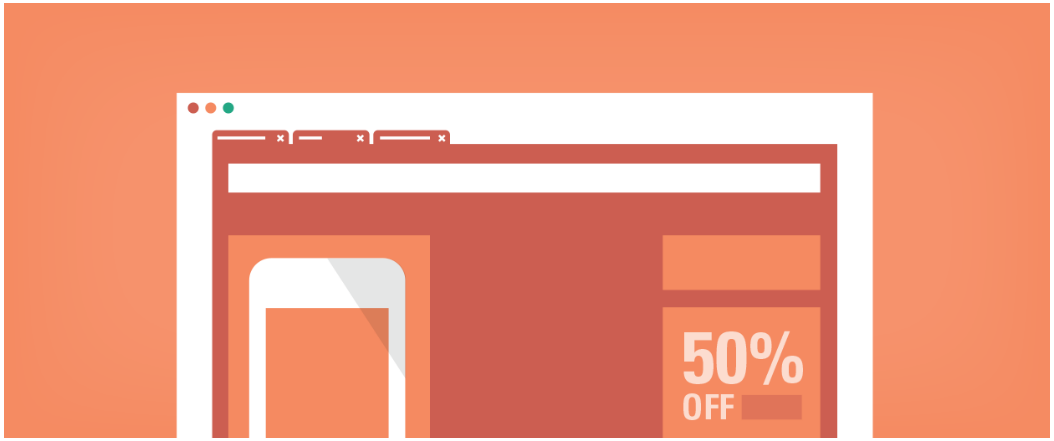
AD-EXTRACTOR TOOL



Developer: Lalit Agarwal

About Ad-Extractor

- A tool to extract and identify advertisements from a given list of webpages.
- Extracts information of both image and textual ads.
- Outputs an excel file containing information of the ads present on the given webpages
- The tool was developed as a part of a research study at Bell Labs.

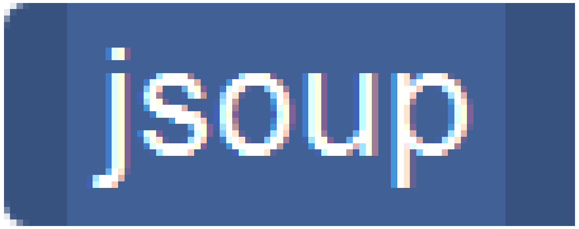
Motivation

- □ Understand the nature of advertisements being shown to the users.
- □ On the basis of data collected, identify any common features to identify and block advertisements on the basis of their categories.
- □ Identify any ads which can be considered inappropriate or embarrassing by users.

Methodology

- Collected browsing history of past 1 month from users who were part of a user study[1] after their consent.
- From the set containing the browsing history of all users, randomly selected and created 3 sets of browsing history- each containing 500, 2500 and 5000 URLs.
- Ran this tool on the three different set of webpages collected from user's browsing history during the user study and extracted the ads being displayed on them.

Tools Used



Tools Used

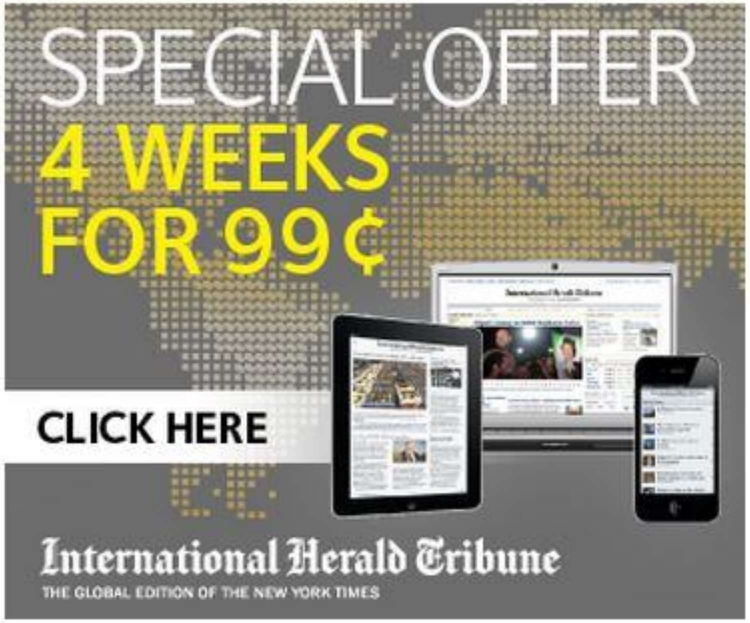
- In order to perform extraction of ads, **Selenium's Firefox web driver** was used which is a famous browser automation tool.
- It automates web application for testing purposes and allows running automated scripts to perform various tasks.
- To parse the HTML, Jsoup parser was used.
- Aho-Corasick string matching algorithm was used for comparing strings.
- We used the Easylist's list of filters which is also used by many adblockplus users.

