PhishZoo: Detecting Phishing Websites By Looking at Them

Sadia Afroz

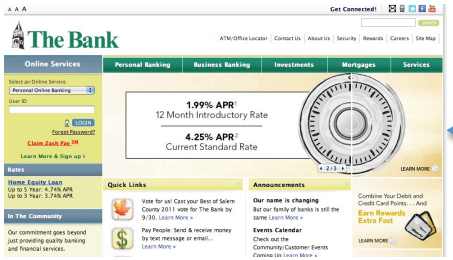
Rachel Greenstadt

The Phishing Problem

URL

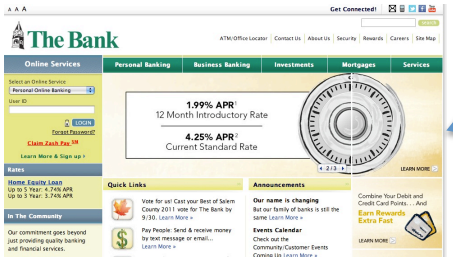
Browser Indicator

SSL



Real bank

Alice uses online bank



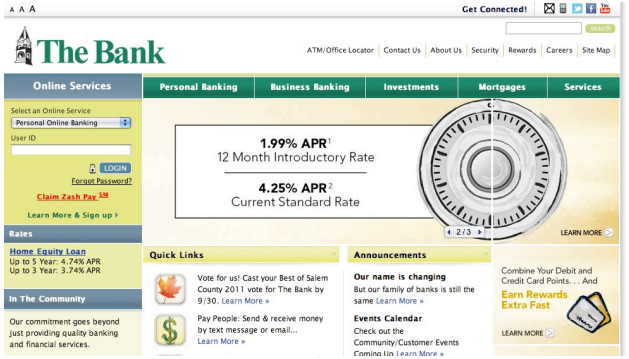
Fake bank

Alice thinks everything that looks like her bank
Is her bank!

What is PhishZoo

Fake site

?



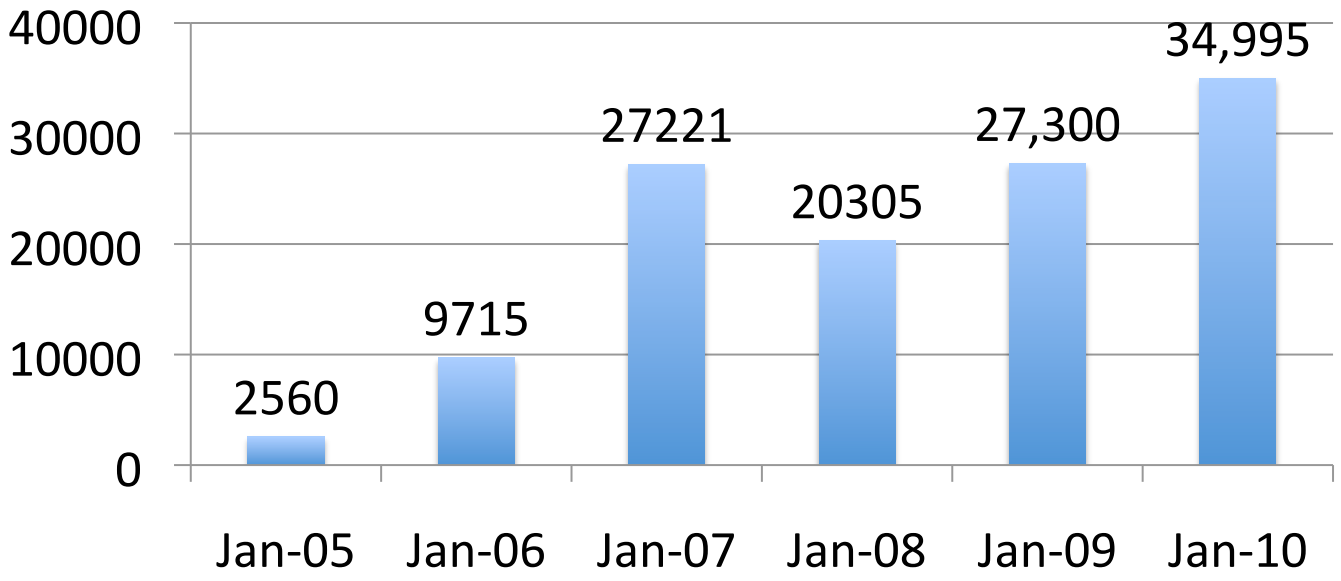
Real site

Overview

- Motivation
- Related works
- Contribution
- PhishZoo: Approach
- Evaluation and results
- Conclusion and future works

Motivation

- Current state of phishing
  - According to the Anti-Phishing Working Group (APWG), there were at least 67, 677 phishing attacks in the last six months of 2010.



