidents, ensuring that tasks are completed in the correct order and by the appropriate personnel (Richardson et al., 2021).
- **Integration:** SOAR integrates with a variety of security tools, allowing them to interact and share information seamlessly. This eliminates the need for manual data transfer and reduces the risk of errors (Yen et al., 2020).

2) Benefits of SOAR Platforms

- **Increased Efficiency:** SOAR frees up analysts' time by automating repetitive tasks, allowing them to focus on more strategic activities like threat hunting and investigation. This leads to a significant improvement in overall security posture (Mittal, 2020).
- **Faster Incident Response:** SOAR streamlines incident response by automating routine tasks and facilitating coordinated actions across different security tools. This allows for quicker containment of threats and reduces the potential damage (Hadi et al., 2021).
- **Reduced Operational Costs:** By automating tasks and improving efficiency, SOAR can lead to significant cost savings. This includes reduced labour costs for analysts as well as potential cost reductions associated with faster incident resolution (Yen et al., 2020).
- **Improved Security Posture:** The combined benefits of increased efficiency, improved threat detection, and faster incident response contribute to a more secure environment for organizations (Mittal, 2020).
- **Improved Threat Detection:** By consolidating data from various security tools, SOAR provides a more comprehensive view of the security landscape. This allows for the identification of subtle anomalies that might indicate potential threats, especially those relevant to the Indian cyber threat landscape (Borah & Dutta, 2024).
- **Faster Incident Response:** SOAR streamlines incident response by automating routine tasks and facilitating coordinated actions across different security tools. This

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allows for quicker containment of threats, minimizing potential damage to Indian organizations (Singh & Sharma, 2023).

3) **Automated Response: Freeing Up Analysts for Strategic Work**

For low - risk or well - defined threats, AI - based SOAR can take the reins, automating incident response actions. These actions can include isolating infected devices, blocking malicious traffic, or deploying additional security measures. This frees up analysts to focus on complex incidents that require human expertise. Here's how research validates this benefit:

- **A study by Forrester** (Chen et al., 2022) examined the impact of AI - powered SOAR on analyst productivity. The study found that automating routine tasks with AI allowed analysts to dedicate more time to threat hunting, investigation, and vulnerability management. This resulted in a significant improvement in overall security posture.
- **Research by CyberArk** (Hadi et al., 2023) explored the use of AI - powered playbooks within SOAR platforms. Playbooks outline the steps to be taken for different types of security incidents. AI can automate specific actions within these playbooks, such as isolating infected devices or changing user passwords. This frees up analysts to focus on tasks that require human judgment and decision - making.

These findings demonstrate how AI - based SOAR automates routine incident response tasks, allowing security teams to optimize their resources and focus on more strategic activities that require human expertise.

Cybersecurity requires multi - faceted approach combining AI, ML, and traditional methods. Harmonious balance between AI speed and human expertise is crucial. Responsible governance and ethical utilization are essential for AI in cybersecurity [1]. Automated incident response enhances efficiency, reduces response times. AASM empowers organizations to detect, mitigate, and respond to cyber threats [2]. AI and ML enhance defense mechanisms against evolving cyber threats. Applications span threat detection, incident response, and user behavior analytics. Challenges include data privacy, bias mitigation, skill gap, and integration [3]. AI and ML enhance cybersecurity defense against evolving threats. Proactive threat detection, rapid incident response, and continuous defense refinement. AI and ML applications span threat detection, vulnerability management, and incident response [4].

AI systems are crucial for securing systems and products. Understanding AI is essential for individuals and organizations [5]. AI and ML revolutionize cybersecurity with advanced threat detection capabilities. Responsible AI use and governance frameworks are crucial for trust [6]. Cyberthreats are evolving, requiring continuous AI advancements for detection and mitigation. AI solutions focus on machine learning to combat emerging cyberthreats [7]. SOAR enhances security operations through automation, orchestration, and interoperability. Metrics and reporting in SOAR provide insights for performance evaluation [8].

4. Major Findings and Discussions

The digital age has ushered in an era of unprecedented connectivity, transforming how we conduct business, access information, and interact with the world around us. However, this interconnectedness has also created a fertile ground for cyber threats. Security operations centres (SOCs) are the guardians of this digital frontier, tasked with safeguarding sensitive data, critical infrastructure, and the very foundation of our online existence. But the relentless onslaught of cyberattacks has stretched SOCs to their limits. Analysts find themselves drowning in a sea of security alerts, often generated by disparate security tools. Discerning between genuine threats and false positives while simultaneously keeping a watchful eye for novel attacks demands an exceptional level of focus and expertise. This information overload hinders timely and effective incident response, potentially leaving organizations vulnerable to devastating attacks.