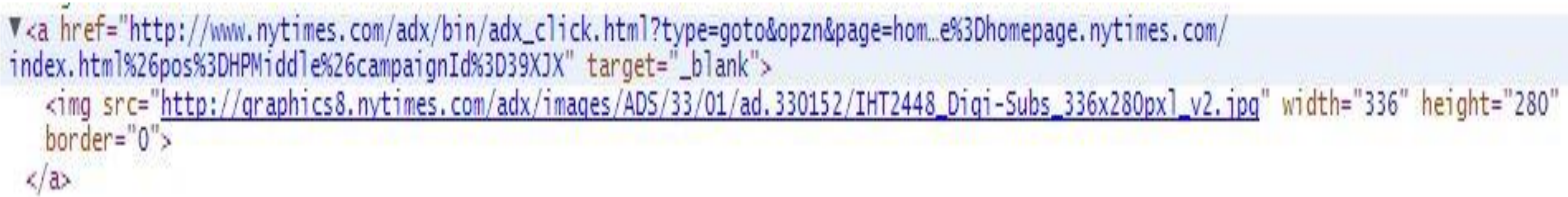
Implementation

- **Ads inside an anchor tag**
  - These ads are usually images or textual ads and are located inside anchor tags
  - Usually these are non-behavioral ads i.e. every user gets to see the same ads when they visit the same website.
  - They are loaded without any use of JavaScript.
  - They are of the form:

```
<a href=http://www.makemytrip.com/flights>
<img src=http://makemytrip/flights/offers.jpg>
</a>
```

Ads inside anchor tags


SPECIAL OFFER
4 WEEKS
FOR 99¢
CLICK HERE
International Herald Tribune
THE GLOBAL EDITION OF THE NEW YORK TIMES



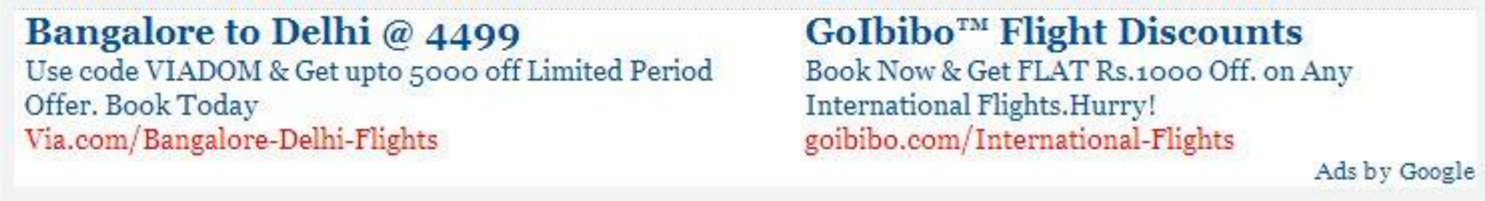
```
▼<a href="http://www.nytimes.com/adx/bin/adx_click.html?type=goto&opzn&page=hom…e%3Dhomepage.nytimes.com/
index.html%26pos%3DHPMiddle%26campaignId%3D39XJX" target="_blank">
    <img src="http://graphics8.nytimes.com/adx/images/ADS/33/01/ad.330152/IHT2448_Digi-Subs_336x280px1_v2.jpg" width="336" height="280"
    border="0">
  </a>
```