- Importance of Appearance
  - 90.9% people trusts a site based on it's appearance [Dhamija et al, 2006]

- Spear Phishing
  - Increase use of spear phishing or targeted attacks

- The majority of users provide sensitive credentials to a small set of sites (fewer than 20) [Cao et al, 2008]

Related works

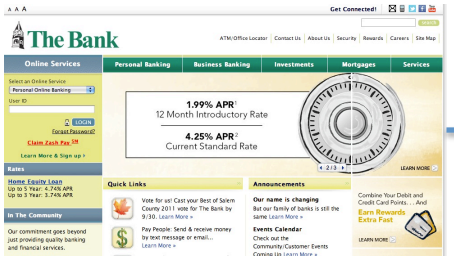
- Non-content based approaches:
  - URL based phishing detection [Ma et al, 2009]
  - Blacklisting
  - Whitelisting
- Content based approaches:
  - CANTINA
  - Google's anti-phishing filter
- Visual similarity based phishing detection:
  - Screenshots of websites [Chen et al, 2009]
  - Screen capture with Earth Mover's Distance [Fu et al, 2006]
  - Layout and style similarity [Liu et al, 2006]
  - Optical character recognition of Screenshots of webpage [Dunlop et al, 2010]

Contribution

1. We investigated vision techniques to detect phishing sites more robustly.

2. It can detect new phishing sites which are not yet blacklisted and targeted attacks against small brokerages and corporate intranets..

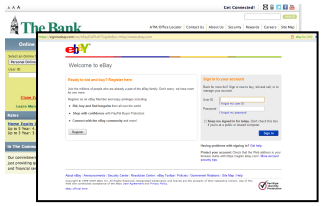
PhishZoo: Approach



Real site

Extracts visual elements of the site

Images
Visible text



Profile Stored

Visual components match but the url, ssl don't match

Phishing Alert

Fake site

Extracts visual elements of the site

Images
Visible text

PhishZoo: Site Profile

- Profile Making
  - A profile of a site is a combination of different metrics that uniquely identifies that site
  - A user chooses real sites that he wants to protect from phishing to be saved as profiles.
  - In a profile, PhishZoo stores SSL certificates, URL and contents related to a site's appearance such as HTML files, extracted features of the logo.
  - SIFT is used to extract image features.

PhishZoo: Image matching

- Currently, only logo of a site is saved in the site profile.
- For image matching, we used SIFT
- SIFT extracts keypoints from an image
- These keypoints are invariant to affine transformation, scaling, rotation upto 30 degrees, and illumination.
- During matching, the keypoints of two images are matched.
- Two images are considered similar if the percentage of matched keypoints is greater than a threshold

