# Phishing Websites Detection Based on Phishing Characteristics In The Webpage Source Code

**Sivakumar Sivaranjani[1], Dr V.Saravanan[2]**
[1]Dept of Library Information Science
[2]HOD & Professor, Dept of Information Technology
[1, 2] Hindusthan College of Arts and Science, Coimbatore, India

***Abstract***- *World Wide Web Consortium (W3C) is the international standards organization for the World Wide Web (www). It develops standards, specifications and recommendations to enhance the interoperability and maximize consensus about the content of the web and define major parts of what makes the World Wide Web work. Phishing is a type of Internet scams that seeks to get a user"s credentials by fraud websites, such as passwords, credit card numbers, bank account details and other sensitive information. There are some characteristics in webpage source code that distinguish phishing websites from legitimate websites and violate the w3c standards, so we can detect the phishing attacks by check the webpage and search for these characteristics in the source code file if it exists or not.*

*In this paper, we propose a phishing detection approach based on checking the webpage source code, we extract some phishing characteristics out of the W3C standards to evaluate the security of the websites, and check each character in the webpage source code, if we find a phishing character, we will decrease from the initial secure weight. Finally we calculate the security percentage based on the final weight, the high percentage indicates secure website and others indicates the website is most likely to be a phishing website. We check two webpage source codes for legitimate and phishing websites and compare the security percentages between them, we find the phishing website is less security percentage than the legitimate website; our approach can detect the phishing website based on checking phishing characteristics in the webpage source code.*

***Keywords***- phishing, phishing characteristics, w3c standards, webpage source code, secure website weigh.

## I. INTRODUCTION

Phishing is a fraudulent attempt to gain personal information from victims such as bank information, credit card information, social security, employment details, and online shopping account passwords and so on. Phishing attacks use fraudulent e-mails or websites designed to fool users into divulging personal financial data by stealing the trusted brands of well-known banks, e-commerce and credit card companies [8]. People regularly trust about any information they receive through email or website and phishers use injection attacks to

hide his website by email or by URL redirection [1]. Phishing websites are like legitimate websites, even to the point of using the graphics and links straight of the legitimate website.

While phishing tricks are continuously growing, one common trick is to have a login screen in a popup window, which allows them to copy the legitimate website exactly [8]. Phishers send an email contain a hyperlink to open a new window or popup windows while browsing the web that claims to be legitimate website. The popup window may ask to update, validate or confirm account information and it is like official organizations websites. One of the W3C standards is avoid using popup windows or using a hyperlink to open in a new window in the webpage [9]. So, we conclude that phishers use some tricks to fool the user and tempting them, some of these are external links for images or logos, suspicious URLs, external domains, email, iframe, suspicious script, and popup window [6].

Phishing detection can be roughly classified into two categories: List-Based and Heuristic-Based [2]. List-based anti-phishing approaches are widely used today. Classifying a website as phishing or trusted is a simple database lookup. List-based approaches can be broken down into blacklist and whitelist.

Blacklists hold URLs that refer to websites that are considered phishing. Whenever a browser loads a page, it queries the blacklist to determine whether the currently visited URL is on this list. If so, appropriate countermeasures can be taken. Otherwise, the page is considered legitimate. The blacklist can be stored locally at the client or hosted at a central server. Whitelist is a list of trusted websites. The basic idea is that the user builds a list of trusted websites that he/she accesses on a regular basis. If the user attempts to navigate to a website that is not in the trusted list, he/she is either blocked from the website or prompted to add the website to the trusted list.

Heuristic-based approaches check one or more characteristics of a website to detect phishing rather than look in a list. These characteristics can be the uniform resource locater (URL), the hypertext markup language (HTML) code, or the page content itself. Most of the heuristics were targeted at the HTML source code while two considered the content of the URL.

W3C recommends standards for web development; the following are overview of some web languages and their standards [4]:

Hypertext Markup Language (HTML) is used to structure text documents and put a hypertext linkbetween documents on the web .The text coding consists of commands in angle brackets <> that affect the display of elements and can be interpreted by an internet browser. For example, browsers display the italic element (<i> … </i>) as italic text.