Implementation

- **Ads inside an iframe-**
  - These ads are usually tailored based on the user’s demographics, browsing pattern etc.
  - They are loaded using JavaScript.
  - For such kind of ads, the browser sends HTTP get requests to the web server along with the required cookies so that they can be customized for the user. They usually take some time to load.
  - They are of the form:

```
<iframe src=http://google.ad.doubleclick.com”>
<html><body>
<a href=“googleadservices.com/pagead/adf”>
<img src=http://makemytrip/img/flight.jpg>
</a></body</html>
</iframe>
```

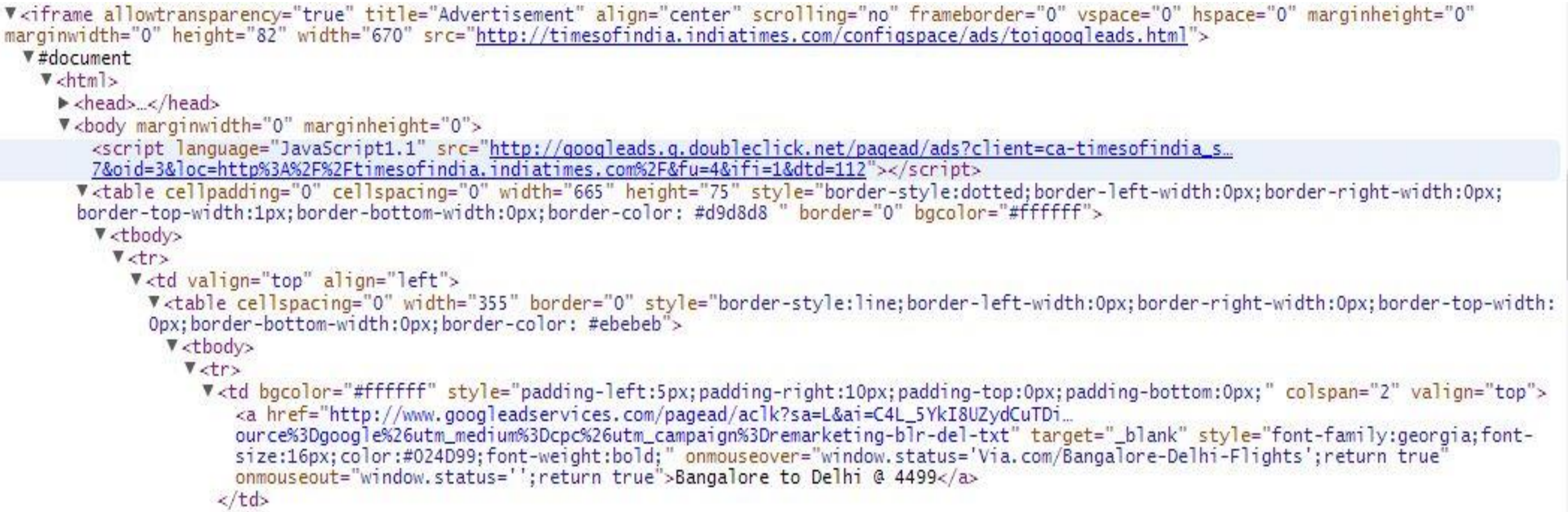
Ads inside iframes



Bangalore to Delhi @ 4499
Use code VIADOM & Get upto 5000 off Limited Period Offer. Book Today
Via.com/Bangalore-Delhi-Flights

GoIbibo™ Flight Discounts
Book Now & Get FLAT Rs.1000 Off. on Any International Flights.Hurry!
goibibo.com/International-Flights

