Hands-on lab: Web scraping and Extracting Data using APIs

Estimated Effort: 30 mins

Web scraping is used for extraction of relevant data from web pages. If you require some data from a web page in a public domain, web scraping makes the process of data extraction quite convenient. The use of web scraping, however, requires some basic knowledge of the structure of `HTML` pages. In this lab, you will learn the process of analyzing the `HTML` code of a web page and how to extract the required information from it using web scraping in Python.

Objectives

By the end of this lab, you will be able to:

- Use the `requests` and `BeautifulSoup` libraries to extract the contents of a web page
- Analyze the `HTML` code of a webpage to find the relevant information
- Extract the relevant information and save it in the required form

Scenario

Consider that you have been hired by a Multiplex management organization to extract the information of the top 50 movies with the best average rating from the web link shared below.

```
https://web.archive.org/web/20230902185655/https://en.everybodywiki.com/100_Most_Highly-Ranked_Films
```

The information required is `Average Rank`, `Film`, and `Year`.
You are required to write a Python script `webscraping_movies.py` that extracts the information and saves it to a `CSV` file `top_50_films.csv`. You are also required to save the same information to a database `Movies.db` under the table name `Top_50`.

Initial steps

You require the following libraries for this lab.

1. `pandas` library for data storage and manipulation.
2. `BeautifulSoup` library for interpreting the `HTML` document.
3. `requests` library to communicate with the web page.
4. `sqlite3` for creating the database instance.

While `requests` and `sqlite3` come bundled with `Python3`, you need to install `pandas` and `BeautifulSoup` libraries to the IDE.

For this, run the following commands in a terminal window.

```
python3.11 -m pip install pandas
python3.11 -m pip install bs4
```

Now, create a new file by the name of `webscraping_movies.py` in the path `/home/project/`.

You will write all of your code in this file.

Code setup

To create a Python script, call the relevant libraries and the initializations as a first step.

Importing Libraries

Import the following four libraries by adding lines of code noted below to your `webscraping_movies.py`file.

```
import requests
import sqlite3
import pandas as pd
```

```
from bs4 import BeautifulSoup
```

Initialization of known entities

You must declare a few entities at the beginning. For example, you know the required `URL`, the `CSV` name for saving the record, the database name, and the table name for storing the record. You also know the entities to be saved. Additionally, since you require only the top 50 results, you will require a loop counter initialized to 0. You may initialize all these by using the following code in `webscraping_movies.py`:

```
url = 'https://web.archive.org/web/20230902185655/https://en.everybodywiki.com/100_Most_Highly-Ranked_Films'
db_name = 'Movies.db'
table_name = 'Top_50'
csv_path = '/home/project/top_50_films.csv'
df = pd.DataFrame(columns=["Average Rank","Film","Year"])
count = 0
```

Loading the webpage for Webscraping

To access the required information from the web page, you first need to load the entire web page as an `HTML` document in `python` using the `requests.get().text` function and then parse the text in the `HTML` format using `BeautifulSoup` to enable extraction of relevant information.

Add the following code to `webscraping_movies.py`:

```
html_page = requests.get(url).text
data = BeautifulSoup(html_page, 'html.parser')
```

