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Mitigation Of DDOS Attacks with Machine Learning, Deep Learning and Transformers

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ABSTRACT

One of the most significant challenges in global cybersecurity is the rise of cyberattacks, particularly Distributed Denial of Service (DDoS) attacks, which threaten the availability of critical services and impact operations, reputation, and data integrity. Efficient DDoS detection systems are essential to mitigate these risks. This study aims to develop and evaluate advanced machine learning (ML) and deep learning (DL) models for multiclass DDoS detection, leveraging the CICDDoS2019 dataset, which includes 17 distinct DDoS attack classes, ensuring a comprehensive evaluation. The algorithms tested include traditional machine learning models (Random Forest, Logistic Regression, Support Vector Machines, XGBoost, LightGBM), deep learning architectures (Neural Networks, Recurrent Neural Networks, Long Short-Term Memory, Gated Recurrent Units), and advanced transformer-based models (Transformers, Transformer-CNN Hybrid). Deep learning models, particularly GRU and LSTM, excel in learning long-range dependencies and sequence patterns, making them well-suited for evolving attack patterns. This study underscores the importance of leveraging advanced ML and DL techniques for robust multiclass DDoS detection, contributing to the development of adaptive cybersecurity solutions capable of addressing the dynamic and multifaceted nature of DDoS threat.

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