Extensible Markup Language (XML) is more flexible than HTML, because we can add our format and elements and defining data elements on a webpage, HTML defines how elements are displayed but XML defines what those elements contained.

Cascading Style Sheets (CSS) is for webpages presentation and element appearance, including colors, fonts, etc., CSS separate content from presentation and the W3C recommended that layout in HTML be phased out and replaced by stylesheets to control the webpage layout and presentation.

In this paper, we show some phishing detection approaches, objects of W3C and common properties of phishing attacks, and we propose a phishing detection approach based on checking the phishing characteristics in the webpage source code that extracted out of the W3C standards and detect if there a phishing attacks based on the security percentage.

This paper is organized as follows. Section 2 introduces literature review about relevant phishing website detection and in section 3 we introduce W3C webpage objects and properties of phishing attack, followed by an overview of our methodology in section 4. The testing results are reported in section 5. Section 6 concludes our work and future work in this paper.

a) Using the IP address.
b) Abnormal request URL.
c) Abnormal URL of anchor.
d) Abnormal DNS record.
e) Abnormal URL.

2- Security & Encryption.

a) Using SSL certificate.
b) Certification authority.
c) Abnormal cookie.
d) Distinguished Names Certificate (DNC).

3- Source Code & Java script.

a) Redirect pages.
b) Straddling attack.
c) Pharming attack.
d) Using onMouseOver to hide the Link.
e) Server Form Handler (SFH).

4- Page Style & Contents.

a) Spelling errors.
b) Copying website.
c) Using forms with “Submit” button.
d) Using Popups windows.
e) Disabling right click.

5- Web Address Bar.

a) Long URL address.
b) Replacing similar characters for URL.
c) Adding a prefix or suffix.
d) Using @ symbol to confuse.
e) Using hexadecimal character codes.

6- Social Human Factor.

a) Much emphasis on security and response.

b) The rule base has input parameters (criterion) and one output that contain all the “IF-THEN” rules of the system. The output for each criterion is one of the following: Genuine, Doubtful or Fraud. The output of final website phishing is one of the final output (Very Legitimate, Legitimate, Suspicious, Phishy or Very Phishy) which representing final phishing website rates.

c) Second approach is a client-side defense against web-based identity theft [6]. It proposes a framework for client-side defense: a browser plug-in called SpoofGuard that examines webpages and warns the user when requests for data may be part of a spoof attack, it computes a spoof index (a measure of the likelihood that a specific page is part of a spoof attack), and warns the user if the index exceeds a level selected by the user. SpoofGuard uses a combination of page evaluation and examination of outgoing post data to compute a spoof index.

d) When a user enters a username and password on a spoof website that contains some combination of suspicious URL, misleading domain name, images from an honest website, and a username and password that have previously been used at an honest website, SpoofGuard will intercept the post and warn the user with a popup that foils the attack. The paper describes common properties of ten spoof websites recently found, they are Logos, Suspicious URLs, User input, Short lived, Copies, Sloppiness or lack of familiarity with English and HTTPS. The browser plug-in applies tests to all downloaded pages and combines the results using a scoring mechanism. The total spoof index of a page determines whether the plug-in alerts the user and determines the severity and type of alert. Since popup warnings are intrusive and annoying, it attempts to warn the user through a passive toolbar indicator in most situations.

e) In order to apply image and URL check, the SpoofGuard plug-in is supplied with a fixed database of images and their associated domains. When the browser downloads a login page all images on the page are compared to images in the SpoofGuard database. The spoof-score for the page is increased if a match is found but the page‟s domain is not a valid domain for the image. The browser history file and additional history stored by SpoofGuard are used to evaluate the referring page. When a user fills in form data, SpoofGuard intercepts and checks the HTML post data, allowing the actual post to proceed only if the spoof index is below the user specific threshold for posts.

f) Third approach is Anomaly Based Web Phishing Page Detection [7]. It examines the anomalies in webpages, in particular, the discrepancy between a website‟s identity and its structural features and HTTP transactions. A structured webpage is composed of W3C DOM objects. Among them, it lists five categories, based on their relevance to the web identity. They are Keyword/Description (KD), Request URL (RURL), URL of Anchor (AURL), Server Form Handler (SFH) and Main Body (MB).These categories are the main sources which the identity and features are derived from and lists the characteristics of phishing like Abnormal URL, Abnormal

DNS record, Abnormal Anchors, Abnormal Server Form Handler, Abnormal Request URL, Abnormal cookie and abnormal certificate in SSL.