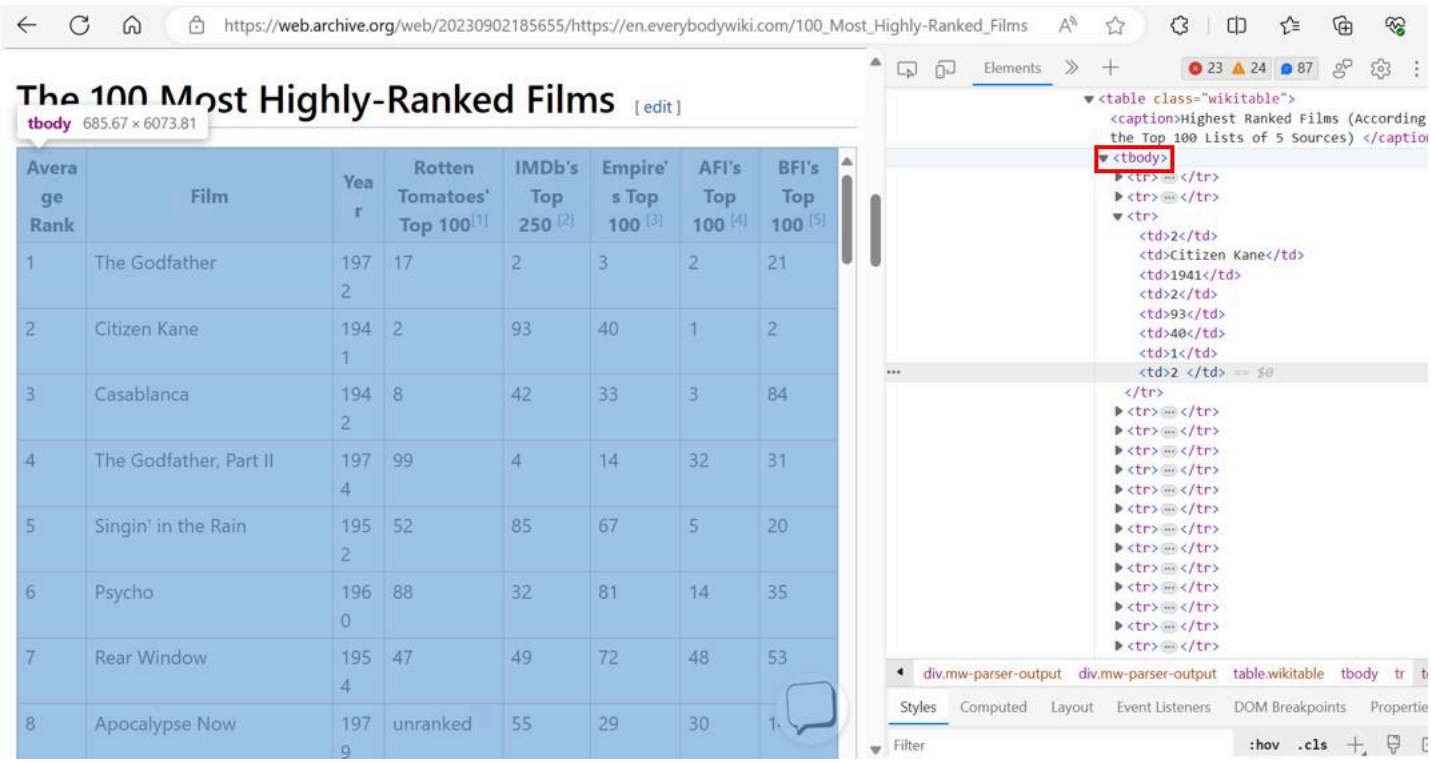
Save your file using `Ctrl+S`.

Analyzing the HTML code for relevant information

Open the web page in a browser and locate the required table by scrolling down to it. Right-click the table and click `Inspect` at the bottom of the menu, as shown in the image below.

Average Rank	Film	Year	Rotten Tomatoes' Top 100[1]	IMDb's Top 250 [2]	Empire's Top 100 [3]	AFI's Top 100 [4]	BFI's To 10 [5]
1	The Godfather	1972	17	2	3	2	21
2	Citizen Kane	1941	2	93	40	1	2
3	Casablanca	1942	8	42	33	3	84
4	The Godfather, Part II	1974	99	4	14	32	31
5	Singin' in the Rain	1952	52	85	67	5	20
6	Psycho	1960	88	32	81	14	35
7	Rear Window	1954	47	49	72	48	53

This opens the `HTML` code for the page and takes you directly to the point where the definition of the table begins. To check, take your mouse pointer to the `tbody` tag in the `HTML` code and see that the table is highlighted in the page section.



Average Rank	Film	Year	Rotten Tomatoes' Top 100[1]	IMDb's Top 250 [2]	Empire's Top 100 [3]	AFI's Top 100 [4]	BFI's Top 100 [5]
1	The Godfather	1972	17	2	3	2	21
2	Citizen Kane	1941	2	93	40	1	2
3	Casablanca	1942	8	42	33	3	84
4	The Godfather, Part II	1974	99	4	14	32	31
5	Singin' in the Rain	1952	52	85	67	5	20
6	Psycho	1960	88	32	81	14	35
7	Rear Window	1954	47	49	72	48	53
8	Apocalypse Now	1979	unranked	55	29	30	1

Notice that all rows under this table are mentioned as `tr` objects under the table. Clicking one of them would show that the data in each row is further saved as a `td` object, as seen in the image above. You require the information under the first three headers of this stored data.