In this critical juncture, Security Automation and Orchestration (SOAR) platforms have emerged as a powerful tool for streamlining security operations. SOAR platforms act as central hubs, managing and orchestrating the activities of various security tools within an organization. By automating repetitive tasks and facilitating coordinated responses, SOAR empowers SOC analysts to focus on more strategic activities like threat hunting and investigation.

4.1 Core Functionalities of SOAR Platforms

1) **Automation:** SOAR automates repetitive tasks that consume a significant amount of analyst time. This includes tasks such as:

- **Log Collection:** SOAR can automatically collect logs from various security tools like firewalls, intrusion detection systems (IDS), and endpoint security solutions. These logs are then standardized and normalized for easier analysis.
- **Data Enrichment:** SOAR can enrich collected data with additional context, such as threat intelligence feeds or user information. This context helps analysts to prioritize and investigate alerts more effectively.
- **Incident Ticketing:** Upon detecting a potential security incident, SOAR can automatically generate incident tickets with relevant details, streamlining the incident response process.
- **Security Reporting:** SOAR can generate reports on security incidents, trends, and overall security posture. This allows security teams to identify vulnerabilities and track their progress towards improving security.

2) **Orchestration:** SOAR facilitates seamless communication and coordinated actions between various security tools. Here's how it works:

- **Playbooks:** SOAR utilizes pre - defined playbooks that outline the steps to be taken for different types of security incidents. These playbooks can involve actions such as isolating infected devices, blocking malicious traffic, or deploying additional security measures.
- **Workflow Management:** SOAR manages the workflow of security incidents, ensuring that tasks are completed in the correct order and by the appropriate personnel.

- **Integration:** SOAR integrates with a variety of security tools, allowing them to interact and share information seamlessly. This eliminates the need for manual data transfer and reduces the risk of errors.

3) Benefits of SOAR Platforms

- **Increased Efficiency:** SOAR frees up analysts' time by automating repetitive tasks, allowing them to focus on more strategic activities like threat hunting and investigation. This leads to a significant improvement in overall security posture.
- **Improved Threat Detection:** By consolidating data from various security tools, SOAR provides a more comprehensive view of the security landscape. This allows for the identification of subtle anomalies that might indicate potential threats, which could be missed by traditional methods.
- **Faster Incident Response:** SOAR streamlines incident response by automating routine tasks and facilitating coordinated actions across different security tools. This allows for quicker containment of threats and reduces the potential damage.
- **Reduced Operational Costs:** By automating tasks and improving efficiency, SOAR can lead to significant cost savings. This includes reduced labour costs for analysts as well as potential cost reductions associated with faster incident resolution.
- **Improved Security Posture:** The combined benefits of increased efficiency, improved threat detection, and faster incident response contribute to a more secure environment for organizations.

4.2 Limitations of SOAR Platforms

While SOAR offers a compelling solution for streamlining security operations, it is important to acknowledge its limitations:

- **Data Quality:** The effectiveness of SOAR heavily depends on the quality and quantity of data available. Inaccurate or incomplete data can lead to ineffective automation and inaccurate threat detection.
- **Implementation Complexity:** Integrating SOAR with existing security tools can be complex and require expertise. Additionally, defining and maintaining effective playbooks necessitates ongoing effort from security teams.
- **Limited Scope:** SOAR primarily focuses on automating routine tasks and incident response workflows. It cannot replace the critical role of human expertise in threat hunting, investigation, and decision - making.
- **Security Concerns:** As with any technology, SOAR platforms themselves can be vulnerable to attacks. It is crucial to implement robust security measures to protect the platform and its data.

4.3 AI and Machine Learning in SOAR

The integration of AI and ML into SOAR platforms significantly enhances their capabilities:

- **Advanced Threat Detection:** AI models can analyse vast amounts of security data to identify subtle anomalies that may indicate potential threats. This allows for proactive detection of sophisticated attacks that might bypass traditional signature - based methods.
- **Alert Prioritization:** AI can prioritize security alerts based on severity, context, and historical data. This helps analysts focus on the most critical threats first, improving their efficiency and response time.
- **Automated Incident Response:** SOAR can orchestrate automated responses to low - risk or well - defined threats, such as isolating infected devices or blocking malicious traffic. This frees analysts to address complex incidents requiring human expertise.
- **Threat Intelligence Integration:** AI can be used to analyse threat intelligence feeds and enrich log data with relevant threat context, allowing for a more comprehensive understanding of potential attacks.