Ads by Google



```
▼<iframe allowtransparency="true" title="Advertisement" align="center" scrolling="no" frameborder="0" vspace="0" hspace="0" marginheight="0"
marginwidth="0" height="82" width="670" src="http://timesofindia.indiatimes.com/configspace/ads/toigoogleads.html">
  ▼#document
    ▼<html>
      ▶<head>…</head>
      ▼<body marginwidth="0" marginheight="0">
          <script language="JavaScript1.1" src="http://googleads.g.doubleclick.net/pagead/ads?client=ca-timesofindia_s…
          7&oid=3&loc=http%3A%2F%2Ftimesofindia.indiatimes.com%2F&fu=4&ifi=1&dtd=112"></script>
        ▼<table cellpadding="0" cellspacing="0" width="665" height="75" style="border-style:dotted;border-left-width:0px;border-right-width:0px;
        border-top-width:1px;border-bottom-width:0px;border-color: #d9d8d8 " border="0" bgcolor="#ffffff">
          ▼<tbody>
            ▼<tr>
              ▼<td valign="top" align="left">
                ▼<table cellspacing="0" width="355" border="0" style="border-style:line;border-left-width:0px;border-right-width:0px;border-top-width:
                0px;border-bottom-width:0px;border-color: #ebebeb">
                  ▼<tbody>
                    ▼<tr>
                      ▼<td bgcolor="#ffffff" style="padding-left:5px;padding-right:10px;padding-top:0px;padding-bottom:0px;" colspan="2" valign="top">
                          <a href="http://www.googleadservices.com/pagead/aclk?sa=L&ai=C4L_5YkI8UZydCuTDi…
                          ource%3Dgoogle%26utm_medium%3Dcpc%26utm_campaign%3Dremarketing-blr-del-txt" target="_blank" style="font-family:georgia;font-
                          size:16px;color:#024D99;font-weight:bold;" onmouseover="window.status='Via.com/Bangalore-Delhi-Flights';return true"
                          onmouseout="window.status='';return true">Bangalore to Delhi @ 4499</a>
                        </td>
```

