

Web Scraping

Hey, web scraping!

You may want to...

- download all videos from a website;
- download all news articles from a media platform;
- download all academic papers from a journal;
- download all tweets/weibo of a specific person.

You may need to spend days and nights downloading these data manually, and you can easily make a lot of mistakes.

Hey, web scraping!

In today's class, we are going to learn about webscraping.
In Chinese, it is called 网络爬虫.

What is webscraping?

Using tools to gather data you can see on a webpage.
Almost anything you see on a website can be scraped.

It can be done with python, R,... We are doing it on R.

<https://www.youtube.com/embed/Ct8Gxo8StBU?enablejsapi=1>

Learning about HTML

HTML stands for “HyperText Markup Language.”

Websites are written on the HTML language, and web scraping is based on reading and interpreting the HTML of a webpage.

But how to find the HTML of a webpage?

Learning about HTML

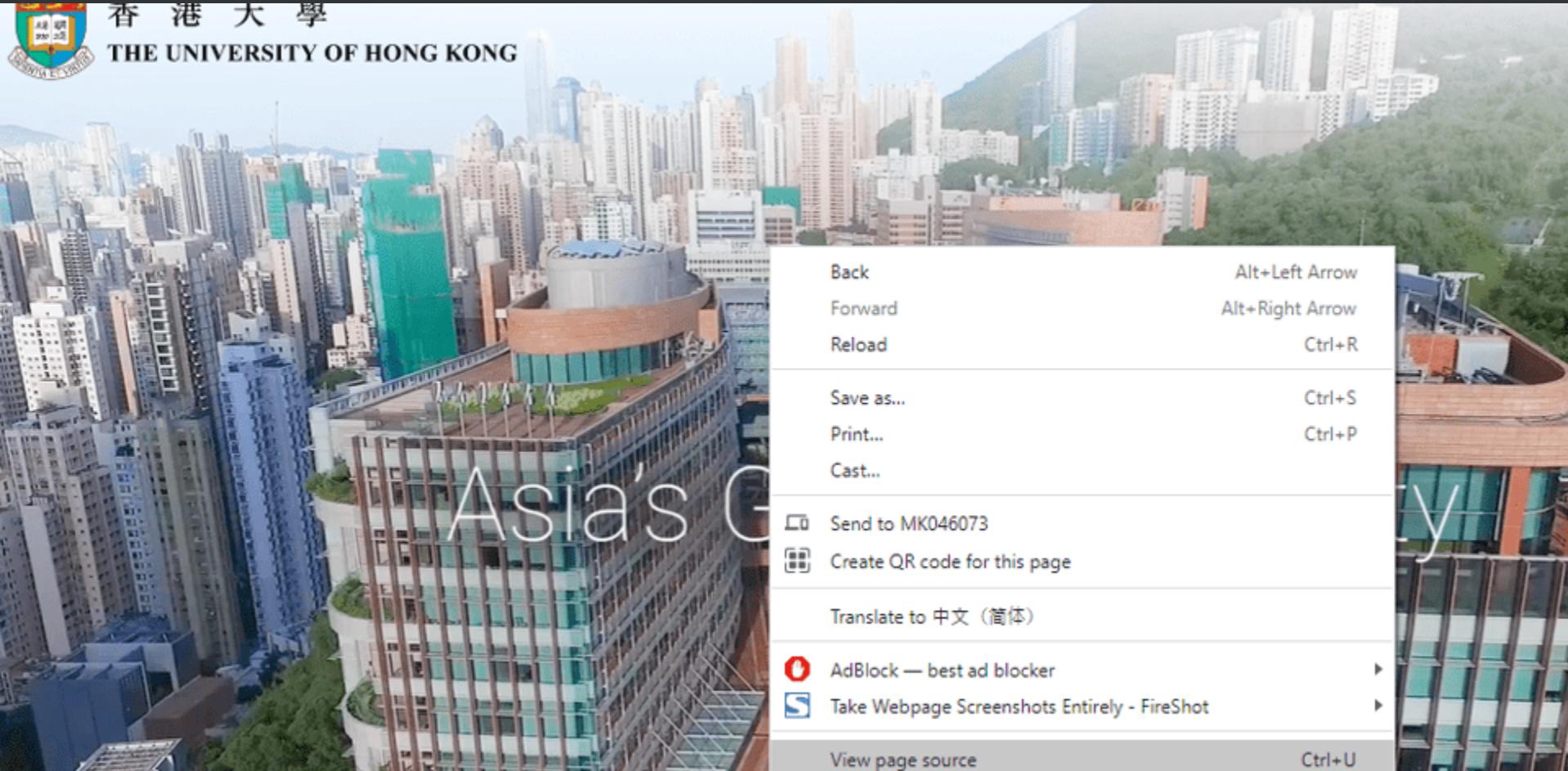
Please use Google Chrome as your browser.