It extracts the related web objects from a webpage and converts them into a feature vector based on the characteristics of phishing analysis. The page classifier takes the feature vector as input and determines whether the page is bogus or not. The proposed phishing detector consists of two components Identity Extractor and Page Classifier.

Identity Extractor uniquely identifies the website‟s ownership; the identity is an abbreviation of the organization‟s full name and/or a unique string appearing in its domain name.

Page classifier refers to these objects/properties as structural features. One source of structural features is those identity related W3C DOM objects in a webpage, e.g. URI domain of an anchor. Another source of structural features is HTTP transactions. Page classifier employs Support Vector Machine (SVM), a well-known algorithm for classification. It outputs a label 1 which indicating a phishing page or a label -1 which indicating an authentic one.

To facilitate SVM based classification, they quantify those features into vectors. The output from the execution of the webpage identity extractor is a character strings from extracted identity words. The feature vector initialization of webpage are URL address, DNS record ,URL of anchor , request URL , server form handler , domain in cookie and certificate in SSL. Given an identity and a set of features, the task of determining the genuineness of a webpage is executed by Support Vector Machine (SVM), which is a well-known classifier and has been widely employed in pattern recognition.

From the approaches we conclude that, there are many characteristics and anomalies can be found in the webpage and we can detects any possible attacks based on these characteristics, phishers use these characteristics in phishing webpages to gain sensitive information from users.

In our approach is based on checking the phishing characteristics in the webpage source code file, we extract these characteristics out of W3C standards to evaluate the website security and make a security percentage based on the final weight to decide if the

webpage secure or not.

## II. PHISHING ATTACKS CHARACTERISTICS

DNS record, Abnormal Anchors, Abnormal Server Form Handler, Abnormal Request URL, Abnormal cookie and abnormal certificate in SSL.

It extracts the related web objects from a webpage and converts them into a feature vector based on the characteristics of phishing analysis. The page classifier takes the feature vector as input and determines whether the page is bogus or not. The proposed phishing detector consists of two components Identity Extractor and Page Classifier.

Identity Extractor uniquely identifies the website‟s ownership; the identity is an abbreviation of the organization‟s full name and/or a unique string appearing in its domain name.

Page classifier refers to these objects/properties as structural features. One source of structural features is those identity related W3C DOM objects in a webpage, e.g. URI domain of an anchor. Another source of structural features is HTTP transactions. Page classifier employs Support Vector Machine (SVM), a well-known algorithm for classification. It outputs a label 1 which indicating a phishing page or a label -1 which indicating an authentic one.

To facilitate SVM based classification, they quantify those features into vectors. The output from the execution of the webpage identity extractor is a character strings from extracted identity words. The feature vector initialization of webpage are URL address, DNS record ,URL of anchor , request URL , server form handler , domain in cookie and certificate in SSL. Given an identity and a set of features, the task of determining the genuineness of a webpage is executed by Support Vector Machine (SVM), which is a well-known classifier and has been widely employed in pattern recognition.

From the approaches we conclude that, there are many characteristics and anomalies can be found in the webpage and we can detects any possible attacks based on these characteristics, phishers use these characteristics in phishing webpages to gain sensitive information from users.

In our approach is based on checking the phishing characteristics in the webpage source code file, we extract these characteristics out of W3C standards to evaluate the website security and make a security percentage based on the final weight to decide if the webpage secure or not.

