目录

解放你的双手：自动化测试

- 最新版本：`v2.0`
- 更新时间：`20210429`

简介

介绍如何通过自动化测试，去解放你的双手，提高测试效率。包括进行概述，以及详细介绍PC端和移动端。包括PC端的Web端的Selenium、puppeteer、Playwright和移动端的常见框架，比如Android的uiautomator2、iOS的facebook-wda等自动化工具。

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本书的各种源码、在线浏览地址、多种格式文件下载如下：

Gitbook源码

- crifan/free_hand_test_automation: 解放你的双手：自动化测试

如何使用此Gitbook源码去生成发布为电子书

详见：crifan/gitbook_template: demo how to use crifan gitbook template and demo

在线浏览

- 解放你的双手：自动化测试 book.crifan.com
- 解放你的双手：自动化测试 crifan.github.io

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鸣谢

感谢我的老婆**陈雪**的包容理解和悉心照料，才使得我 `crifan` 有更多精力去专注技术专研和整理归纳出这些电子书和技术教程，特此鸣谢。

更多其他电子书

本人 `crifan` 还写了其他 `100+` 本电子书教程，感兴趣可移步至：

crifan/crifan_ebook_readme: Crifan的电子书的使用说明

概述

- 自动化测试
  - = `test automation`
    - = `automation testing`
  - 根据目标平台和设备不同可分为
    - **PC端**
      - **Web领域=Web端=浏览器操作自动化**
        - 常见框架
          - `Selenium`
            - Selenium知识总结
          - `puppeteer`
          - `Playwright`
    - **移动端**
      - 概览
        - 移动端自动化测试概览
      - 常见框架
        - **Android**
          - `uiautomator2`
            - 安卓自动化测试利器：uiautomator2
        - **iOS**
          - `facebook-wda`
            - iOS自动化测试利器：facebook-wda