If you are not a user of Google Chrome, download and install one on your laptop. Google Chrome is particularly helpful for analyzing webpages for scraping.



香港大學

THE UNIVERSITY OF HONG KONG



```
1 <!DOCTYPE html>
2 <!--[if lt IE 9]><html class="no-js lte-ie9 lt-ie9lang-en" lang="en"><![endif]-->
3 <!--[if IE 9]><html class="no-js lte-ie9 ie9lang-en" lang="en"><![endif]-->
4 <!--[if gt IE 9]><!-->
5 <html class="no-js" xmlns="http://www.w3.org/1999/xhtml"
6   xml:lang="en" lang="en">
7
8 <head>
9   <meta http-equiv="Content-Type" content="text/html; charset=utf-8" />
10  <meta http-equiv="X-UA-Compatible" content="IE=edge" />
11  <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no" />
12  <meta http-equiv="Content-Style-Type" content="text/css" />
13  <meta http-equiv="Content-Script-Type" content="text/javascript" />
14  <link rel="apple-touch-icon" sizes="180x180" href="/assets/img/apple-touch-icon.png" />
15  <link rel="icon" type="image/png" href="/assets/img/favicon-32x32.png" sizes="32x32" />
16  <link rel="icon" type="image/png" href="/assets/img/favicon-16x16.png" sizes="16x16" />
17  <link rel="manifest" href="/assets/img/manifest.json" />
18  <link rel="shortcut icon" href="/assets/img/favicon.ico" />
19  <meta name="msapplication-config" content="/assets/img/browserconfig.xml" />
20  <meta name="theme-color" content="#ffffff" />
21
22 <noscript><style>
```

Learning about HTML

The data you want to scrape appears in certain place of the HTML. For example, suppose that you want to scrape data from the HKU marketing faculty [webpage](#):



Learning about HTML

You can find the name and images of the professors from the HTML file:

```
▼ <div class="people-card fadeInUp animated" data-animate="fadeInUp"> ⚡
  ▼ <a href="https://www.hkubs.hku.hk/people/jinzhao-du/" class="el-processed">
    ► <noscript>...</noscript>
    
    ▼ <div class="people-info">
      <div class="h5">Prof. Jinzhao DU</div> == $0
      </div>
    </a>
  </div>
  ▶ <div class="wgl_col-3 people-item">...</div>
  ▶ <div class="wgl_col-3 people-item">...</div>
```

Learning about HTML

And even the link to their photos (see [this link](#) for example).

```
▼ <div class="people-card fadeInUp animated" data-animate="fadeInUp"> flex
  ▼ <a href="https://www.hkubs.hku.hk/people/jinzhao-du/" class="el-processed">
    ▶ <noscript>...</noscript>
    
    ▼ <div class="people-info">
      <div class="h5">Prof. Jinzhao DU</div> == $0
    </div>
  </a>
</div>
</div>
▶ <div class="wgl_col-3 people-item">...</div>
▶ <div class="wgl_col-3 people-item">...</div>
```

Webscraping

Suppose that you want to download the names of each individual marketing faculty, what should you do?

First, you need to get the HTML for the webpage.

Second, you need to analyze the HTML to get the desired information --- this is much more difficult.