Procedure

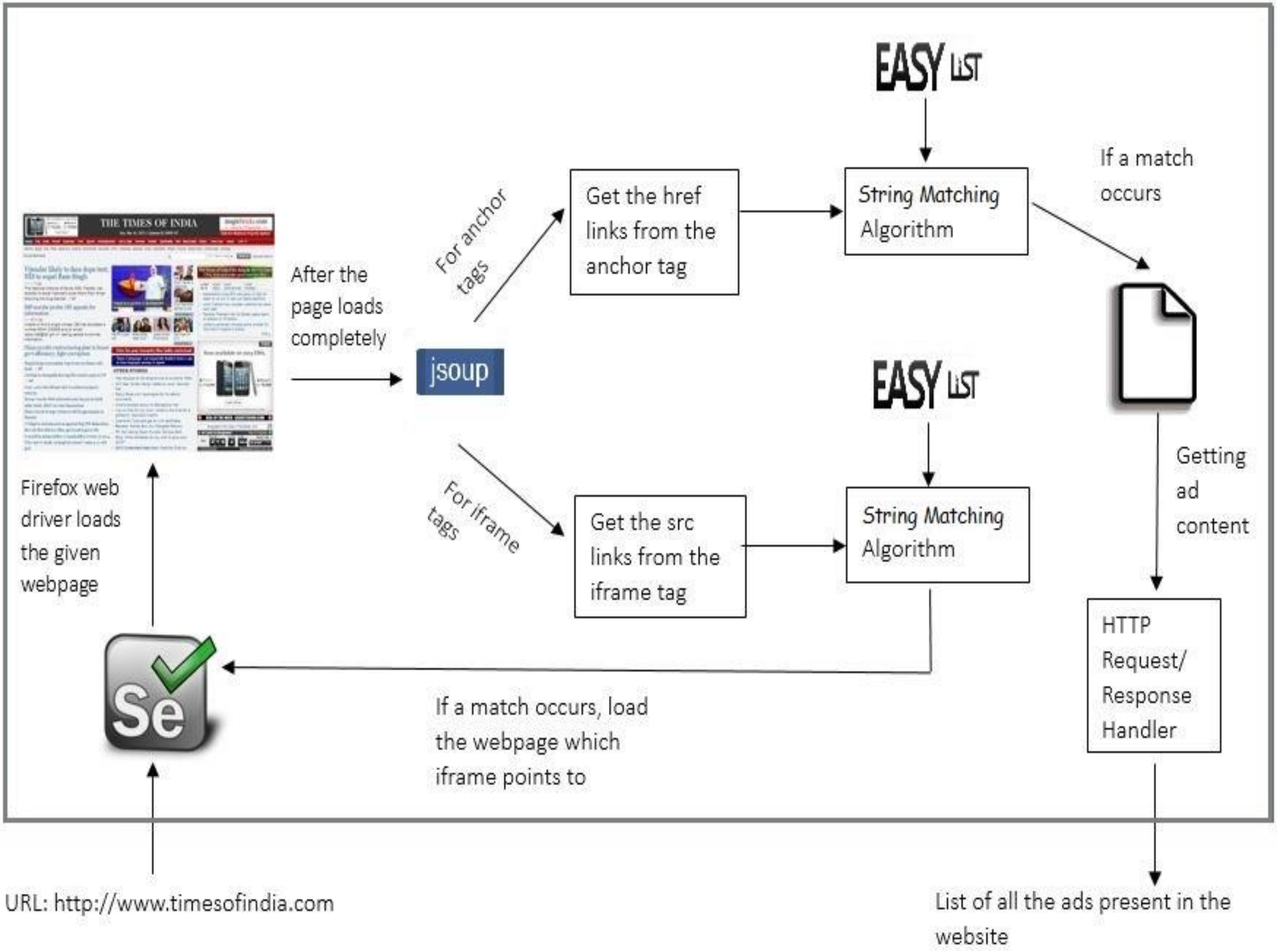
- The first step was to fetch the webpage from which ads are to be extracted using Firefox web driver. The web driver automates the Firefox browser i.e. it opens the Firefox browser and waits for the page to load, allowing JavaScript to execute if required.

- Once the page completely loads,
  - **For ads inside anchor tags,**
    - Tool parses the HTML content of the page using Jsoup to search for all the anchor tags.
    - For each anchor tag, it compares the href link in that anchor tag with the list of advertisement filters to see if that link is an ad or not. If it is an ad, it stores the link in a file.

Procedure

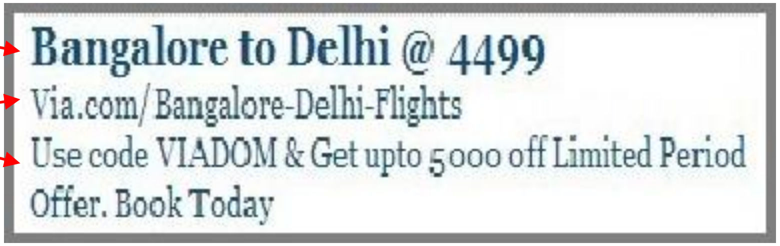
- **For ads inside iframes**, the web driver identifies all the iframes in the HTML page using Jsoup and compares the source links to a list of all third-party advertisers using the Aho-Corasick string matching algorithm.
  - If string match occurs, then another instance of web driver is used to load the iframe webpage from the source link.
  - The new webpage is parsed to look for all anchor tags and compare them with a list of ad filters. If the string match occurs again, the link is stored on a file.

- Finally to get the content of these ads, HTTP get requests is sent to the web sever on all the links stored in the file which were identified as ads and content of the ads are fetched from the HTTP response received.