## III. PHISHING ATTACKS CHARACTERISTICS

### A. World Wide Web Consortium (W3C) objects:

A structured webpage is composed of W3C objects, some of these objects are [7]:

1) **Request URL (RURL):** External objects (such as images, external scripts, CSS) in a webpage are loaded from other <img src="https://home.peoplepc.com/i/60/common/ppco logo.gif"> in http://www .peoplepc.com.

2) **URL of Anchor (AURL):** A high portion of anchors in a legitimate webpage point to the same domain as the page itself. One example is <a href="http://www.ebay.com/"> in http://www.ebay.com. Webpage names must be meaningful to the visitor Webpage names must be short, in all lower case, contain no spaces, use hyphens, not underscores between words.

3) **Server Form Handler (SFH):** For security and management reasons, most finance/e-business web portals require usernames and passwords. Therefore, those pages usually contain a server form handler. For example, <form action="/inetSearch/index.jsp" method="post" target=" top"> in http://www.chase.com. For phishing websites, the SFH usually is void or refers to a different domain.

### B. Common properties of Phishing attacks:

The following lines represent number of properties of phishing attacks in the websites, they are [6]:

1) **Logos:** The Phishing website uses logos found on the legitimate website to mimic its appearance. So phishers can load it from the legitimate website domain to their phishing websites (external domain).
2) **Suspicious URLs:** Phishing websites are located on servers that have no relation with the legitimate website. The phishing website‟s URL may contain the legitimate website‟s URL as a substring (http: //www.ebaymode.com), or may be similar to the legitimate URL (http://www.paypa1.com) in which the letter „L‟ in PayPal is substituted with number „1‟. IP addresses are sometimes used to mask the host name (http://25255255255/top.htm). Others use @ marks to make host names difficult to understand (http://ebay.com:top@255255255255/top.html) or contain suspicious usernames in their URLs (http://middleman/http://www.ebay.com).
3) **User input:** Phishing websites typically contain pages for the user to enter sensitive information, such as account number, password and so on.
4) **Short lived:** Most phishing websites are available for only a few hours or days – just enough time for the attacker to defraud a high enough number of users.

5) **Copies:** Attackers copy HTML from the legitimate websites and make minimal changes.
6) **Sloppiness or lack of familiarity with English:** Many Phishing pages have misspellings, grammatical errors, and inconsistencies.

## IV. PHISHING WEBSITES DETECTION METHODOLOGY

### A. The phishing characteristics out of the W3C standards:

Phishers use some tricks and to fool users and tempting them, so our approach is to check for these tricks and factors in the webpage source code and calculate the security percentage based on these factors to classify the webpage if it is secure or not, they are:

1) **Https:** It is the secured protocol which used to tell us that this website is secured but it should be in "URL" of the website not in the body source of the webpage because phishers used Https inside their source code file to tell us that this images or this links is secured but it is not. The normal page should be like this <img src="mona.png" />. But there is some phishers use the SSL certificate in the source code like this <img src=https://www.xx.com/mona.png/>. They use https to make us think its secured website buts it is not. Many similar phishing attacks in which phishing websites use a certificate that can be expected to trigger a browser warning.
2) **Images:** All images in the website including website logo should load from the same URL of the website not from another website, so all links should be internal links not external links. Therefore, we check the links to detect any external links inside the source code like this : <img src=https: //www.Phishers.com/logo.jpg>" it is a phishing character.
3) **Suspicious URLs:** Most of the phishers use an IP address instead of using the actual domain name. Others use @ marks to ambiguous their host names.
4) **Domain:** It is the external domains mean: if we logged to website which its name is www.paypal.com and we found there is some URLS of links in the source code like this " www.pay-pal.com" which it is not the source URL so it means that this website try to hack our information .Phisher use forward domain also called domain redirection, it is a technique on the World Wide Web for making a webpage available under many URLs.
5) **Email:** There is a function on PHP called mail or email and it take our information which we enter in the forms like "MasterCard number, etc. "and send them when we press the pay button throw e-mail to the phishers e-mail. Phisher can insert PHP code inside Html code and use this function to send our information.
6) **iframe:** It is HTML tag code and used to embedding another webpage into current webpage. It creates a frame or window on a webpage so that another page can load inside this frame. Phishers use the iframe and make it invisible i.e. without frame borders, when the user goes to website, he/she cannot know that there is another page is also loading in the iframe window. It is a big problem which all people do not know it, it is like small website open in current webpage