Webscraping



```
1 install.packages("rvest")
2 library(rvest)
3 url = "https://www.hkubs.hku.hk/people/faculty?
pg=1&staff_type=faculty&subject_area=marketing&track=all"
4 webpage = read_html(url, encoding = "UTF-8")
5 print(webpage)
```

Webscraping

Now, you get the HTML source file here. The next thing you need to do it to understand the HTML file, which is very challenging.

```
> print(webpage)
[1] <html _document>
<html dir="ltr" lang="en-US" prefix="og: https://ogp.me/ns#">
[1] <head>\n<meta http-equiv="Content-Type" content="text/html; charset=UTF-8">\n<meta name="viewp ...
[2] <body class="page-template page-template-people-listing page-template-people-listing-php page ...
```

Webscraping

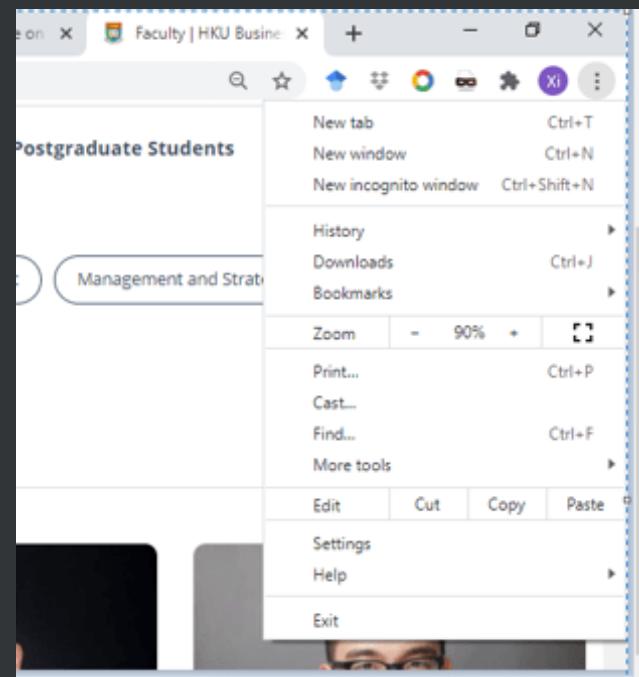
To better understand the HTML code, you are strongly recommended to use Chrome as your browser.

Chrome allows you to check the HTML code in a much more convenient matter.

Check HTML with Chrome

Open the webpage in your Chrome browser.

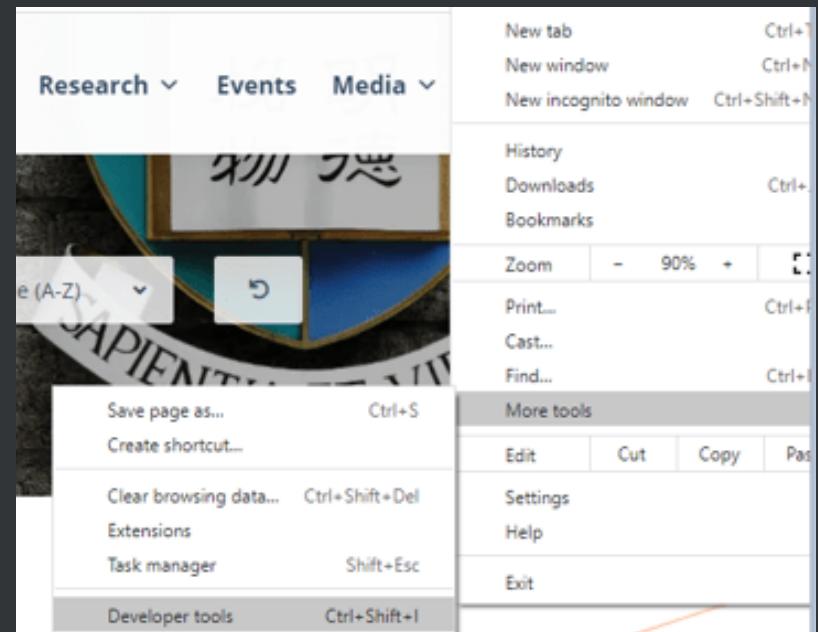
Click the upper right Chrome setting button of your browser and you will be directed here.



Check HTML with Chrome

Choose “More tools”...

Choose “Developer tools”...

