Algorithmic Methods of Data Mining

Web Scrapping

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HyperText Markup Language (HTML)

- HTML is the most basic building block of the Web.
- It defines the meaning and structure of web content.
- Values can contain any type of records.
- Other technologies besides HTML:
  - CSS: describe a web page's appearance/presentation.
  - JavaScript: describe functionality/behavior of a web page.

HyperText

- "Hypertext" refers to
  - links that connect web pages to one another.
  - either within a single website or between websites.
- Links are a fundamental aspect of the Web.

Markup Language

- A markup language is a computer language that uses tags to define elements within a document.
- It is human-readable, meaning markup files contain standard words, rather than typical programming syntax.
- HTML uses "markup" to annotate text, images, and other content for display in a Web browser.

HTML markup includes special "elements"

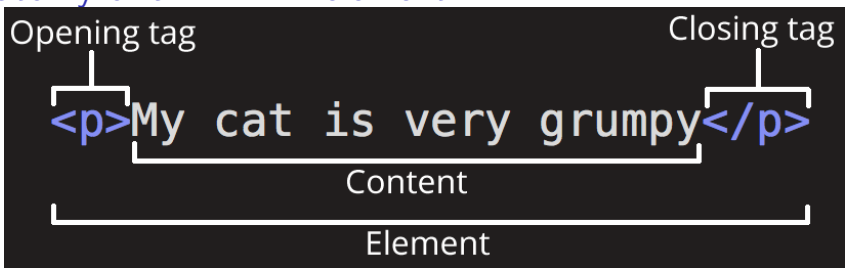
`<head>`, `<title>`, `<body>`, `<header>`, `<footer>`, `<article>`, `<section>`, `<p>`, `<div>`, `<span>`, `<img>`, `<aside>`, `<audio>`, `<canvas>`, `<datalist>`, `<details>`, `<embed>`, `<nav>`, `<output>`, `<progress>`, `<video>`, `<ul>`, `<ol>`, `<li>`

HTML Element

- An HTML element is set off from other text in a document by "tags".
- Tags consist of the element name surrounded by "<" and ">".
- The name of an element inside a tag is case insensitive.
- For example, the `<title>` tag can be written as `<Title>`, `<TITLE>`, or in any other way.

```
<p>My cat is very grumpy</p>
```

Anatomy of an HTML element



- The opening tag: The name of the element. Marks where the element begins or starts to take effect.
- The content: The content of the element.
- The closing tag: The same as the opening tag, except that it includes a forward slash before the element name. This marks where the element ends.

Nesting HTML Element

- Elements can be placed within other elements.
- This is called Element nesting.

```
<p>My cat is <strong>very</strong> grumpy.</p>
```

- There is a right and wrong way to do nesting.
- Tags have to open and close in a way that they are inside or outside one another.

Wrong usage of Element nesting

```
<p>My cat is <strong>very grumpy.</p></strong>
```

Block versus inline elements

- Two important categories of HTML elements.
- Block-level elements form a visible block on a page.
  - Usually the structural elements on the page.
  - Appear on a new line.
  - For example, a block-level element might represent headings, paragraphs, lists, navigation menus, or footers.
- Inline elements contained within block-level elements.
  - Surround only small parts of the document's content.
  - Will not cause a new line to appear in the document.
  - Typically used with text, for example an `<a>` element creates a hyperlink, and elements such as `<em>` or `<strong>` create emphasis.

```
<em>first</em><em>second</em><em>third</em>

<p>fourth</p><p>fifth</p><p>sixth</p>
```

Empty HTML Elements

- Empty elements are sometimes called void elements.
- Not all elements follow the pattern of an opening tag, content, and a closing tag.
- Some elements consist of a single tag, which is typically used to insert/embed something in the document.
- For example, the `<img>` element embeds an image file onto a page.

```
<img src="https://raw.githubusercontent.com/mdn/
beginner-html-site/gh-pages/images/firefox-icon.png">
```

Attributes of HTML element

- Elements can also have attributes. Attributes look like this:

- Extra information about the element that won't appear in the content.
- An attribute should have:
  - A space between it and the element name.
  - The attribute name, followed by an equal sign.
  - An attribute value, wrapped with opening and closing quote marks.

The HREF Elements

- Adding links using the anchor `<a>` element.
- An anchor can make the text it encloses into a hyperlink.
- Anchors can take a number of attributes, but several are as follows:
  - href: specifies the web address for the link.
  - title: specifies extra information about the link. Appears as a tooltip when a cursor hovers over the element.
  - target: specifies the browsing context used to display the link. If you want to display the linked content in the current tab, just omit this attribute.

```
<a href="https://www.mozilla.org/"
   title="The Mozilla homepage"
   target="_blank">The name of the link</a>
```

Boolean Attributes

- Sometimes you will see attributes written without values.
- These are called Boolean attributes.
- Boolean attributes can only have one value, which is generally the same as the attribute name.
- For example, consider the `disabled` attribute, which you can assign to form input elements.

```
<input type="text" disabled="disabled">

<input type="text" disabled>
```

Anatomy of an HTML document

```
<!DOCTYPE html>
<html>
  <head>
    <meta charset="utf-8">
    <title>My test page</title>
  </head>
  <body>
    <p>This is my page</p>
  </body>
</html>
```

- `<html></html>` – wraps all the content on the page. It is sometimes known as the root element.
- `<head></head>` – page metadata elements.
- `<body></body>` – all the content.

