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Analyzing fusion of regularization techniques in the deep learning-based intrusion detection system

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Abstract

The surge of constantly evolving network attacks can be addressed by designing an effective and efficient Intrusion Detection System (IDS). Various Deep Learning (DL) techniques have been used for designing intelligent IDS. However, DL techniques face an issue of overfitting because of complex network structure and high-dimensional data sets. Dropout and regularization are two competently perceived concepts of DL used for handling overfitting issue to enhance the performance of DL techniques. In this paper, we aim to apply fusion of various regularization techniques, namely, L1, L2, and elastic net regularization, with dropout regularization technique, for analyzing and enhancing the performance of Deep Neural Network (DNN)-based IDS. Experiments are performed using NSL-KDD, UNSW_NB-15, and CIC-IDS-2017 data sets. The value of dropout probability is derived using GridSearchCV-based hyperparameter optimization technique. Moreover, the paper also implements state-of-the-art Machine Learning techniques for the performance comparison. Apart from DNN, we have also presented performance analysis of various DL techniques, namely, Recurrent Neural Network, Long Short-Term Memory, Gated Recurrent Unit, and Convolutional Neural Network using a fusion of regularization techniques for intrusion detection and