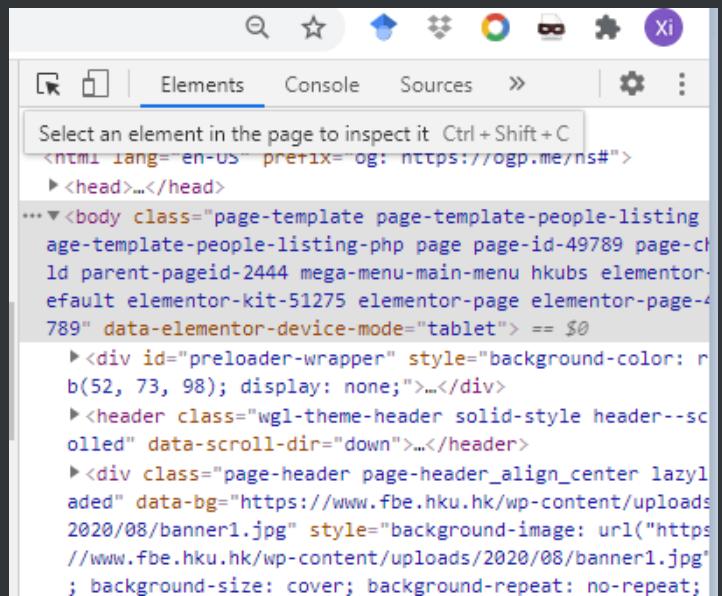


Check HTML with Chrome

Click the  button and you will get to “select an element in the page to inspect it”.

Alternatively, use “Ctrl + Shift + C.”

If needed, also click the  button to switch between desktop and mobile version.



The screenshot shows the Google Chrome DevTools interface with the 'Elements' tab selected. At the top, there's a search bar and several icons. Below the tabs, a message says "Select an element in the page to inspect it Ctrl + Shift + C". The main area displays the DOM structure of a page. The root node is <html>. The body node has several classes applied: "page-template page-template-people-listing", "age-template-people-listing-php", "page page-id-49789", "page-cl", "id parent-pageid-2444", "mega-menu-main-menu", "hkubs", "elementor-", "default", "elementor-kit-51275", "elementor-page", "elementor-page-49789", and "data-elementor-device-mode="tablet">. Below the body, there's a preloader-wrapper div with a background color of #52, 73, 98, and a header element with a scroll dir of "down". The page also features a banner image from https://www.fbe.hku.hk/wp-content/uploads/2020/08/banner1.jpg.

Check HTML with Chrome

Take Prof. Du's information as an example. You can see his name appears here in the HTML code. But what does this mean?

```
▼ <a href="https://www.hkubs.hku.hk/people/jinzhao-du/" class="el-processed">
  ▶ <noscript>...</noscript>
    
      <div class="h5">Prof. Jinzhao DU</div> == $0
    </div>
  </a>
</div>
</div>
```

```
▼ <div class="listing">
  ▼ <div class="row" style="flex">
    ▶ <div class="wgl_col-3 people-item">...</div>
    ▼ <div class="wgl_col-3 people-item">
      ▼ <div class="people-card fadeInUp animated" data-animate="fadeInUp" style="flex">
        ▶ <a href="https://www.hkubs.hku.hk/people/jinzhao-du/" class="el-processed">
          ▶ <noscript>...</noscript>
          
        ▼ <div class="people-info">
          <div class="h5">Prof. Jinzhao DU</div> == $0
          </div>
        </a>
      </div>
    </div>
  ▶ <div class="wgl_col-3 people-item">...</div>
```

Secret: Changing the webpage

Understanding HTML

Here, the name information is within a “div” node.

And this node belongs to a “div” node.

This “div” node further belongs to another “a” node.

And so on....

