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Deep Learning-Based Anomaly Detection in Cloud Computing Environments

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Abstract

Cloud computing has become an essential technology for delivering scalable, flexible, and cost-effective computing resources. However, the dynamic and distributed nature of cloud environments introduces significant security and performance challenges, particularly in detecting anomalous activities such as unauthorized access, resource misuse, denial-of-service attacks, and abnormal network behavior. Traditional anomaly detection techniques often depend on predefined rules or manually engineered features, which may be ineffective against complex and evolving threats. This paper presents a deep learning-based approach for anomaly detection in cloud computing environments. The proposed framework utilizes deep neural networks to automatically learn meaningful patterns from cloud-related data, including network traffic, system logs, resource utilization, and user activities. By learning both normal and abnormal behavioral characteristics, the model can identify deviations that may indicate security threats or performance issues. The framework is designed to support real-time monitoring and improve detection accuracy while reducing dependence on manual feature engineering. Experimental evaluation can be performed using publicly available cloud or network security datasets, with performance assessed through accuracy, precision, recall, F1-score, and false-positive rate. The proposed approach aims to provide an adaptive and scalable solution for strengthening cloud security and improving operational reliability. The study also discusses challenges such as imbalanced datasets, computational overhead, and model interpretability, highlighting potential directions for future research.

Keywords: Cloud Computing, Deep Learning, Anomaly Detection, Cybersecurity, Neural Networks, Network Security, Intrusion Detection, Cloud Security