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Intelligent Smart Power Grid Intrusion Detection System Using Preprocessing and Classification Techniques

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Abstract:
In a smart grid, intrusion detection is a key task for ensuring the network's safety and reliability. In this research paper, we present an innovative technique for data preparation in smart grid intrusion detection that employs MDS (Multi-Dimensional Scaling), Locally Linear Embedding (LLE), and t-distributed Stochastic Neighbour Embedding (t-SNE). The preprocessed data is then utilized to train a CNN (Convolution Neural Network) for classification. The model's performance is assessed using accuracy, precision and recalls determining its usefulness for identifying intrusions. The t-SNE-based preprocessing increases the CNN's capacity to distinguish between normal and invasive events, resulting in greater accuracy, precision, and recall scores.

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I Introduction

According to D. Mohanty et al., (2021), a SG (Smart Grid) is a cyber-physical system that improves the capability of traditional power networks by using functional automation of ICT (Information and communication technology). These systems enable energy providers to provide inexpensive, reliable electric power with minimum losses. Despite their benefits, such cyber-physical systems are vulnerable to diverse threats that compromise the security and confidentially of data [1]. According to Dou An et al., (2022), a smart grid incorporates improved sensors, effective techniques for measuring, progressive control tools, and other approaches and devices to provide secure, effective, and affordable grid system operation. But, the diverse and open environment of a SG makes its energy and information highly susceptible to hostile attacks [2]. In a SG system, ID(Intrusion Detection) is critical for delivering a secure service and sending a high-priority alarm notification to the system administrator regarding the existence of adversary operations [4].

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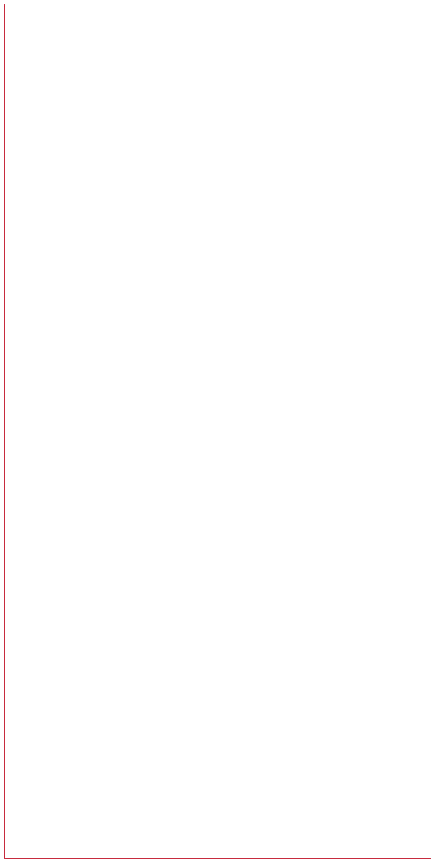
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