

AI-Enhanced Phishing Detection: Leveraging Advanced Transformer-Based Representations with GAN for Robust Security

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Abstract—Phishing is a sophisticated cybercrime technique where attackers trick users into interacting with fraudulent websites, leading to the disclosure of sensitive information. With the increasing frequency and sophistication of phishing attacks targeting both individuals and enterprises, traditional detection methods have become inadequate. Phishing websites often employ content obfuscation and deliberate misspellings to bypass detection systems, making these threats harder to identify. This study proposed an enhanced Transformer-based architecture designed to automatically extract and represent key phishing indicators. The architecture has been improved by modifying the input positional encoding and expanding the analysis beyond the typical textual content of HTML to include comments and attribute data, allowing for a more comprehensive understanding of phishing signals. These indicators are integrated with expertcrafted features to train an enhanced phishing detection model. To further improve the model's generalization to diverse phishing variants, Generative Adversarial Networks (GANs) are employed to generate synthetic phishing sample for more comprehensive training. Extensive evaluations of both model performance and efficiency demonstrate that combining features with extracted HTML content significantly outperforms traditional content-based methods. Moreover, the incorporation of synthetic data into the training process elevated detection accuracy from 87.2% to 93.7%, highlighting the potential of deep learning techniques to bolster phishing detection capabilities in dynamic environments.

Keyword—Phishing Attack, Cybersecurity, Data Imbalance, Generative Adversarial Networks, Transformer, Machine Learning, Deep Learning



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