### B. System design and implementation:

#### i. System overview:

Detect the phishing websites by checking the webpage source code, we extract some phishing characteristics out of the W3C standards to evaluate the security of the websites, and check each character in the webpage source code, if we find a phishing character, we will decrease from the initial secure weight. Finally we calculate the security percentage based on the final weight, the high percentage indicates secure website and others indicates the website is most likely to be a phishing website.

The environment built by using Microsoft Visual Studio 2010 and use C# programming language. Figure 1 shows the phishing detection layout.

#### ii. System description and work flow:

**1- First:**

- Browse button opens an open file dialog to choose the source code file to check the webpage security; figure 2 is the program main window.
- Starts a file stream that opens the file in read mode.

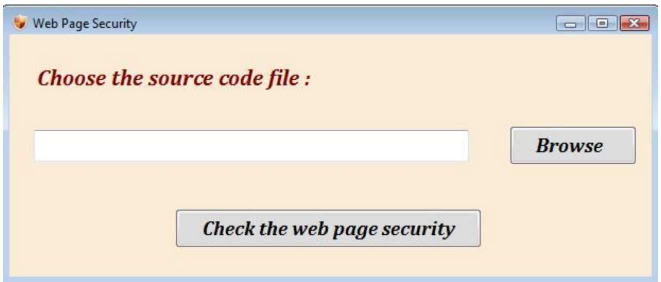


**Figure 2: Phishing detection program main window**

**iii. System description and work flow:**

**1- First:**

- Browse button opens an open file dialog to choose the source code file to check the webpage security; figure 2 is the program main window.
- Starts a file stream that opens the file in read mode.

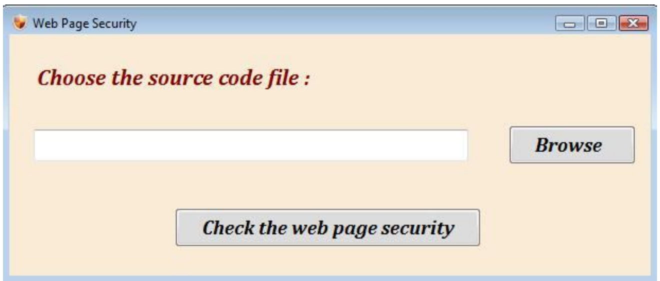


**Figure 2: Phishing detection program main window**

**2- Second:**

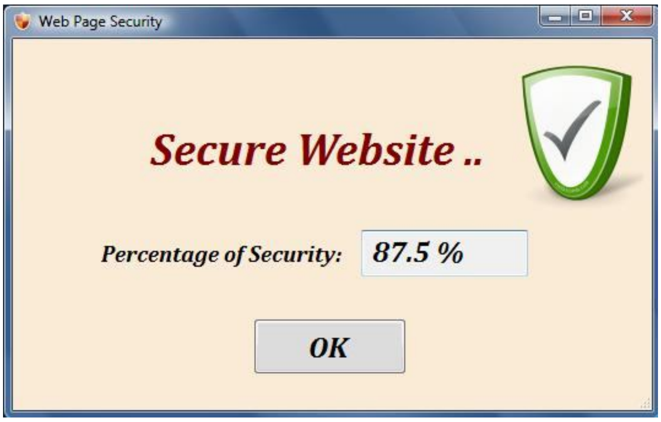
- Checks the webpage security throw the check button.
- Reads every line in the source code individually.

a. Initializing the counter by a secure website weight.
b. Checks for each phishing characteristics in the webpage source code and we have 8 phishing character. They are: different domain, external link for images, suspicious URLs, domain tag, iframe, email, suspicious script and popup window.
c. Phishing characteristics classification :

## V. TESTING AND RESULTS

**Results screenshots:**

***The First window:*** The webpage is secured when the security percentage is 80% or higher, figure 4 is an example of testing results.



