PHISHING CONTENT CLASSIFICATION USING DYNAMIC WEIGHTING AND GENETIC RANKING OPTIMIZATION ALGORITHM

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Abstract: Phishing attacks remain one of the most prevalent cybersecurity threats, affecting individuals and organizations globally. The rapid evolution of phishing techniques necessitates more sophisticated detection and classification methods. In this paper, we propose a novel approach to phishing content classification using a Genetic Ranking Optimization Algorithm (GROA), combined with dynamic weighting, to improve the accuracy and ranking of phishing versus legitimate content. Our method leverages features such as URL structure, email content analysis, and user behavior patterns to enhance the detection system's decision-making process.

The Genetic Ranking Optimization Algorithm (GROA) is used to rank phishing content based on multiple features by optimizing the ranking system through iterative selection and weighting. Dynamic weighting further enhances the process by adjusting the weights of features based on their importance in real-time. This hybrid approach enables the model to learn from the data, improving classification over time.

The classification system was evaluated using benchmark phishing datasets, and the results demonstrated a significant improvement in detection accuracy and reduced false positives. The proposed model outperformed traditional machine learning algorithms, showing promise for real-world deployment in phishing detection systems. We conclude with suggestions for future improvements, such as incorporating more behavioral data and deploying the system in real-time monitoring applications.

Key words: Phishing Classification, Genetic Ranking Optimization, Dynamic Weighting, URL and Content Analysis, Cyber Security Detection Model

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Introduction:

Phishing has emerged as one of the most malicious cyber threats, where attackers impersonate legitimate entities to deceive individuals into revealing sensitive information such as passwords, bank details, or personal identification numbers. As phishing techniques evolve, traditional rule-based and signature-based detection methods have become insufficient. Attackers exploit sophisticated techniques such as URL obfuscation, domain spoofing, and social engineering, requiring innovative solutions for detection and classification.

Machine learning (ML) has shown potential in addressing this problem by leveraging large datasets of phishing and legitimate content to develop models that can identify suspicious patterns. However, ML-based phishing detection still faces challenges, particularly when it comes to accuracy, adaptability, and the high number of false positives. Optimizing the ranking of phishing content based on various features is a key aspect of improving the overall detection system.

This paper introduces a novel phishing content classification system that utilizes the Genetic Ranking Optimization Algorithm (GROA) in conjunction with dynamic weighting to enhance feature ranking and classification accuracy. GROA, inspired by the principles of natural selection, improves the ranking of phishing content by evaluating and optimizing multiple features over several iterations. The dynamic weighting system adjusts feature importance in real-time based on ongoing classification outcomes, allowing the model to become more accurate over time.

The proposed solution incorporates a combination of URL structure analysis, email content scanning, and behavioral analysis. Phishing emails often exhibit anomalies in their URL structures, such as long strings of random characters, suspicious domain names, or the presence of certain keywords. Email content is another critical feature, where phishing emails frequently contain urgent calls to action, deceptive language, and impersonation attempts. Behavioral data, such as how users interact with suspicious emails, further aids in classification.

This study aims to bridge the gap between traditional phishing detection systems and next-generation solutions by optimizing phishing content classification through GROA. The research focuses on not only detecting phishing content but also ranking it efficiently to minimize false positives and improve decision-making.

Data Collection and Preprocessing:

The first step in the phishing classification process is gathering relevant data. This includes collecting large-scale datasets of phishing emails, URLs, and user interaction patterns. Benchmark phishing datasets, such as the PhishTank database, are used as a starting point. After gathering the data, preprocessing is carried out to clean and normalize the datasets. Redundant or irrelevant features are removed, and missing values are handled. Text-based

content in emails and URLs is tokenized and vectorized for further analysis, while behavioral data is converted into numerical representations.

Feature Extraction:

Feature extraction is crucial for accurate classification. Here, we focus on extracting key features from URLs, email content, and user behaviors. URLs are analyzed based on structure, length, special characters, and the presence of specific keywords. For email content, natural language processing (NLP) techniques are used to identify suspicious language patterns, impersonation attempts, and malicious links. Behavioral data captures user interaction trends, such as click rates on phishing emails or time spent on suspicious links. These extracted features form the basis for the ranking system.