We call this is “path”: ...div/div/div/a/div/div

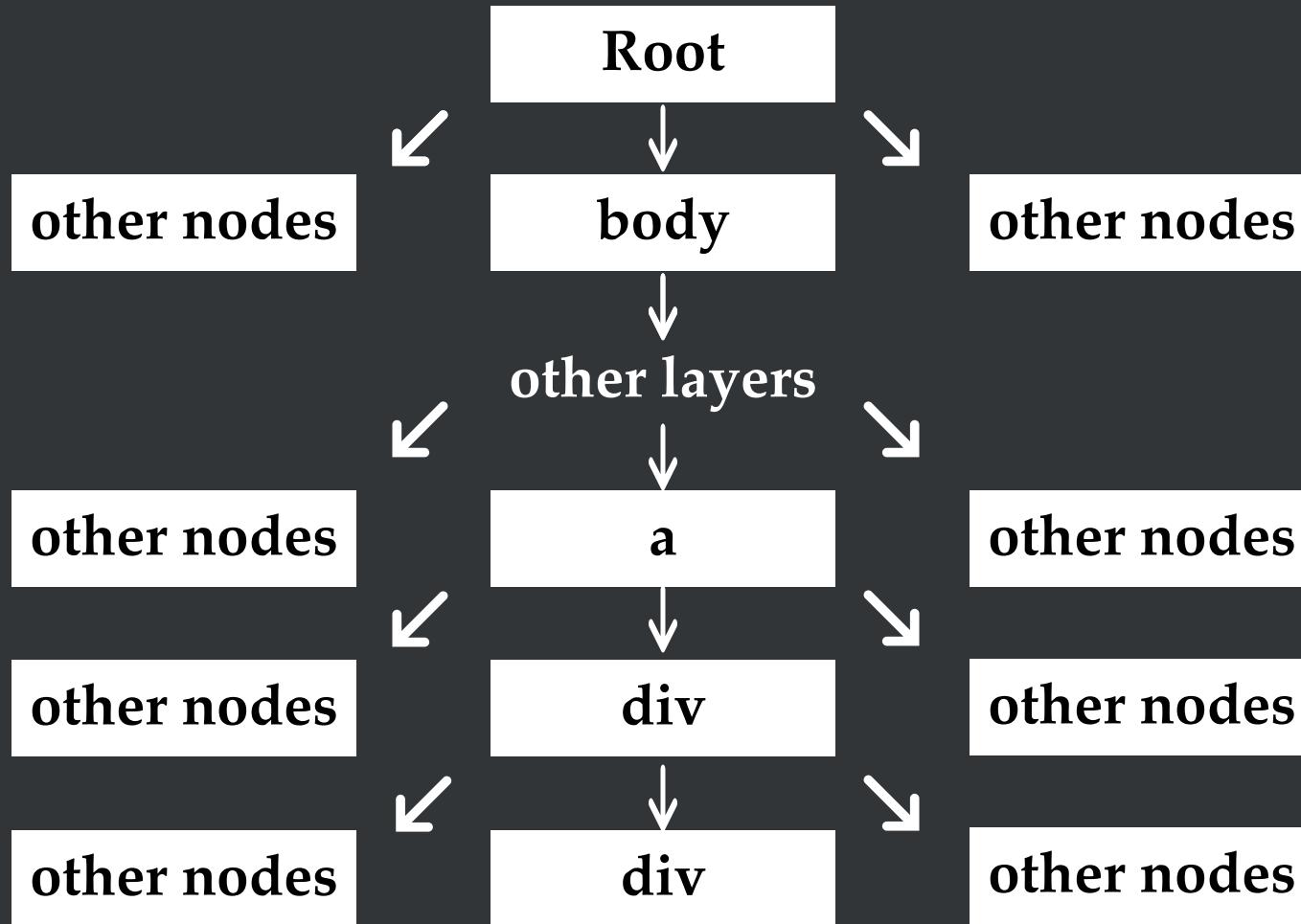
Understanding HTML

You can see that we have various types of nodes, including “div”, “a”, and “img”. You may wonder, “what do these types mean?”

Here, these types are called “tag”. For example, an “img” tag is used to mark up an image in the HTML language.

For detailed information, check [here](#).

Understanding HTML



Understanding HTML

This is something like your home address:

We have something like...

Country/Province/City/District/Street/Building/Floor/Room

The path helps us locate nodes and find the content of the nodes.

Understanding HTML

However, unlike your home address, here each node does not have its name.

For example, we know it is a “**div**” node (not an “a” node) but there may be multiple “**div**” nodes.

My building is in a **street** (not an **avenue** or **road**) but there may be multiple **streets** here.

Understanding HTML

Let's get all "div" nodes. This can be done by running this:

```
1 nodes <- html_nodes(webpage,xpath = '//div')
```

You can see that in total we have 253 "div" nodes.

```
1 print(length(nodes))
```

Understanding HTML

We want to make the path more accurate to pin down to the “div” nodes that we are interested in. That is, we want to remove other unrelated “div” nodes.