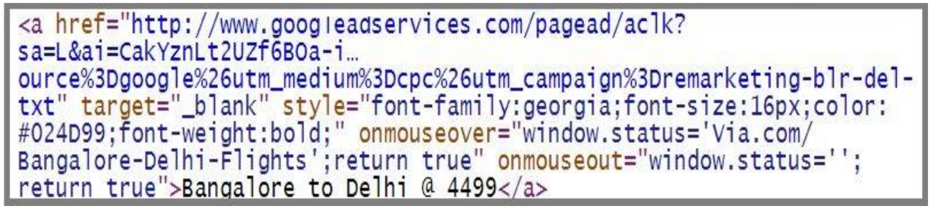

THE TIMES OF INDIA
After the page loads completely
jsoup
For anchor tags
For iframe tags
Get the href links from the anchor tag
Get the src links from the iframe tag
EASY LIST
EASY LIST
String Matching Algorithm
String Matching Algorithm
If a match occurs
Getting ad content
HTTP Request/ Response Handler
Firefox web driver loads the given webpage
If a match occurs, load the webpage which iframe points to
URL: http://www.timesofindia.com
List of all the ads present in the website

Data collected

- □ Ad-Title
- □ Ad-Content
- □ Ad-Display URL
- □ Ad-Source URL
- □ Landing Page Title
- □ Landing Page URL
- □ Image Source
- □ URL of the main page
- □ isThirdParty?
- □ isIFrame?



Bangalore to Delhi @ 4499
Via.com/Bangalore-Delhi-Flights
Use code VIADOM & Get upto 5000 off Limited Period
Offer. Book Today



```
<a href="http://www.googleadservices.com/pagead/aclk?
sa=L&ai=CakYznLt2UZf6BOa-i…
ource%3Dgoogle%26utm_medium%3Dcpc%26utm_campaign%3Dremarketing-blr-del-
txt" target="_blank" style="font-family:georgia;font-size:16px;color:
#024D99;font-weight:bold;" onmouseover="window.status='Via.com/
Bangalore-Delhi-Flights';return true" onmouseout="window.status='';
return true">Bangalore to Delhi @ 4499</a>
```