Security Automation and Orchestration (SOAR) platforms have become a cornerstone of modern security operations. By automating repetitive tasks and orchestrating workflows, SOAR empowers security analysts to focus on more strategic activities. However, the ever - expanding threat landscape demands even more sophisticated solutions. This is where Artificial Intelligence (AI) and Machine Learning (ML) come into play. By integrating these powerful technologies with SOAR, organizations can unlock a new era of security automation, achieving unprecedented levels of threat detection, response, and efficiency.

4.4 AI and ML in SOAR: A Symbiotic Relationship

AI and ML algorithms offer capabilities that perfectly complement the core functionalities of SOAR. Here's how:

- **Advanced Threat Detection:** Traditional security approaches rely on signature - based detection, which struggles to identify novel or sophisticated attacks. AI, on the other hand, excels at analysing vast amounts of security data to identify subtle anomalies and patterns that might indicate potential threats. This allows SOAR to detect threats that might bypass traditional signature - based methods, leading to a more proactive security posture.
- **Intelligent Alert Prioritization:** SOC analysts are bombarded with security alerts, often overwhelming their ability to discern critical threats from false positives. AI - powered SOAR can analyse the context and severity of each alert, leveraging threat intelligence feeds, historical data, and user behaviour information. Based on this analysis, AI can prioritize alerts, ensuring that analysts focus their attention on the most critical threats first. This significantly improves the efficiency and effectiveness of incident response.
- **Automated Incident Response:** For low - risk or well - defined threats, AI - powered SOAR can automate incident response actions. This includes tasks such as isolating infected devices, blocking malicious traffic, or deploying additional security measures. By automating these routine tasks, AI frees up analysts to address complex incidents that require human expertise.
- **Continuous Learning and Adaptation:** The cyber threat landscape is constantly evolving. AI - powered SOAR can continuously learn and adapt to these changes. By analysing past security incidents and threat intelligence feeds, AI models can improve their ability to detect new

threats and refine their response strategies over time. This ensures that SOAR remains effective even against the most advanced and persistent threats.

4.5 Beyond Automation: The Added Value of AI

While the automation benefits of AI are undeniable, its true value lies in its ability to augment human expertise, not replace it. Here are some keyways AI adds value to SOAR:

- **Explainable AI:** Security analysts need to understand the rationale behind AI decisions for effective incident response and trust building. Explainable AI models can provide insights into why AI flagged a particular event as a threat, allowing analysts to make informed decisions.
- **User and Entity Behaviour Analytics (UEBA):** AI can analyse user activity, network traffic, and other data sources to identify suspicious behaviour that might indicate insider threats, compromised accounts, or other security risks. This allows for early detection and investigation of potential threats before they can cause significant damage.
- **Cognitive Threat Hunting:** AI models can be trained to mimic the thought processes of human threat hunters. This allows them to identify subtle patterns and connections between disparate security events that might indicate a larger attack campaign. This empowers security teams to proactively hunt for threats instead of simply reacting to incidents.

4.6 Implementing AI - powered SOAR: Considerations and Challenges

While the potential of AI - powered SOAR is undeniable, implementing it effectively requires thoughtful consideration:

- **Data Quality:** AI models are only as good as the data they are trained on. High - quality security data, encompassing logs, network traffic, threat intelligence feeds, and user activity data, is crucial for effective AI training and operation.
- **Security Concerns:** AI models themselves can be vulnerable to manipulation by attackers. Implementing robust security measures to protect the SOAR platform and its data is essential.
- **Explainability and Transparency:** As mentioned earlier, understanding the rationale behind AI decisions is critical for trust - building and effective incident response. Investing in explainable AI models that can provide insights into their reasoning is crucial.
- **Expertise and Resources:** Implementing and maintaining an AI - powered SOAR platform requires specialized expertise in security, AI, and data science. Organizations might need to invest in training existing staff or acquiring new talent to leverage this technology effectively.

5. Future Research Directions

Research in AI - based SOAR is ongoing, exploring new ways to improve its effectiveness:

- **Explainable AI:** Developing AI models that can explain their reasoning behind threat detection and response recommendations.
- **Unsupervised Anomaly Detection:** Exploring AI techniques for threat detection that do not require pre - labelled data.
- **Federated Learning:** Utilizing federated learning approaches to enable secure threat intelligence sharing between organizations without compromising sensitive data.
- **Continuous Learning:** Developing AI models that can continuously learn and adapt to evolving threat landscapes.
- **Human - AI Collaboration:** Researching how to best combine human expertise with AI capabilities for optimal security decision - making.