It is also important to note that this is the first table on the page. You must identify the required table when extracting information.

Scraping of required information

You now need to write the loop to extract the appropriate information from the web page. The rows of the table needed can be accessed using the `find_all()` function with the `BeautifulSoup` object using the statements below.

```
tables = data.find_all('tbody')
rows = tables[0].find_all('tr')
```

Here, the variable `tables` gets the body of all the tables in the web page and the variable `rows` gets all the rows of the first table.

You can now iterate over the rows to find the required data. Use the code shown below to extract the information.

```
for row in rows:
    if count<50:
        col = row.find_all('td')
        if len(col)!=0:
            data_dict = {"Average Rank": col[0].contents[0],
                         "Film": col[1].contents[0],
                         "Year": col[2].contents[0]}
            df1 = pd.DataFrame(data_dict, index=[0])
            df = pd.concat([df,df1], ignore_index=True)
            count+=1
    else:
        break
```

The code functions as follows.

1. Iterate over the contents of the variable `rows`.
2. Check for the loop counter to restrict to 50 entries.
3. Extract all the `td` data objects in the row and save them to `col`.
4. Check if the length of `col` is 0, that is, if there is no data in a current row. This is important since, many timesm there are merged rows that are not apparent in the web page appearance.
5. Create a dictionary `data_dict` with the keys same as the columns of the dataframe created for recording the output earlier and corresponding values from the first three headers of data.
6. Convert the dictionary to a dataframe and concatenate it with the existing one. This way, the data keeps getting appended to the dataframe with every iteration of the loop.
7. Increment the loop counter.
8. Once the counter hits 50, stop iterating over rows and break the loop.

Print the contents of the dataframe using the following:

```
print(df)
```

Save the file using `Ctrl+S`.

Storing the data

After the dataframe has been created, you can save it to a CSV file using the following command:

```
df.to_csv(csv_path)
```

Remember that you defined the variable `csv_path` earlier.

To store the required data in a database, you first need to initialize a connection to the database, save the dataframe as a table, and then close the connection. This can be done using the following code:

```
conn = sqlite3.connect(db_name)
df.to_sql(table_name, conn, if_exists='replace', index=False)
conn.close()
```

Save the file using `Ctrl+S`.

This database can now be used to retrieve the relevant information using SQL queries. You will learn how to do that later in the course.

Execute the code

Execute the code using the statement below in a terminal window. Make sure the current directory is `/home/project/`.

```
python3.11 webscraping_movies.py
```

You can expect the output to look as shown below.
Note that the CSV and the DB files are also created under the project folder.

Important Note:

> To maintain consistency of the lab structure, the web page you access is routed through an archive database. Often, in case the archive server is busy, the users may encounter delayed execution and/or an error such as:
> `requests.exceptions.ConnectionError: HTTPSConnectionPool(host='web.archive.org', port=443): Max retries exceeded with url.`
> In such a situation, try executing the code again. In case the problem persists, you can change the URL to the live version, such as:
> `https://en.everybodywiki.com/100_Most_Highly-Ranked_Films`

Lab solution

In case you are not able to get the required output from the code or are facing some errors, the final file for `webscraping_movies.py` is shared below. Please note that this is for your help, and we encourage you to first try to resolve the errors on your own.

▶ webscraping_movies.py

Practice problems

Try the following practice problems to test your understanding of the lab. Please note that the solutions for the following are not shared. You are encouraged to use the discussion forums in case you need help.

1. Modify the code to extract `Film`, `Year`, and `Rotten Tomatoes' Top 100` headers.
2. Restrict the results to only the top 25 entries.
3. Filter the output to print only the films released in the 2000s (year 2000 included).

Conclusion

In this lab, you learned how to:

1. Analyze HTML pages for relevant data position.
2. Use `BeautifulSoup`, `requests` and `pandas` libraries for web scraping the required information.
3. Store the extracted data as a CSV file and SQL Database.

Author(s)

Abhishek Gagneja