A Simple Cheat Sheet for Web Scraping with Python

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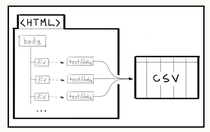
What is web scraping?

Web scraping is the process of extracting data from the internet programmatically

It's used when you want to obtain a large amount of data from a website that doesn't provide a method to download that data.



Make sure to check the website's policy on web scraping before any scraping. Generally, try to avoid spamming a site with too many/too frequent requests.

What tools do you need?

There are multiple options for web scraping in Python, it ultimately depends on the task.

1. First, you need an **IDE (Integrated development environment)**:

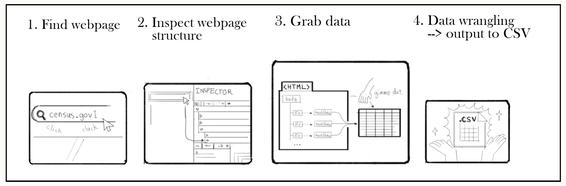
   I prefer using an **.ipynb file** in **Jupyter Notebook** or **VS Code**
   (IMO, using cells fits the iterative, incremental nature of web scraping)

2. You will also need to install and import **scraping packages**:

   beautifulsoup4 (& requests), **selenium**, **pandas** (yes pandas can be used for scraping)

   by running `pip install package_name` in the command prompt at your project directory

What does a typical workflow look like?



Option 0: **Pandas**

If the data is present in a neat **<table>** element → always use Pandas' **pd.read_html()** (it's simply the simplest option)

Head

```
import pandas as pd
tables = pd.read_html(url, match='matching string') # returns a list of dataframes
                                                    # created from each table in the html
df = tables[1]                                      # to grab a specific table, grab via index
df.head()                                           # preview table
```

source: pandas.read_html

Option 1: **BeautifulSoup**

Docs: **Beautiful Soup Documentation**

Use BeautifulSoup when working with a *static* webpage
(i.e. when the desired data is entirely within the page's HTML representation)

0. Imports + Setup

```
import requests
import BeautifulSoup from bs4

url = 'example.com'
request = requests.get(url)                          # grab the HTML file from the url
soup = BeautifulSoup(request.content, 'html.parser') # create soup object from HTML file and parser
```

1. Getting Elements

```
# common methods
first_elt = soup.find('a')                           # finds the first <a> tag

multiple_elts = soup.find_all('div',class_='c-name') # finds all <div> tags with class 'c-name'
# soup.find_all('div','c-name')                      # can leave out class_, since class is 2nd arg
# soup.find_all('div',{class:'c-name', id:'i-name'}) # or specify multiple identifiers with dictionary
# soup('div')                                        # same thing as calling soup.find_all('div')

soup.find('div',id_='id-name')                       # finds <div> tag with id 'id-name'

soup.find(string="Exact text")                       # finds by exact text

---

# less common methods
soup.find_all('div', id=lambda x: x and x.startswith('start-')) # finds <div> tags with ids that
                                                                # start with 'start-'
import re
soup.find(string=re.compile("Link")).parent          # finds first element with partial text 'Link'

soup.find('div',class_='c-name1 c-name2')            # finds element with multiple classes
soup.find('div',class_=['c-name1', 'c-name2'])       # or use list when multi-class
soup.select("div.c-name1.c-name2")                   # or .select()

first_elt.next_sibling()                             # grabs the next child with the same parent as
                                                     # first_elt, (the next sibling); useful when an
                                                     # elt doesn't have identifier, but first_elt does

---

# I almost never use these
children = first_elt.contents                        # returns direct children of first_elt in a list
all_children = first_elt.descendants                 # returns all children, down to leaf node
papa = first_elt.parent                              # returns direct parent
ancestors = first_elt.parents                        # returns all parents, up to root node
```

Note: you don't need to list *all* classes to find a multi-class element, but being more specific can help narrow the list down

2. Getting Attributes

```
first_href = e.get('href')              # gets the value of the href attribute
# e['href']                             # can also index with []

all_hrefs = [e.get('href') for e in el] # use list comprehension to return list of
                                        # the hrefs from multiple_elts

text = first_elt.get_text()             # gets text of first_elt
```

3. Misc Tips

```
print(first_href.prettify())                    # prints element cleanly

soup.html.find_all("title", recursive=False)    # recursive=False only finds direct children

element.encode("utf-8")                         # encodes tag/soup objects as other encodings

tag.name = "blockquote"                        # you can assign/re-assign the name of a tag
tag['id'] = "new-id"                           # same with tag attributes
                                               # (though I haven't discovered a use for this)

# use soup.css.select() or soup.select() to use css-selectors
```

more on css.select: Beautiful Soup Documentation – css-selectors

Option 2: **Selenium**

Docs: **Selenium with Python**

Web scraping with selenium involves using *web automation* to collect data through a *web driver* rather than working with a local HTML file as beautiful soup does
Use Selenium when:

- the data requires navigation (querying, clicking buttons, etc.) to access
- the data is located across multiple pages with non-uniform URLs,
- or the elements don't have good class/id naming conventions (i.e. XPATH is the best option)

0. Imports + Setup

```
from selenium import webdriver
from selenium.webdriver.edge.service import Service
from webdriver_manager.microsoft import EdgeChromiumDriverManager

# download the most updated version of the driver, open the driver, and assign to driver variable
driver = webdriver.Edge(service=Service(EdgeChromiumDriverManager().install()))

# driver = webdriver.Edge(path/to/driver/executable)   # can also download web driver locally and
                                                       # provide it's path (make sure it's the
                                                       # newest version!)
url = 'example.com'
driver.get(url)                                        # opens driver with the specified URL
```