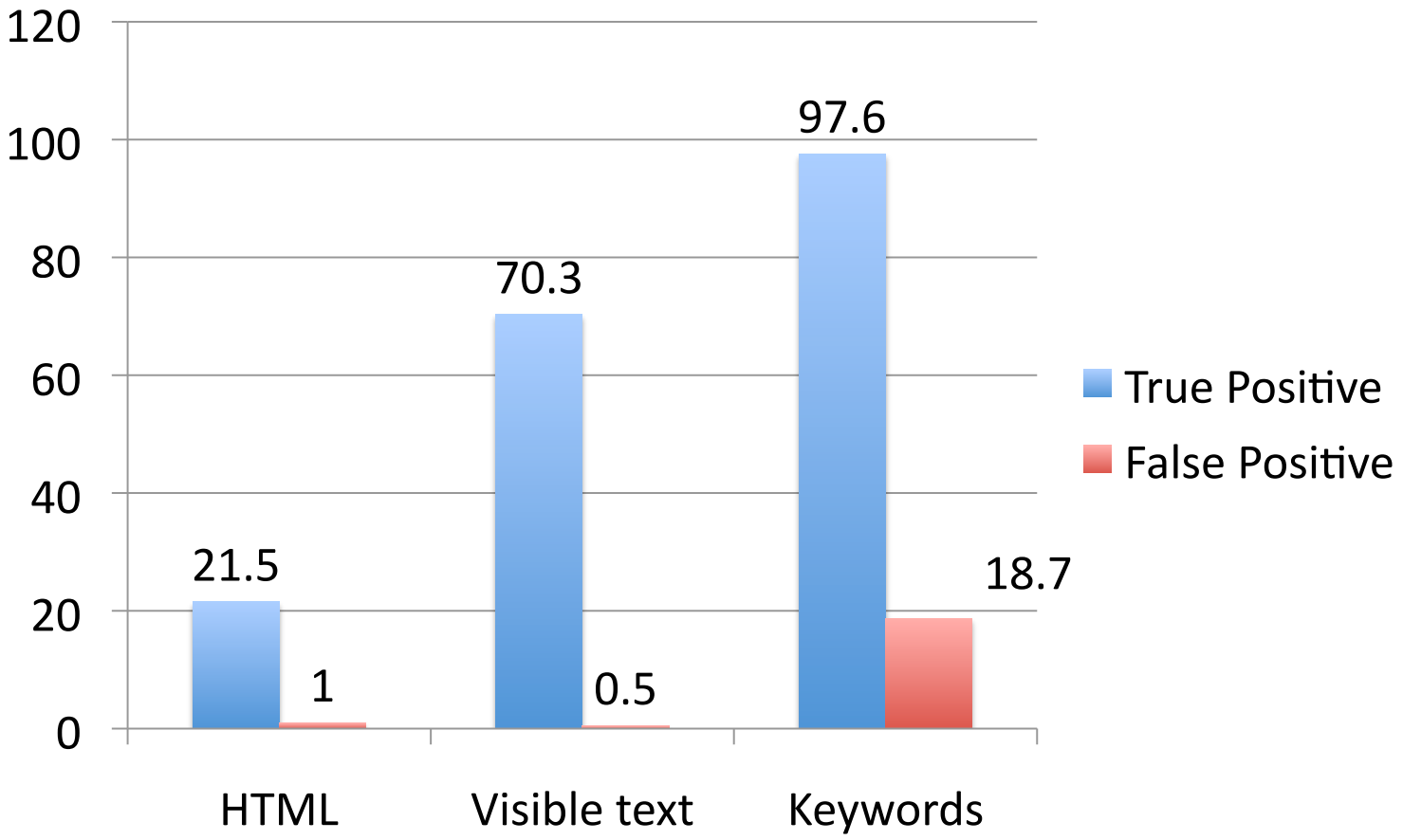
Data Collection

- We used 20 stored sites.
- For true positive testing: 1000 verified phishing sites from Phishtank.
- For false positive testing: 200 most popular sites accessed by Internet users (taken from http://www.alexa.com/topsites).