We can do this by putting more restrictions on the path.

<https://www.youtube.com/embed/vNOyRZIkC7o?enablejsapi=1>

Understanding HTML

Consider the following code:

```
1 nodes <- html_nodes(webpage,xpath = '//div/div')  
2 print(length(nodes))
```

Here we restrict the parent of the “div” node must also be a “div” node. Now, we have 199 nodes --- still too many.



The screenshot shows a portion of a web page's DOM structure. The visible elements include:

- An anchor tag () with a href pointing to <https://www.hkubs.hku.hk/people/jinzhao-du/> and a class of "el-processed".
- A noscript tag () containing some text.
- An img tag () with decoding="async", width="800", height="800", and a src attribute pointing to https://www.hkubs.hku.hk/wp-content/uploads/fly-images/8059/Dr_Du_Jinzhou_2019-x800-ct.jpg. It also has a data-src attribute pointing to the same URL, a class of "attachment-people-thumbnail lazyloaded", and an alt attribute with the text "Prof. Jinzhao DU".
- A div tag (

) with a class of "people-info" containing:
 - A div tag (

) with a class of "h5" containing the text "Prof. Jinzhao DU".
 - A closing div tag (

).

- A closing a tag ().
- A closing div tag (

Understanding HTML

Consider the following code:



```
1 nodes <- html_nodes(webpage,xpath = '//div[@class="people-info"]/div')  
2 print(length(nodes))
```

Here we restrict the parent of the “div” node must also be a “div” node. Moreover, the its parent node must have a class attribute will is called “people-info.”

A screenshot of a browser's developer tools, specifically the DOM inspector. It shows a tree structure of HTML elements. A node under the 'a' element is highlighted with a light gray background. The highlighted node is a 'div' with the class 'people-info'. The entire tree is shown in a monospaced font, representing the raw HTML code.

```
▼ <a href="https://www.hkubs.hku.hk/people/jinzhao-du/" class="el-processed">  
  ▶ <noscript> ⇵ </noscript>  
      
  ▼ <div class="people-info">  
    <div class="h5">Prof. Jinzhao DU</div> == $0  
  </div>  
  </a>  
</div>  
</div>
```

Understanding HTML

Now, we only have 16 div nodes selected. These are actually all HKU marketing faculties. Let us print their names:



```
1 nodes <- html_nodes(webpage,xpath = '//div[@class="people-info"]/div')  
2 for (node in nodes)  
3   print(html_text(node))
```

Understanding HTML

You can also use other refinement to select the nodes that you are looking for. For example, the following codes work as well:



```
1 nodes <- html_nodes(webpage,xpath = '//div[@class="h5"]')  
2 for (node in nodes)  
3   print(html_text(node))
```

The complete code is here.



```
1 library(rvest)
2 url = "https://www.hkubs.hku.hk/people/faculty?
  pg=1&staff_type=faculty&subject_area=marketing&track=all"
3 webpage = read_html(url, encoding = "UTF-8")
4 nodes <- html_nodes(webpage,xpath = '//div[@class="h5"]')
5 for (node in nodes)
6   print(html_text(node))
```

Exercise

Great! You know have a sense of how to scrape data from the web. It is very preliminary, and you will need a lot more exercises. Let us try the following exercise.

Exercise

HKU makes press announcements on its official news webpage: <https://hku.hk/press/all/>

All News 



[◀ 2025](#)

[JAN](#) [FEB](#) [MAR](#) [APR](#) [MAY](#) [JUN](#) [JUL](#) [AUG](#) [SEP](#) [OCT](#) [NOV](#) [DEC](#)

17 Dec 2025	▶ HKU-led Cross-Institutional Team Develops New Memristor-based Converter	Press Release
16 Dec 2025	▶ HKU physicists awarded 2025 Brillouin Medal for groundbreaking discovery in phononics	Press Release
16 Dec 2025	▶ HKUMed reveals childhood maltreatment raises schizophrenia risk five-fold and leaves lasting genetic marks linked to neurodegenerative diseases	Press Release
16 Dec 2025	▶ Symbols of Identity: IKAT Textiles from Indonesia	Press Release
15 Dec 2025	▶ HKU Co-hosts International Lunar Sample Research Symposium	Press Release

[▲ TOP](#)

Exercise

Try to download the titles of these press articles!