If you prefer other browsers, there are also Chrome, Firefox, and Safari web drivers

0b. Managing Driver + Driver Options

```
driver.quit()                                          # closes entire driver (all tabs)
driver.close()                                         # closes currently focused driver tab

driver.navigate().back()                               # returns to previous page in browser history

driver.execute_script("window.open('');")              # opens a new tab
driver.switch_to.window(driver.window_handles[1]) # switch to new tab (2nd tab) assuming 1 tab was open
driver.get(new_url)                                    # get new_url on new tab

alert = driver.switch_to.alert
alert.accept()                                         # closes popups

from selenium.webdriver.edge.options import Options
options = Options()
options.add_argument("--incognito")                    # add new driver option
driver = webdriver.Chrome(options=options)             # passes options into driver instance
# there are many more driver options like window size, headers, gpu, etc...
```

1. Getting Element(s)

```
from selenium.webdriver.common.by import By            # for grabbing elements by attribute
# common methods for getting element(s)
first_elt = driver.find_element(By.ID, 'id-name')      # finds the first element with id 'id-name'

multiple_elts = driver.find_elements(By.CLASS, 'c-name') # finds all elements with class 'c-name'
                                                         # note we're using .find_elements() instead

xpath_elt = driver.find_element(By.XPATH,'//xpath/elt')  # use as last resort when no suitable class/id
                                                         # identifier exists
                                                         # should be last resort because small change
                                                         # in HTML can invalidate XPATH

first_elt.find_elements(By.CLASS, ...)                   # can also call .find_elements() on other
                                                         # elements (this searches first_elt's children)

# other less common methods include: TAG_NAME, LINK_TEXT, PARTIAL_LINK_TEXT, NAME, CSS_SELECTOR
```

read more here: 4. Locating Elements – Selenium Python

To find the XPATH of an element: 1) open inspector (Ctrl+Shift+I) or right click –> Inspect
2) select element
3) right click the element in inspector
4) copy XPATH

1b. XPATH examples

```
driver.find_element(By.XPATH,"//div[@class='gallery'][1]/img[@id='some-image']")

//                <-- looks for all elements from the root node
/                 <-- looks for first elt from root node (starting with / means absolute path)
[@attr]           <-- looks for elements with this attribute
[@attr=value]     <-- looks for elements with attribute equal to value
/div[1]           <-- selects the first (XPath uses 1-indexing) div from the root node
/div[position()<3] <-- selects the first 3 divs from the root node
/div[1]/*         <-- wildcard, matches any child element of the 1st div
```

source: XPath Syntax (w3schools.com)

more info on XPATH syntax

1c. Getting Attributes from Elements

```
elt_href = first_elt.get_attribute('href')             # gets the href attribute value from first_elt

hrefs = [e.get_attribute('href') for e in multiple_elts] # use list comprehension to return
                                                         # a list of the hrefs from multiple_elts

text = first_elt.text                                  # gets the inner text of first_elt
                                                       # e.g. <div><p>this is the inner text</p></div>

# for dynamic inputs (like if a checkbox is checked) use get_property() instead of get_attribute()
checkbox.get_property('checked')
```

2. Waits

```
# Sometimes, the web page takes a while to load a page/element, so we need to tell the driver to
# WAIT until the element (or another reference element is loaded) to grab your element
from selenium.webdriver.support.wait import WebDriverWait
from selenium.webdriver.support import expected_conditions as EC

time_wait = 10
waited_elt = WebDriverWait(driver, time_wait).until(
    EC.presence_of_element_located((By.ID, "elt-id")) # waits 10 seconds before looking for this elt
)

# driver.implicitly_wait(time_wait)                  # can also set wait for all future elements
# Note: time.sleep(sec) is another alternative to WebDriverWait, but a more hacky option
```

read more here: 5. Waits – Selenium Python

3. Input

```
from selenium.webdriver.common.keys import Keys  # includes special keys like Ctrl, Backspace, etc.
from selenium.webdriver.support.ui import Select # for dropdowns

btn.click()                                      # clicks on a button, works for checkbox/radio

dropdown = Select(driver.find_element_by_id('dropdown')) # Select option from a dropdown
dropdown.select_by_visible_text('Option 1')      # by text
# select by value select.select_by_value('1')    # by value attribute

text_input.clear()                               # clear text input, type something, then submit
text_input.send_keys('example input')
text_input.submit()
# text_input.send_keys(Keys.RETURN)              # can also press enter to trigger form submit

# more advanced actions require importing ActionChains
from selenium.webdriver.common.action_chains import ActionChains
actions = ActionChains(driver)                   # create ActionChains instance

driver.execute_script("arguments[0].scrollIntoView();", elt) # scrolls till element is in view
elt.location_once_scrolled_into_view             # scrolls to element + returns coords.

actions.move_to_element(elt).perform()           # moves mouse to element (triggers hover)

actions.double_click(elt)                        # double clicks on element

# a much more comprehensive list of Actions, Keys, etc. can be found in the full API ↓
```

full list of actions in API: 7. WebDriver API

good option for dealing with hidden submenu items:
first .move_to_element(submenu), then .click(submenu_item)

4. Misc Tips

```
from selenium.common.exceptions import [TheNameOfTheExceptionClass] # selenium has exception handling

driver.maximize_window()             # you can probably guess what this does

driver.save_screenshot("image.png") # takes screenshot of element

"//*[contains(@id,'_ending')]"       # XPATH can match partial identifiers
"//*[ends-with(@href,'.gov')]"       # works with attributes as well

driver.switch_to_frame("f-name")     # accesses iframes by name or ID
```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