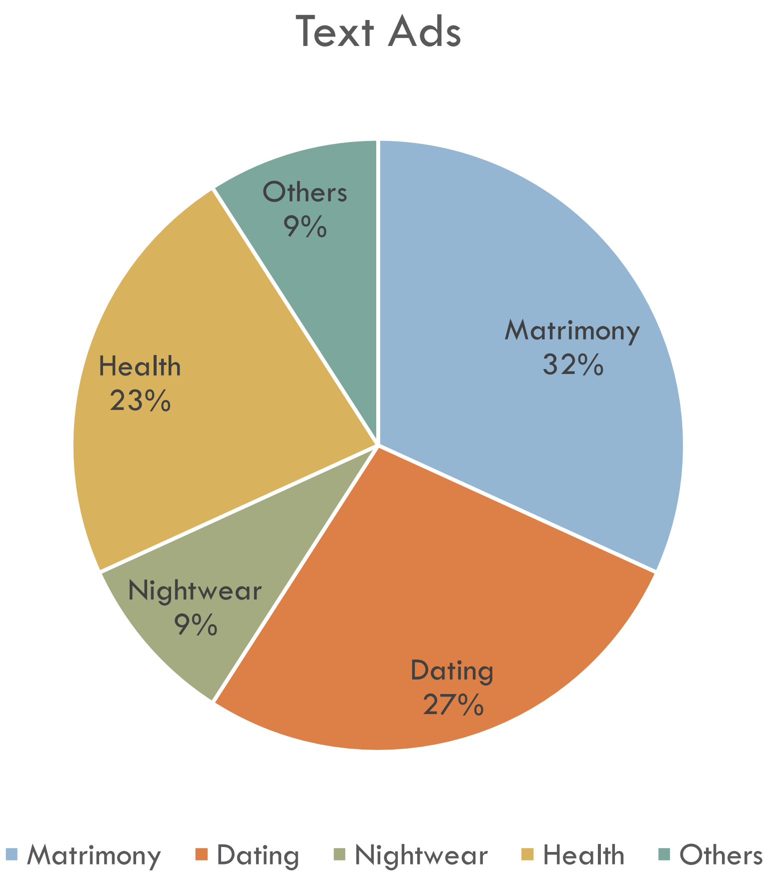
Simulation Results

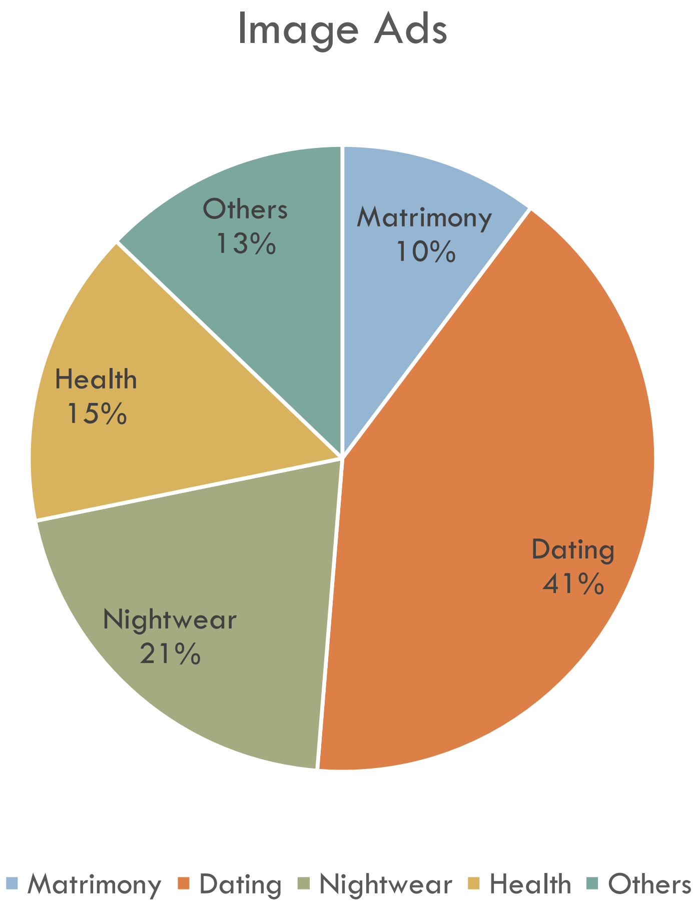
- Avg. time taken to get all the ads/webpage: 8 sec
- Avg. time taken to
  - Load a web-page: 4.5 sec
  - Fetch all anchor tags/webpage: 0.5 sec
  - Fetch all iframe tags/webpage: 4.3 sec
- Avg. no. of anchor tags in a webpage: 290
- Avg. no. of iframe tags in a webpage: 4

Results

Data Set	Text Ads	Embarrassing Text Ads	Image Ads	Embarrassing Image Ads
Set 1 (500 URLs)	192	4	156	5
Set 2 (2500 URLs)	1235	29	742	16
Set 3 (5000 URLs)	2587	40	1423	30
Total	**4014**	**73 (2%)**	**2321**	**51 (2%)**

Embarrassing Ads





Limitations of the tool

- The tool identifies only textual and image ads. It does not identify flash ads.
- Since some of the ads are loaded using Javascript, the tool waits for the entire webpage to load before it can extract the ads.
- Headless browsers tool which can extract ads loaded using Javascript are currently not available.

Acknowledgement

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References

[1] "Do not Embarrass: Re-Examining User Concerns for Online Tracking and Advertising", SOUPS 2013.
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[2] F. Roesner, T. Kohno, and D. Wetherall. Detecting and Defending Against Third-Party Tracking on the Web. In Proc. of NSDI, 2012

[3] J. Mayer and J. Mitchell. Third-party web tracking: Policy and technology. In Proc. of IEEE Symposium on Security and Privacy, 2012.

[4] B. Ur, P. G. Leon, L. F. Cranor, R. Shay, and Y. Wang. Smart, useful, scary, creepy: Perceptions of online behavioral advertising. In Proc. SOUPS, 2012.