URL: <https://hku.hk/press/all/>

Exercise

Now, let us visit the Harvard School of Professional Learning: <https://pll.harvard.edu/trending>



❖ HUMANITIES

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💻 ONLINE

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Exercise

In this exercise, we attempt to scrape the course titles, e.g., “CS50’s Introduction to Artificial Intelligence with Python”

Try this exercise yourself!

Exercise

First, we identify the root of each individual course. We need to inspect the HTML code first.

```
▼<div class="field field--name-title field--type-string field--label-hidden field__items">
  ▼<h3 class="field__item">
    <a href="/course/cs50s-introduction-artificial-intelligence-python" hreflang="en" data-
      once="dlInternalCampaignClickedViewCourses dlLinkClicked">CS50's Introduction to
      Artificial Intelligence with Python</a> == $0
  </h3>
</div>
```

Scraping Images

Previously, we have discussed how to scrape text information from a website using a web scraper.

Now, let us consider scraping images from the web.

Scraping Images

Let us study the Harvard marketing faculty [webpage](#):



Tomomichi Amano
Assistant Professor of Business Administration



Eva Ascarza
Professor of Business Administration



Madhav Kumar
Assistant Professor of Business Administration



Michael T. Moynihan
Senior Lecturer of Business Administration

Scraping Images

You can find a link to each photo (in “src” attribute):

```
::before
▼<div class="span2">
   == $0
</div>
▼<div class="span99">
  ▼<h2 class="eta">
    <a href="/faculty/Pages/profile.aspx?facId=548988">Eva Ascarza</a>
  </h2>
  <div class="nu">Professor of Business Administration</div>
```

Scraping Images

Once you get the [link](#), you will have access to the photo.

So, our first step to get the link information.

Scraping Images



```
1 library(rvest)
2 url =
  "https://www.hbs.edu/faculty/units/marketing/Pages/faculty.aspx"
3 webpage = read_html(url, encoding = "UTF-8")
4 image_nodes <- html_nodes(webpage, xpath = '//img[@width="180"]')
5 print(length(image_nodes))
```

Scraping Images

But that's not enough. We not only want to get the nodes, but also need the link to each of the nodes. The link appears in the "src" attribute.

```
::before
▼<div class="span2">
  
</div>
▼<div class="span99">
  ▼<h2 class="eta">
    <a href="/faculty/Pages/profile.aspx?facId=548988">Eva Ascarza</a>
  </h2>
  <div class="nu">Professor of Business Administration</div>
```

Scraping Images

But that's not enough. We not only want to get the nodes, but also need the link to each of the nodes. The link appears in the "src" attribute.



```
1 image_nodes <- html_nodes(webpage, xpath = '//img[@width="180"]')  
2 for (image in image_nodes)  
3 {  
4   photourl <- html_attr(image, "src")  
5   print(photourl)  
6 }
```

Scraping Images



```
1 number = 1
2 for (image in image_nodes)
3 {
4   photourl <- html_attr(image, "src")
5   print(photourl)
6   download.file(photourl,
7                 paste0(toString(number), '_Photo.jpg'), mode = 'wb')
8   number = number + 1
9 }
```

The compete code is here.



```
1 library(rvest)
2 url = "https://www.hbs.edu/faculty/units/marketing/Pages/faculty.aspx"
3 webpage = read_html(url, encoding = "UTF-8")
4 image_nodes <- html_nodes(webpage, xpath = '//img[@width="180"]')
5 number = 1
6 for (image in image_nodes)
7 {
8   photourl <- html_attr(image, "src")
9   print(photourl)
10  download.file(photourl,
11                 paste0(toString(number), '_Photo.jpg'), mode = 'wb')
12  number = number + 1
13 }
```

Static vs. Dynamic Websites

<https://www.youtube.com/embed/hlg6q6OFoxQ?enablejsapi=1>

Dynamic Websites

What we learned in today's class works well for static websites. But it does not work equally well on dynamic websites. If you want to scrape data from a dynamic website, you may need to use some more advanced tools.

Thank you!
Enjoy scraping!