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Survey of Phishing Websites Prediction using Machine Learning Approaches

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Abstract- Phishing is known as one of the oldest forms of Cyber attacks. A phishing website is a domain similar in name and appearance to an official website. They're made in order to fool someone into believing it is legitimate. Today, phishing schemes have gotten more varied, and are potentially more dangerous than before. Artificial intelligence based machine and deep learning techniques is capable to predict the phishing websites. This paper presents the review of prediction of phishing websites using machine learning approaches.

Index Terms- Phishing Websites, Machine Learning, Accuracy, Error rate.

I. INTRODUCTION

Phishing is the process of attempting to acquire sensitive information such as usernames, passwords and credit card details by masquerading as a trustworthy entity using bulk email which tries to evade spam filters. Emails claiming to be from popular social web sites, banks, auction sites, or IT administrators are commonly used to lure the unsuspecting public. It's a form of criminally fraudulent social engineering.

As the world responded to the Coronavirus Disease 2019 (COVID-19) pandemic in 2020, digital operations became more important, and people started to depend on new initiatives such as the cloud and mobile infrastructure. Consequently, the number of cyberattacks such as phishing has increased. Phishing websites can be detected using machine learning by classifying the websites into legitimate or illegitimate websites [1].

Now-a-days there are different types of cybercrime, Phishing is one of cyber-attacks where attackers impersonate as a member of legitimate institutions or organizations through an email, text message, advertisements or through any means to steal sensitive information which results to loss of personal and sensitive information such as account no, social security no, credit card no etc. Phishing attack has been increasing exponentially. In this attack mostly innocent users are comes to losses their sensitive, unique, personal, valuable and secure data and information's.

Many hackers are accomplished through phishing attacks where client are trapped into interacting with web-pages which looks like to be legitimate websites [2]. Enormous network connectivity, big data, the Internet of Things (IoT), digitalization of the world, and the use of social websites and apps have brought enormous institutional and individual security challenges. The conventional security system often fails to provide cyber security to institutions and individuals. Artificial Intelligence (AI) is highly adaptive and smart to handle the volatile cyber security environment. AI plays a prudent role in access control, user authentication and behavior analysis, spam, malware, and botnet detection [3].

Scraping bots or scrapers are computer programs that automatically fetch data from the Internet. The price of products is illegally copied from different e-commerce stores and pasted into their sites for their benefit. Various web traffic surveys show that automated programs account for approximately half of all website traffic. However, an E-commerce website concerns many security issues that remain unresolved despite a significant increase in E-commerce development. One of the most damaging attacks on E-commerce sites is the price scraping when it comes to competitors [4].

Third-party tracking on the Web has been used for collecting and correlating user's browsing behavior. Due to the increasing use of ad-blocking and third-party tracking protections, tracking providers introduced a new technique called CNAME cloaking. It misleads Web browsers into believing that a request for a subdomain of the visited website originates from this particular website, while this subdomain uses a CNAME to resolve to a tracking-related third-party domain. This technique thus circumvents the third-party targeting privacy protections. The goals of this paper are to characterize, detect, and protect the end-user against CNAME cloaking based tracking. Firstly, we characterize CNAME cloaking-based tracking by crawling top pages of the Alexa Top 300,000 sites and analyzing the usage of CNAME cloaking with CNAME blocklist, including websites and tracking providers using this technique to track users' activities [6].



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Artificial intelligence (AI) in web development is a new sector that a lot of people are into recently. AI continues to evolve and grow, and plays an increasingly important role in the web app development space [1]. When it comes to developing innovative and more sophisticated web applications, the involved technologies continue to play a bigger role. With the involvement of the internet into our daily lives, particularly businesses are enjoying the aspects of AI. Precisely, companies use AI in proper marketing of their products and enhancing their brand visibility by building their websites and web applications [2]. AI or Machine Learning (ML) models are able to help web app developers to solve problems related to security, user experience, content analysis, quality assurance and much more. This presents the need for a framework or tool that can allow third party developers to seamlessly build an AI based app [7].

