

Enhancing Intrusion Detection Systems with Conditional Adversarial Autoencoders for Class Imbalance Mitigation

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Abstract : Class imbalance is a critical challenge in intrusion detection systems, often limiting the effectiveness of classifiers in low-occurrence classes on datasets like CICIDS 2017. We propose a novel approach using Conditional Adversarial Autoencoders (CAAEs) to generate realistic synthetic features for minority classes, enhancing dataset balance and model performance. By formulating binary classification tasks, we evaluated the impact of CAAE-generated data using artificial neural networks (ANNs). Compared to traditional feature generation techniques like SMOTE, CAAEs achieved superior performance even for minority classes with an average F1-Score of 99.38%.

Keywords : intrusion detection systems, feature generation, conditional adversarial autoencoders, SMOTE, CICIDS 2017

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