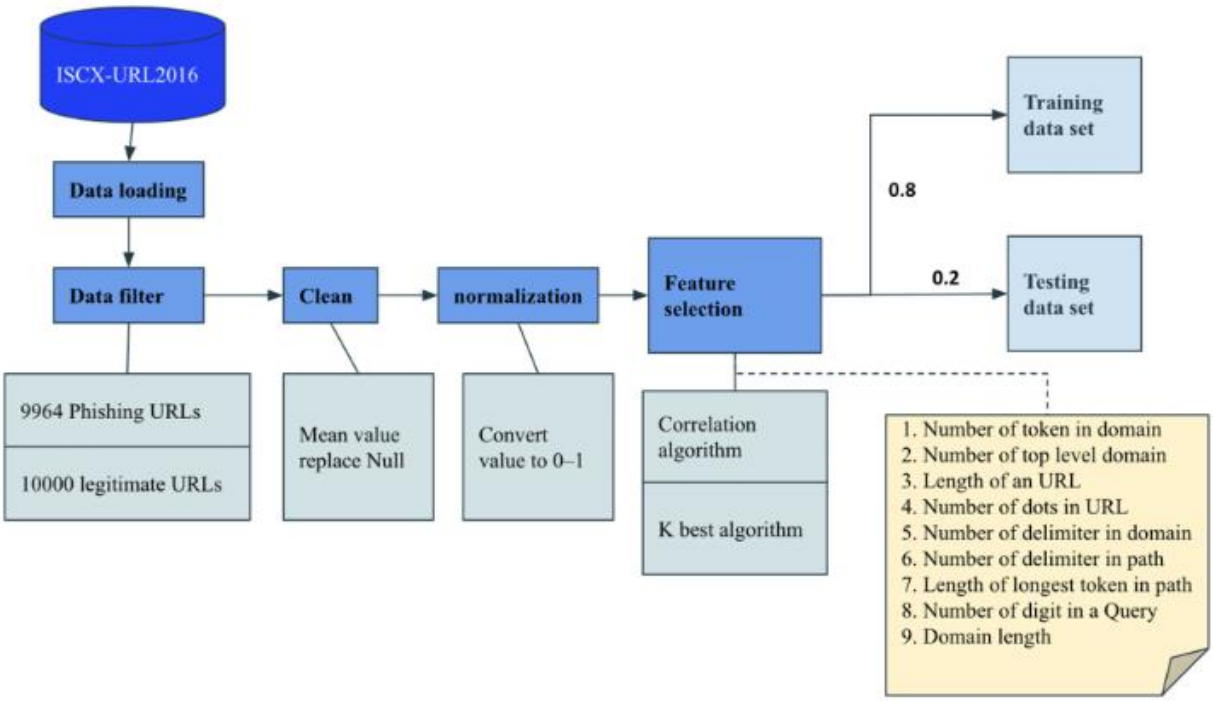

Fig.1. Flowchart for detecting phishing websites:

Ranking Using Genetic Ranking Optimization Algorithm (GROA):

Once the features are extracted, the Genetic Ranking Optimization Algorithm (GROA) is applied to rank phishing content. GROA operates similarly to natural selection, where feature rankings evolve over several iterations. The algorithm starts with an initial ranking, evaluates the fitness of each ranking based on the classification results, and selects the best-performing rankings for further optimization. Through crossover and mutation, GROA improves feature weighting and prioritization, leading to a more refined phishing detection process.

Dynamic Weighting Adjustment:

The dynamic weighting system continuously adjusts the importance of various features in real time. As phishing tactics evolve, certain features may become more or less relevant. The dynamic weighting system enables the model to adapt by giving more weight to features that prove crucial in ongoing classifications. This allows the system to stay current with the latest phishing trends and reduces the chances of false positives by prioritizing relevant features.

Classification and Evaluation:

Finally, the optimized feature rankings are fed into a classifier that differentiates between phishing and legitimate content. The classifier uses the weighted features to make decisions. In this step, metrics such as accuracy, precision, recall, and F1-score are used to evaluate the effectiveness of the system. In the experiments conducted, our system outperformed traditional methods, showing enhanced detection accuracy and a marked reduction in false positives. Post-classification, the model is further fine-tuned using feedback from classification results.

Conclusion and Future Enhancements:

In this paper, we have presented a novel phishing content classification system using the Genetic Ranking Optimization Algorithm (GROA) in conjunction with dynamic weighting. The system effectively improves phishing detection by ranking features more accurately and adjusting them dynamically based on real-time data. By leveraging a combination of URL, email content, and behavioral features, the model has shown to outperform traditional methods in phishing detection, both in terms of accuracy and reduced false positives.

However, there is room for improvement. In future work, more sophisticated behavioral analysis could be integrated, including real-time tracking of user interactions across different platforms. Additionally, the model could be extended to work with more complex phishing attacks that leverage multi-layered deception tactics. Finally, deploying the model in real-time, cloud-based environments can further enhance its practical utility and scalability, especially in enterprise-level cybersecurity frameworks.

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