II. REVIEW OF LITERATURE

F. Yahya et al.,[1] the purpose of the study is to conduct a mini-review of the existing techniques and implement experiments to detect whether a website is malicious or not. The dataset consists of 11,055 observations and 32 variables. Three supervised learning models are implemented in this study: Decision Tree, K-Nearest Neighbour (KNN), and Random Forest. The three algorithms are chosen because it provides a better understanding and more suitable for the dataset. Based on the experiments undertaken, the result shows Decision Tree has an accuracy of 91.16% which is the lowest compared to the other models, 97.6 % for the KNN model which is the highest among all the models and 94.44% accuracy for the Random Forest model.

K. S. Swarnalatha et al.,[2] Phishers are appears in many platform of communication such as in the form of VOIP, message and e-mails which is not real. Commonly users have many accounts on various websites including social media, email, and also in bank. So that innocent users are the most vulnerable targets for these types of attack. This happened because most of the peoples are unknown of the sensitive data, which helps them to get their information successfully. As of 2020, phishing is the most common attack performed by cyber criminals according to FBI's Internet Crime Complaint Centre. First phishing Datasets are collected from phish tank and then legitimate websites are collected from University of New Brunswick and then dataset is preprocessed using wrapper and filter method so that it covers the dataset which gets missed, tampered and unstructured.

S. M. Istiaque et al.,[3] Machine learning (ML) models are the building blocks of AI. In this research, a novel practical approach is followed to prove the effectiveness of AI in the field of cyber-security. Multiple machine learning algorithms are applied to prove that. A two-step suitability test is conducted in this study. In the 1st step, the KDD'99 data set is used to train and test the AI models. In the second step, train models are repeatedly tested on a fresh data set, NSL-KDD. Finally, the testing results are compared to prove the authenticity of AI in cyber-security. An absolute practical approach and reliable outputs of various AI models prove AI's suitability in cyber-security.

R. Yaqoob et al.,[4] aims to uncover the fact that both humans and bots are involved in stealing the prices of products from different e-commerce stores without the permission of original sites. This paper discusses the well-known price scraping tools and techniques. First, we have performed real-time price scraping attacks through custom XPATH, and we have obtained results which show that some platforms are still vulnerable for bots e.g., Alibaba and eBay.

M. Min et al.,[5] The emergence of illegal online gambling (IOG) has led to an increase in gambling addiction and threats to cyber security. Since IOG is advertised through short message service (SMS), we propose a novel system to detect and extract uniform resource locator (URL) information from SMS spam. For majority of the cases, these URLs are not directly linked to a real website address, which causes difficulties for detection systems. In order to address this problem, we utilized a readable transformation technique (RTT). The resulting suggestions can be enhanced to extract URLs automatically from SMS spam, which will allow local authorities identify and block IOG operations.

H. Dao et al.,[6] privacy protection extensions are largely ineffective to deal with CNAME cloaking-based tracking except for Firefox with a developer's version of the uBlock Origin extension. Secondly, we propose a supervised machine learning-based approach to detect CNAME cloaking-based tracking without the on-demand DNS lookup. We show that the proposed approach outperforms well-known tracking filter lists. Finally, to circumvent the lack of DNS API in Chrome-based browsers, we design and implement a prototype of the supervised machine learning-based browser extension to detect and filter out CNAME cloaking tracking, called CNAMETracking Uncloaker.

R. Nanjundappa et al.,[7] present an AI Enabled Web Contents Authoring Framework (AWAF), where AI models can be simply dragged into workspace, provide options to build, train Deep learning models using a simple web visual interface, and ultimately ship the AI features into the web application. Also, we provide an option to connect together smart blocks called AI Nodes, to create our custom deep learning models. These AI Nodes are designed flexible enough to reap the advantages of portability and reusability. And, laterally, we also focus on assigning or distributing the computational AI Nodes to capable IOT-edge devices like high-end TV etc. to leverage their hardware capabilities in order to increase the overall responsiveness of the AI application on low-end devices.

K. E. Aydın et al.,[8] Categorization of web sites is an important problem and has many practical applications. One such application is parental control for safe internet for children. Failure to classify websites by specific rules makes it difficult to access information, as well as leaving many users of different age groups with the harmful side of the Internet. Current secure internet solutions are not comprehensive or cannot be customized. Furthermore, the fact that the blocking orders issued by the courts do not cover all harmful sites and these websites change their domains so often. Thus, dynamic classification of websites using the text data is very important.