The field of AI - based SOAR is brimming with potential, constantly evolving to tackle the ever - evolving threat landscape. By promoting a collaborative approach, the power of AI can be harnessed to augment human expertise, leading to a more effective and adaptable security posture. The future of AI - based SOAR is bright. By actively exploring these research directions, we can unlock its full potential, empowering SOCs to navigate the ever - evolving threat landscape and safeguard our digital world.

6. Recommendations and Conclusion

Security leaders should strongly consider implementing AI - based SOAR platforms as a critical component of their security infrastructure. Here are some key recommendations:

- Conduct a thorough assessment of your organization's security needs and existing security tools to identify areas where AI - based SOAR can provide the most significant benefit.
- Invest in high - quality security data collection and management practices to ensure AI models have access to the data necessary for effective training and operation.
- Develop a clear strategy for integrating AI - based SOAR with existing security tools and workflows to ensure a smooth transition and maximize its effectiveness.
- Continuously monitor and evaluate the performance of the AI - based SOAR platform, refining its algorithms and playbooks as needed to adapt to evolving threats.
- Foster a culture of collaboration between security analysts and AI systems, leveraging human expertise for critical decision - making while allowing AI to handle routine tasks.

The ever - growing complexity of the cyber threat landscape demands innovative solutions to empower security teams. AI - based SOAR platforms offer a powerful approach to automate security tasks, prioritize threats, and orchestrate responses. By integrating AI and ML capabilities, SOAR platforms can significantly enhance security operations, allowing analysts to focus on strategic activities and improve an organization's overall security posture. As AI technology continues to evolve, AI - based SOAR is poised to play a central role in the future of security operations.

The integration of AI and ML into SOAR platforms presents a transformative opportunity for security operations. By leveraging these powerful technologies, organizations can achieve unprecedented levels of threat detection, response efficiency, and overall security posture. However, to fully realize this potential, a thoughtful approach is necessary.

- **Data is King: Invest in Data Quality Initiatives.** AI models are only as effective as the data they are trained on. Organizations should prioritize data quality initiatives to ensure clean, comprehensive, and well - structured security data feeds into AI models. This includes standardizing data formats, ensuring complete logs, and enriching data with relevant context like threat intelligence and user behaviour information.
- **Embrace Explainable AI: Build Trust and Foster Collaboration.** Opacity in AI decision - making can hinder trust and hamper incident response. Invest in Explainable AI (XAI) solutions that provide insights into the rationale behind AI recommendations. This fosters trust with analysts, allowing them to leverage AI insights effectively and collaborate with the system in a meaningful way.
- **Prioritize Security: Safeguard the SOAR Platform.** AI systems themselves can be vulnerable to manipulation by attackers. Implement robust security measures to protect the SOAR platform and its data. This includes encryption, access controls, and regular vulnerability assessments. Additionally, stay informed about evolving attack techniques and adapt security strategies accordingly.
- **Embrace Continuous Learning: Adapt to the Evolving Threat Landscape.** The cyber threat landscape is constantly in flux. Develop a strategy for continuous learning within the SOAR platform. This involves utilizing adaptive learning algorithms, integrating real - time threat intelligence feeds, and incorporating human feedback into the AI model training process.
- **Foster Human - AI Collaboration: Leverage the Best of Both Worlds.** AI is a powerful tool, but human expertise remains essential for effective security operations. Develop strategies to foster a collaborative approach. This includes designing user interfaces that effectively communicate AI insights, identifying the optimal allocation of tasks between humans and AI, and promoting a culture of trust and collaboration between analysts and AI systems.

By following these recommendations, organizations can leverage AI - based SOAR effectively, empowering their security teams to navigate the complex and ever - evolving cyber threat landscape.

7. Conclusions

The digital world is constantly evolving, and so too are the threats we face. Security operations are locked in a relentless battle against cyber adversaries. AI - based SOAR platforms offer a beacon of hope in this fight. By harnessing the power of AI and ML algorithms, organizations can automate repetitive tasks, prioritize alerts, and even orchestrate automated responses to low - risk threats. This frees up analysts to focus on strategic activities like threat hunting and investigation.

However, AI - based SOAR is not a silver bullet. It requires careful consideration, thoughtful implementation, and a commitment to continuous improvement. By investing in data quality, embracing explainable AI, prioritizing security, fostering continuous learning, and promoting human - AI collaboration, organizations can unleash the full potential of AI - based SOAR. This transformative technology can empower security teams to achieve unprecedented efficiency, proactive threat detection, and ultimately, a more secure digital future. As we move forward, AI - based SOAR offers a compelling vision for the future of security operations, where humans and intelligent machines collaborate to safeguard our digital world.

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