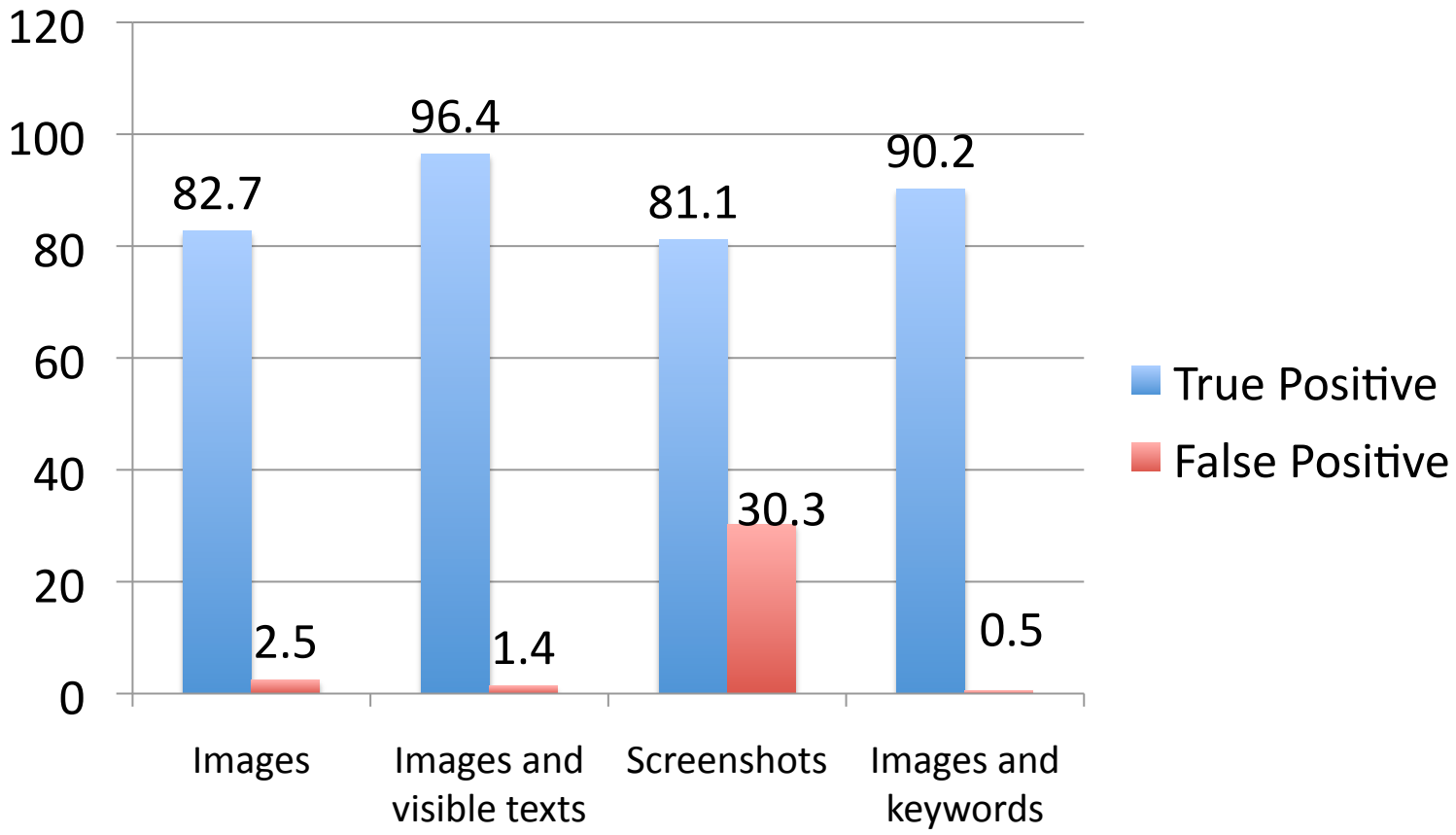
Evaluation and Results

- Profile Content Analysis:
  - HTML
  - Visible text in HTML
  - Keywords : top TF-IDF ranked words of a site and url
  - Images
  - Images and visible text
  - Screenshots
  - Images and keywords

