

Hybrid Stacked MemoryNet–CNN with Reciprocal Points Learning for Open-Set Recognition in Unknown DDoS Attack Detection

Mantest Patil, Saahini Pasham, B. Mahathi Reddy, T. Chakradhar

Assistant Professor, Dept of CSE, CMR Technical Campus, Hyderabad, India

Dept of CSE, CMR Technical Campus, Hyderabad, India

Abstract: *Distributed Denial of Service (DDoS) attacks continue to pose a critical threat to network infrastructure, with attackers continuously innovating novel attack methodologies that evade conventional detection systems. Traditional machine learning and deep learning models trained in a closed-set paradigm fail to generalize to previously unseen attack forms encountered in real-world deployments. This paper proposes an Open-Set Recognition (OSR) framework integrating Reciprocal Points Learning (RPL) with a one-dimensional Convolutional Neural Network (CNN1D) architecture, employing Parametric ReLU (PReLU) activations to enhance generalization and mitigate overfitting. The system is evaluated on the CICIDS2017 dataset, using Wednesday traffic for known attack training and Friday traffic for unknown attack testing. Benchmark comparisons against Support Vector Machine (SVM) and K-Nearest Neighbors (KNN) classifiers demonstrate the superiority of the proposed CNN1D-RPL model, achieving 99.93% accuracy on known attacks and approximately 99% accuracy on unknown attack identification. The proposed framework establishes a robust, scalable, and adaptive intrusion detection mechanism capable of addressing the open-set challenge in real-world cybersecurity environments.*

Keywords: DDoS Detection, Open-Set Recognition, Reciprocal Points Learning, CNN1D, Deep Learning, Intrusion Detection System, CICIDS2017, PReLU, Cybersecurity, Unknown Attack Detection.

