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A Survey of Machine Learning Approaches for Threat Detection and Prevention in Cybersecurity

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Abstract: *With the rapid expansion of digital infrastructure, cybersecurity threats have become more sophisticated, frequent, and challenging to mitigate using traditional rule-based systems. As a result, machine learning (ML) has emerged as a powerful tool to enhance threat detection and prevention mechanisms. This survey presents a comprehensive review of recent advancements in ML techniques applied to cybersecurity, focusing on their effectiveness in identifying and mitigating various types of cyber threats such as malware, phishing, intrusion attempts, and anomalous behavior. We categorize the approaches based on learning paradigms—supervised, unsupervised, semi-supervised, and reinforcement learning—and evaluate their strengths, limitations, and real-world applicability. Furthermore, the survey highlights the challenges associated with data quality, model interpretability, adversarial attacks, and deployment in dynamic threat environments. By synthesizing current trends and identifying research gaps, this paper aims to guide future research directions and the development of robust, intelligent cybersecurity systems.*

Keywords: Cybersecurity, Machine Learning, Threat Detection, Intrusion Prevention, Anomaly Detection

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