

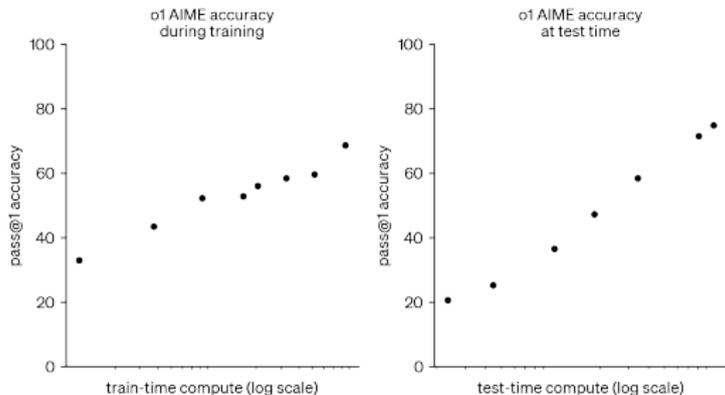
# Lecture 18

## Web Scraping

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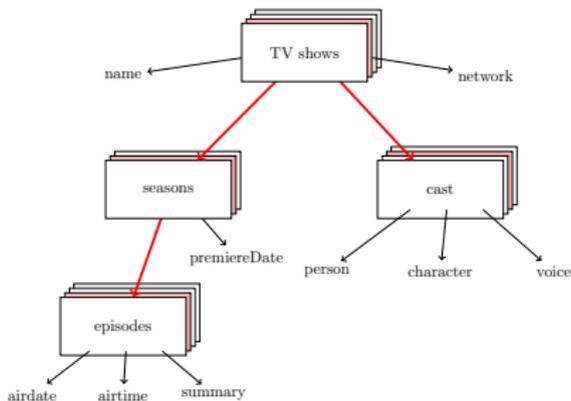
Source: “Learning to reason with LLMs” – OpenAI



- 1 Recap
- 2 HTML Crash Course
- 3 Web Scraping
- 4 Ethics of Web Scraping



# Hierarchical Data



- Hierarchical data can be represented using JSON or XML.
- JSON is just like a Python dictionary.
  - You can use basic Python to extract the information you want.
  - There are built-in functions like `pd.json_normalize` to “flatten” JSON to tabular data.
- XML is a different beast.



# XML

```
<?xml version="1.0" encoding="UTF-8"?>
<root>
  <show>
    <name>Girls</name>
    <network>
      <name>NBC</name>
      ...
    </network>
    <cast>
      <person>...</person>
      <character>....</character>
    </cast>
    <cast>
      ...
    </cast>
    <season>
      <episode>...</episode>
      <episode>...</episode>
      ...
    </season>
    <season>
      ...
    </season>
  </show>
</root>
```

- Fields are represented by named *tags*.
- Each tag has an open `<tag>` and a close `</tag>`.
- Children are represented by nested tags.
- Repeated fields are represented by repeated tags.



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# HyperText Markup Language (HTML)

- HTML is the standard language for describing the layout of webpages.
- It is like XML, with special tags for hyperlinks, tables, images, etc.
- You don't need to be an HTML expert to scrape webpages, but you do need to know a few basics.



# Hyperlinks

The `<a>` tag indicates a (hyper)link.

- The `href=` attribute contains the URL.
- The displayed text is within the `<a>` tag.

Example:

```
Web Scraping<br/>
```

```
<a href="lectures/lecture18.pdf">
```

```
  slides
```

```
</a> |
```

```
<a href="https://colab.research.google.com/drive/1neQvH5uqoX1j74rgCbpu" >
```

```
  colab
```

```
</a>
```



Web Scraping  
[slides](#) | [colab](#)



# Tables

The `<table>` tag indicates a table.

- The `<tr>` tag indicates a row.
- The `<th>` and `<td>` tags indicate a cell within a row.

```
<table>
  <tr>
    <th>Rank</th>
    <th>Player</th>
    <th>Saves</th>
  </tr>
  <tr>
    <td>1</td>
    <td>Mariano Rivera</td>
    <td>652</td>
  </tr>
  <tr>
    <td>2</td>
    <td>Trevor Hoffman</td>
    <td>601</td>
  </tr>
</table>
```



Rank	Player	Saves
1	Mariano Rivera	652
2	Trevor Hoffman	601



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# Web Scraping

Let's use what we've just learned to scrape some data!



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# Ethical Considerations

- Website owners have to pay a small amount each time you visit a webpage.
- This is usually offset by advertising.
- But when you do web scraping:
  - it is easy to rack up many webpage visits,
  - and you don't see any ads to offset this cost.



## robots.txt

- Most websites have a **robots.txt** file in the home directory that indicate which bots are allowed to scrape and which pages they can scrape.
- Here are a few examples:
  - `http://www.espn.com/robots.txt`
  - `http://www.nytimes.com/robots.txt`
- However, **robots.txt** is informational only. It doesn't *prevent* bots from scraping a webpage.



# Preventing Web Scraping

Some websites take more drastic measures to prevent web scraping...

```
[1] import requests
    from bs4 import BeautifulSoup

response = requests.get("https://explorecourses.stanford.edu/search?view=catalog&academicYear=6page=0&q=STATS&fil
soup = BeautifulSoup(response.text)
soup

at org.eclipse.jetty.server.handler.ScopedHandler.handle(ScopedHandler.java:143)
at org.eclipse.jetty.security.SecurityHandler.handle(SecurityHandler.java:578)
at org.eclipse.jetty.server.session.SessionHandler.doHandle(SessionHandler.java:221)
at org.eclipse.jetty.server.handler.ContextHandler.doHandle(ContextHandler.java:1111)
at org.eclipse.jetty.servlet.ServletHandler.doScope(ServletHandler.java:498)
at org.eclipse.jetty.server.session.SessionHandler.doScope(SessionHandler.java:183)
at org.eclipse.jetty.server.handler.ContextHandler.doScope(ContextHandler.java:1045)
at org.eclipse.jetty.server.handler.ScopedHandler.handle(ScopedHandler.java:141)
at org.eclipse.jetty.server.handler.HandlerWrapper.handle(HandlerWrapper.java:98)
at org.eclipse.jetty.server.Server.handle(Server.java:461)
at org.eclipse.jetty.server.HttpChannel.handle(HttpChannel.java:284)
at org.eclipse.jetty.server.HttpConnection.onFillable(HttpConnection.java:244)
at org.eclipse.jetty.io.AbstractConnection$2.run(AbstractConnection.java:534)
at org.eclipse.jetty.util.thread.QueuedThreadPool.runJob(QueuedThreadPool.java:607)
at org.eclipse.jetty.util.thread.QueuedThreadPool$3.run(QueuedThreadPool.java:536)
at java.lang.Thread.run(Thread.java:750)
Caused by: java.lang.RuntimeException: Stop that evilness! If you want data, all you need to do is ask. Peggung
our servers isn't very friendly.
at crsearch.action.SearchAction.execute(SearchAction.java:113)
at crsearch.frontend.ActionServlet.doGet(ActionServlet.java:58)
... 28 more

</pre>
```

