An Enhanced Intrusion Detection Model with FeedForward Neural Network Classifier

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Abstract—— A major obstacle in the face of increasingly complex cyberattacks is network security. Proactive security measures require effective intrusion detection systems (IDS) that can precisely classify and categorize network threats. In order to improve network attack detection and classification, this paper proposes a reliable method utilizing a Feedforward Neural Network (FFNN) supplemented with Adaptive Synthetic (ADASYN) sampling. We created a model using UNSWNB15 dataset that efficiently handles high-dimensional datasets by preprocessing data using a combination of polynomial features transformation and one-hot encoding. The FFNN model is optimized for binary and multi-class classification tasks. It consists of layers of dense units with dropout and batch normalization. Our method's efficacy is proven by rigorous training and validation procedures, where the model significantly increased its ability to handle class imbalances and improve classification accuracy. The synthesis of new training data by ADASYN was crucial in improving model performance, especially in underrepresented classes. Evaluation measures that highlight the potential of deep Learning in network security applications are ROC-AUC scores and classification reports, which show a notable improvement in our IDS's detection capabilities. The results show that advanced machine learning techniques can be used to enhance conventional intrusion detection systems and provide a means to build stronger network security designs.

***Keyword*— Network Security, Feedforward Neural Network, Network Attack Categorization, Anomaly Detection in Network Security, Network Intrusion Detection System, Deep Learning in Intrusion Detection.**

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