U. Iqbal et al.,[9] AdGraph considers many aspects of the context a network request takes place in, it is less susceptible to the single-factor evasion techniques that flummox existing approaches. We evaluate AdGraph on the Alexa top-10K websites, and find that it is highly accurate, able to replicate the labels of human-generated filter lists with 95.33% accuracy, and can even identify many mistakes in filter lists. We implement AdGraph as a modification to Chromium. AdGraph adds only minor overhead to page loading and execution, and is actually faster than stock Chromium on 42% of websites and AdBlock Plus on 78% of websites. Overall, we conclude that AdGraph is both accurate enough and perform enough for online use, breaking comparable or fewer websites than popular filter list based approaches.

N. Megha et al.,[10] The proposed approach detects both phishing sites and websites with malicious content. This multi-agent system contains four autonomous intelligent agents, which communicate with each other using the Extensible Messaging and Presence Protocol (XMPP) for decision-making. The first is a monitoring agent, second and third is for decision-making (using the machine-learning classifiers) and the fourth is for action-performing. The first agent is responsible for extracting URLs.

It passes the extracted URLs to the second agent for feature extraction and classification. If any phishing is detected, the second agent communicates with the fourth agent and the site is blocked. Otherwise, the second agent communicates with the third agent for malicious script detection. If any malicious script is detected then the fourth agent blocks the entire web page. We have tested the performance and accuracy of the proposed method and obtained results ensures its efficiency.

S. S. Hashmi et al.,[11] Websites employ third-party ads and tracking services leveraging cookies and JavaScript code, to deliver ads and track users' behavior, causing privacy concerns. To limit online tracking and block advertisements, several ad-blocking (black) lists have been curated consisting of URLs and domains of well-known ads and tracking services. Using Internet Archive's Wayback Machine in this paper, we collect a retrospective view of the Web to analyze the evolution of ads and tracking services and evaluate the effectiveness of ad-blocking blacklists.

T. Vo et al.,[12] There is an explosion in the advertisements over web nowadays. Most of the websites we visit contain ads, even Facebook, Google and Twitter. Sometimes, it could also appear that someone is spying on us because there are incidents like ads that show up with the content exactly what you have been searching not long ago. Such events happen as a result of Web Tracking. Initially, ads were meant to support businesses and companies to market their products and persuade the users to purchase them. Web Tracker were meant to track the user interaction with the website so it can improve the user experience.

III. PROPOSED STRATEGY

- *Load the phishing websites dataset from the Kaggle*

In this step, the phishing websites dataset will be downloaded from kaggle source. It is a large dataset providing company. Then load this dataset into the python environment.

- *Visualizing the Dataset*

Now open the dataset files and view the various data in term of features like url, length_url, length_hostname, ip etc.

- *Pre-process the Dataset*

Now the data preprocess step applied, here data is finalize for processing. Missing data is either removal or replace form constant one or zero in this step.

- *Splitting the Dataset into training and testing*

In this step, the final preprocessed of dataset is divided into the training and the testing dataset. In the machine learning, firstly the machine is trained through given dataset then it comes in tested period for remaining dataset.

- *Classification Using Machine Learning Algorithm*

Now apply the machine learning technique to find the performance parameters. The existing work applied several techniques. In proposed method, we apply the SVM and KNN method and optimize the better results than other approach.

- *Performance Metrics*

(*Accuracy, Precision, Recall, F1 - Score*)

Now the performance parameters are calculated in terms of precision, recall, f-1 measure, accuracy etc by using the following formulas-

True Positive (TP): predicted true and event are positive.

True Negative (TN): Predicted true and event are negative.

False Positive (FP): predicted false and event are positive.

False Negative (FN): Predicted false and event are negative.

$$Precision = \frac{|TP|}{|TP| + |FP|}$$

$$Recall = \frac{|TP|}{|TP| + |FN|}$$

$$F1 = 2 \cdot \frac{Precision \cdot Recall}{Precision + Recall}$$

$$Accuracy = \frac{|TP| + |TN|}{|TP| + |TN| + |FP| + |FN|}$$

IV. CONCLUSION

The websites exactly seems to be semantically as well as visually to the original websites. The main idea of the phisher or hackers is to gain and purloin the critical information such as credential account, username, password and other private information related to any organization and company. According to phishing or web spoofing techniques is one examples of social engineering attack. This paper present the review of the previous work based on the phishing website detection. In the future take some suitable dataset from kaggle machine learning repository and apply the classification algorithm to achieve the better performance.

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