HTML comments

- Write comments in the code.
- Browsers ignore comments, effectively making comments invisible to the user.

```
<p>I'm not inside a comment</p>

<!-- <p>I am!</p> -->
```

HTML text fundamentals (1)

- There are six heading elements:
  `<h1>`, `<h2>`, `<h3>`, `<h4>`, `<h5>`, `<h6>`.
- Unordered lists: `<ul>`

```
<ul>
  <li>milk</li>
  <li>eggs</li>
  <li>bread</li>
</ul>
```

- Ordered lists: `<ol>`

```
<ol>
  <li>Drive to the end of the road</li>
  <li>Turn right</li>
</ol>
```

HTML text fundamentals (2)

- Emphasis: `<em>`.
- Strong: `<strong>`
- Bold: `<b>`
- Italics: `<i>`
- Underline: `<u>`

Content Division

- The HTML Content Division element (`<div>`) – generic container for flow content.
- Does not inherently represent anything.
- Used to group content so it can be easily styled using the `class` or `id` attributes.

```
<div class="warning">
    <img src="/media/examples/leopard.jpg"
         alt="An intimidating leopard.">
    <p>Beware of the leopard</p>
</div>
```

Tables

- The content of every table is enclosed by these two tags : `<table></table>`.
- The contents of each row is enclosed by these two tags: `<tr></tr>`.
- The contents of each column, within a row, is enclosed by these two tags: `<td></td>`.

```
<table>
<tr>
  <td>Hi, I'm your first cell.</td>
  <td>I'm your second cell.</td>
  <td>I'm your third cell.</td>
  <td>I'm your fourth cell.</td>
</tr>
</table>
```

Beautiful Soup

- Beautiful Soup is a Python library for getting data out of HTML, XML, and other markup languages.

```
pip3 install beautifulsoup4
```

- Additionally, you will need to install a "parser" for interpreting the HTML. To do so, run in the terminal.

```
pip3 install lxml
```

Extracting names and links from an HTML page

```
<table border="1" cellspacing="2" cellpadding="3">
<tbody>
<tr>
<th>Member Name</th>
<th>Birth-Death</th>
</tr>
<tr>
<td><a href="http://bioguide.congress.gov/scripts
/biodisplay.pl?index=A000035">ADAMS, George Madison</a></td>
<td>1837-1920</td>
</tr>
<tr>
<td><a href="http://bioguide.congress.gov/scripts
/biodisplay.pl?index=A000074">ALBERT, William Julian</a></td>
<td>1816-1879</td>
</tr>
</tbody>
</table>
```

Extracting names and links from an HTML page

```
from bs4 import BeautifulSoup

soup = BeautifulSoup (open("43rd-congress.html"), features="lxml")

links = soup.find_all('a')
for link in links:
    names = link.contents[0]
    fullLink = link.get('href')

    print([names,fullLink])
```

```
['ADAMS, George Madison', 'http://bioguide.congress.gov/scripts
/biodisplay.pl?index=A000035']
['ALBERT, William Julian', 'http://bioguide.congress.gov/scripts
/biodisplay.pl?index=A000074']
```

Retrieving Content

- We will use the requests library.

```
cnt  = requests.get("https://www.goodreads.com/book/show/
32767.At_the_Mountains_of_Madness")
```

- Use the contents of the page retrieved

```
soup = BeautifulSoup(cnt.content, features="lxml")
```

- "Beautify" the text:

```
print(soup.prettify())
```

- Write to file:

```
f = open("content.html", "w")
f.write(soup.prettify())
f.close()
```

HTTP Agent

- When we are issuing a HTTP request, the remote server can request information regarding our browser – the HTTP Agent
- We can specify the User-Agent attribute of an HTTP request.
- The User-Agent request header contains a characteristic string that allows the network protocol peers to identify the application type, operating system, software vendor or software version of the requesting software user agent.

```
headers = {'User-Agent': 'Mozilla/5.0 (Linux; Android 5.1.1;
SM-G928X Build/LMY47X) AppleWebKit/537.36 (KHTML, like Gecko)
Chrome/47.0.2526.83 Mobile Safari/537.36'}
countries_response = requests.get("https://www.goodreads.com/book/
show/32767.At_the_Mountains_of_Madness", headers=headers)
```

Selenium

- Selenium is a portable framework for testing web applications.
- Selenium provides a playback tool for authoring functional tests without the need to learn a test scripting language (Selenium IDE).

```
pip3 install selenium
```

- A simple usage:

```
from selenium import webdriver
from selenium.webdriver.common.keys import Keys
from webdriver_manager.firefox import GeckoDriverManager

driver = webdriver.Firefox(executable_path=GeckoDriverManager()
.install())
driver.get("https://www.goodreads.com/book/show/32767.At_the_Mountains_
driver.page_source
```