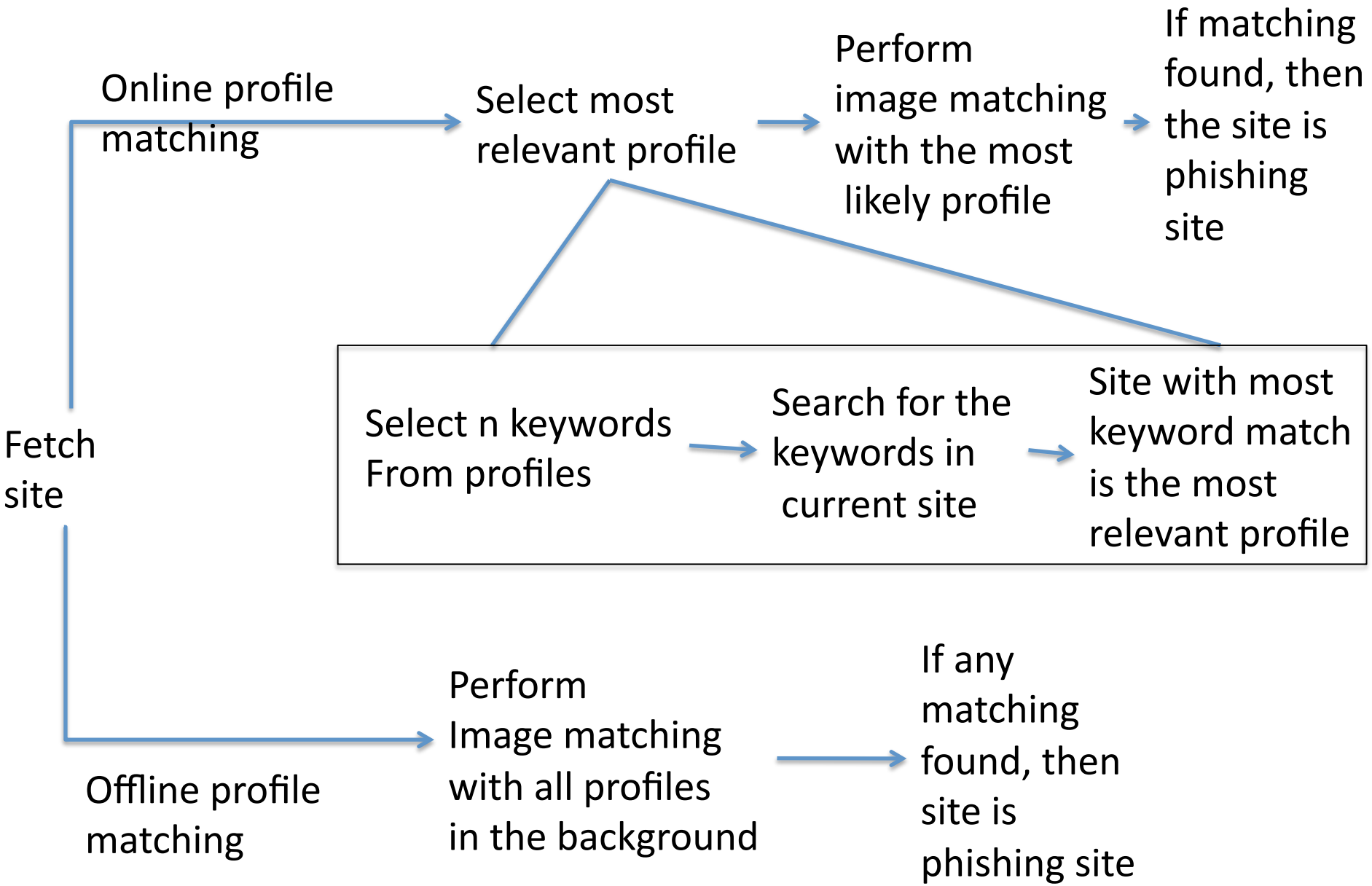
Results: Texts



Results: Images



- Performance Analysis:
  - Keyword and image matching has better accuracy than other profile contents.
  - This recommended approach takes about 7 to 17 seconds on average to compare a site against all the profiles.


Online profile matching
Select most relevant profile
Perform image matching with the most likely profile
If matching found, then the site is phishing site
Fetch site
Select n keywords From profiles
Search for the keywords in current site
Site with most keyword match is the most relevant profile
Offline profile matching
Perform Image matching with all profiles in the background
If any matching found, then site is phishing site

Limitations

1. Site redirection
2. No or obfuscated use of the keywords,
3. Use of cropped, extended or rotated (more than 30 degrees) images

Real logo

Fake logo

Conclusion and Future work

- We described a new approach of web-phishing detection using vision techniques.

- Use a faster image machine algorithm
- Scene analysis

References

- R. Dhamija, J. D. Tygar, and M. Hearst, “Why phishing works,” in CHI ’06: Proceedings of the SIGCHI conference on Human factors in computing systems, 2006.

- Y. Cao, W. Han, and Y. Le, “Anti-phishing based on automated individual white-list,” in DIM ’08: Proceedings of the 4th ACM workshop on Digital identity management. New York, NY, USA: ACM, 2008, pp.51–60.

- S. Egelman, L. Cranor, and J. Hong, “You’ve been warned: An empirical study of the effectiveness of web browser phishing warnings.” in CHI ’08: Proceedings of the twenty-sixth annual SIGCHI conference on Human factors in computing systems, 2008