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Machine Learning Advancements in Cyber-Physical Systems: Enhancing Security, Performance, and Privacy

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Abstract: *This paper investigates the transformative role of Machine Learning (ML) in Cyber-Physical Systems (CPS), exploring its impact on predictive analytics, system optimization, and data security. As CPS are increasingly implemented in fields like transportation, healthcare, and smart grids, ML techniques have become essential for real-time decision-making, anomaly detection, and efficient management. Despite its advantages, challenges such as adversarial attacks, data privacy concerns, and scalability remain. This paper presents a comprehensive analysis of ML's role in enhancing CPS and explores future research directions to address the limitations of ML-based CPS.*

Keywords: Machine Learning, Cyber-Physical Systems, Predictive Analytics, Security, Data Privacy, Anomaly Detection, Adversarial Attacks

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