*Secure Website ..*

*Percentage of Security:* *87.5 %*

## VI. CONCLUSION AND FUTURE WORK

In this paper we proposed a phishing detection approach that classifies the webpage security by checking the webpage source code, we extract some phishing characteristics out of the W3C standards to evaluate the security of the websites, and checked the webpage source code, if we find a phishing character, and we will decrease from the initial secure weight. Finally we calculated the security percentage based on the final weight, the high percentage indicates secure website and others indicates the website is most likely to be a phishing website. We checked two webpage source codes for legitimate and phishing websites and compare the security percentages between them, and we found the phishing website is less security percentage than the legitimate website. In Future work we can add other checks in the program and check more source codes contains many languages in it like PHP, CSS, asp, java, Perl, etc. Also, we can develop a browser plug-in to check the webpages and informs the user if there any possible attack.

## REFERENCES

[1] Ammar Almomani, B. B. Gupta, Samer Atawneh, Meulenberg, and Eman Almomani “A Survey of Phishing Email Filtering Techniques” IEEE Communications Surveys & Tutorials, Vol. 15, No. 4, 2013.

[2] T.Balamuralikrishna, N.raghavendrasai, M.Satya Sukumar “Mitigating Online Fraud by Ant phishing Model with URL & Image based Webpage Matching” International Journal of Scientific & Engineering Research Volume 3, Issue 3, March -2012.

[3] V.R.Mayuri “Phishing Detection based on VisualSimilarity” International Journal of Scientific & Engineering Research Volume 3, Issue 3, March -2012.

[4] Ahmed Abbasi, Fatemeh “Mariam” Zahedi and Yan Chen “Impact of Anti-Phishing Tool Performance on Attack Success Rates” 978-1-4673-2104-4/12/©2012 IEEE

[5] Weiwei Zhuang1,2, Qingshan Jiang2,3*, Tengke Xiong2 “An Intelligent Anti-phishing Strategy Model for Phishing Website Detection” 1545-0678/12 © 2012 IEEE.

[6] Mallikka Rajalingam, Saleh Ali Alomari, Putra Sumari “Prevention of Phishing Attacks Based on Discriminative Key Point Features of WebPages” International Journal of Computer Science and Security (IJCSS), Volume (6): 2012.

[7] Shivender Singh, Anil K. Sarje, Manoj Misra “ClientSide Counter Phishing Application using Adaptive Neuro-Fuzzy Inference System” 978-0-7695-4850-0/12 © 2012 IEEE.

[8] Madhuresh Mishra, Gaurav, Anurag Jain “A Preventive Anti-Phishing Technique using Code word” International Journal of Computer Science and Information Technologies, Vol. 3 (3) , 2012,4248 – 4250.

[9] Mahmoud Khonji, Youssef Iraqi, Andrew Jones “Mitigation of Spear Phishing Attacks: A Content-Based Authorship Identification Framework” 978-1-908320- 00-1/11© 2011 IEEE.

[10] Maher Aburrous, M. A. Hossain, Fadi Thabatah, Keshav Dahal “Intelligent Phishing Website Detection System using Fuzzy Techniques”.

[11] V.Shreeram, M.Suban, P.Shanthi, K.Manjula, “Antiphishing detection of phishing attacks using Genetic Algorithm” 978-1-4244-7770-8/10/ ©2010 IEEE.

[12] Sadia Afroz, Rachel Greenstadt “PhishZoo: Detecting Phishing Websites By Looking at Them”.

[13] Michael Atighetchi, Partha Pal “Attribute-based Prevention of Phishing Attacks” 978-1-4673-2104-4/12/ ©2012 IEEE.

[14] Huajun Huang, Junshan Tan, Lingxi Liu “Countermeasure Techniques for Deceptive Phishing Attack” 978-0-7695-3687-3/09 © 2009 IEEE.

[15] Shinta Nakayama and Hiroshi Yoshiura, Isao Echizen “Preventing False Positives in Content-Based Phishing Detection” 978-0-7695-3762-7/09 $26.00 © 2009 IEEE