Network Intrusion Detection System Using Deep Learning

Musab Ahamed Meeran

B.S Abdur Rahman Crescent Institute of Science and Technology Chennai, Tamil Nadu, India

Farhan Shiyad

B.S Abdur Rahman Crescent Institute of Science and Technology Chennai, Tamil Nadu, India

Abstract:

The fast increase in traffic on the networks and the growth of cyber-attacks complexity. have made the old-fashioned signature-based Intrusion Detection Systems (IDS) inadequate. This is a research project known as NIDS-DL, which suggests an elaborate research framework that employs. Powerful Network Intrusion based on Deep Learning (DL) and Quantum Machine Learning (QML). Detection. We execute and test a number of state-of-the-art architectures, such as Convolutional Neural Networks (CNN), Long Short-Term Memory (LSTM) networks. Transformers and Unsupervised Autoencoders. These models are compared on four benchmarks. major datasets: the old NSL-KDD, the new UNSW-NB15 and the high-fidelity. CICIDS2017 and CICIDS2018 datasets. The experimental findings of our research suggest that although CNNs have the highest trade off between efficiency and accuracy (88.78% on UNSW-NB15), Autoencoders. separate better to detect anomalies (ROC-AUC 0.9468). Furthermore, this project studies the combination of Variational Quantum Classifiers (VQC) and hybrid. quantum-classical models to handle the PennyLane and TensorFlow Quantum models. classical system computational latency bottlenecks. The framework establishes a scalable real-time, adaptive network security foundation in next generation. infrastructures. The NIDS-DL project is a research framework which is modular and intended to benchmark different ones. neural network frameworks resistant to variety of network conditions. The project addresses the "Generalization Gap" of cybersecurity through testing models on datasets whose size approaches a network evolution (since 2009 to 2018). It also fills the divide between classical computing and the new quantum era through the implementation of hybrid models that. use quantum parallelism in classification of features.

Keywords:

Autoencoders, Transformers, Convolutional neural networks (CNN), Deep learning (DL), Long short-term memory (LSTM), Network intrusion detection system (NIDS), Optimization, Quantum machine learning (QML), Variational Quantum Classifiers (VQC).