举例

下面通过实例例子来说明，自动化操作，对于不同平台大概是什么样的，以便于有个宏观的，具体的了解。

百度搜索自动化

下面就通过例子：**百度搜索自动化**，来说明不同平台的自动化具体是什么样子：

PC端

selenium

代码：

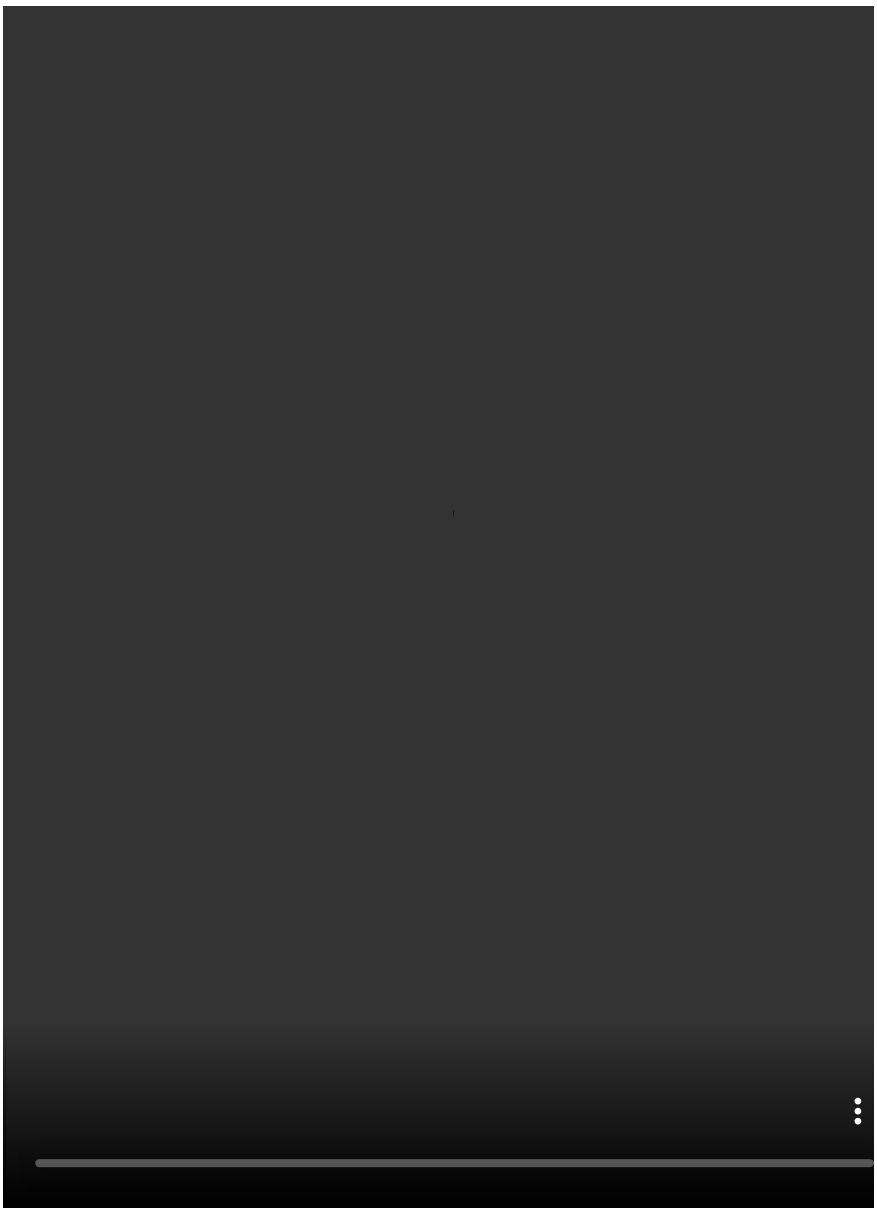
- 文件：seleniumDemoBaiduSearch.py
- 贴出来是

```
# Function: demo selenium do baidu search and extract r
# Author: Crifan Li
# Update: 20210327

from selenium import webdriver
from selenium.webdriver.common.keys import Keys
from selenium.webdriver.common.by import By
from selenium.webdriver.support.ui import WebDriverWait
from selenium.webdriver.support import expected_conditi

from bs4 import BeautifulSoup
import re

chromeDriver = webdriver.Chrome()

#############################################################
# Open url
#############################################################
baiduUrl = "https://www.baidu.com"
chromeDriver.get(baiduUrl)
print("title=%s" % chromeDriver.title)

assert chromeDriver.title == "百度一下，你就知道"
# assert '百度' in chromeDriver.title

#############################################################
# Find/Locate search button
#############################################################
SearchInputId = "kw"
searchInputElem = chromeDriver.find_element_by_id(Searc
print("searchInputElem=%s" % searchInputElem)
# searchInputElem=<selenium.webdriver.remote.webelement

#############################################################
# Input text
#############################################################
searchInputElem.clear()
print("Clear existed content")

searchStr = "crifan"
searchInputElem.send_keys(searchStr)
print("Entered %s to search box" % searchStr)

#############################################################
# Click button
#############################################################

# Method 1: emulate press Enter key
# searchButtonElem.send_keys(Keys.RETURN)
# print("Pressed Enter/Return key")
```

```
# Method 2: find button and click
BaiduSearchId = "su"
baiduSearchButtonElem = chromeDriver.find_element_by_id
print("baiduSearchButtonElem=%s" % baiduSearchButtonEle
baiduSearchButtonElem.click()
print("Clicked button %s" % baiduSearchButtonElem)

############################################################
# Wait page change/loading completed
#   -> following element makesure show = visible
#   -> otherwise possibly can NOT find elements
############################################################
MaxWaitSeconds = 10
numTextElem = WebDriverWait(chromeDriver, MaxWaitSecond
    EC.presence_of_element_located((By.XPATH, "//span[@
)
print("Search complete, showing: %s" % numTextElem)

############################################################
# Extract result
############################################################

# Method 1: use Selenium to extract title list
searchResultAList = chromeDriver.find_elements_by_xpath
print("searchResultAList=%s" % searchResultAList)
searchResultANum = len(searchResultAList)
print("searchResultANum=%s" % searchResultANum)
for curIdx, curSearchResultAElem in enumerate(searchRes
  curNum = curIdx + 1
  print("%s [%d] %s" % ("-"*20, curNum, "-"*20))
  baiduLinkUrl = curSearchResultAElem.get_attribute("hr
  print("baiduLinkUrl=%s" % baiduLinkUrl)
  title = curSearchResultAElem.text
  print("title=%s" % title)

# # Method 2: use BeautifulSoup to extract title list
# curHtml = chromeDriver.page_source
# curSoup = BeautifulSoup(curHtml, 'html.parser')
# beginTP = re.compile("^t.*")
# searchResultH3List = curSoup.find_all("h3", {"class":
# print("searchResultH3List=%s" % searchResultH3List)
# searchResultH3Num = len(searchResultH3List)
# print("searchResultH3Num=%s" % searchResultH3Num)
# for curIdx, searchResultH3Item in enumerate(searchRes
#   curNum = curIdx + 1
#   print("%s [%d] %s" % ("-"*20, curNum, "-"*20))
#   aElem = searchResultH3Item.find("a")
#   # print("aElem=%s" % aElem)
#   baiduLinkUrl = aElem.attrs["href"]
#   print("baiduLinkUrl=%s" % baiduLinkUrl)
```

```
#   title = aElem.text
#   print("title=%s" % title)

##############################################################
# End close
##############################################################
chromeDriver.close()
```

效果：



puppeteer

代码：

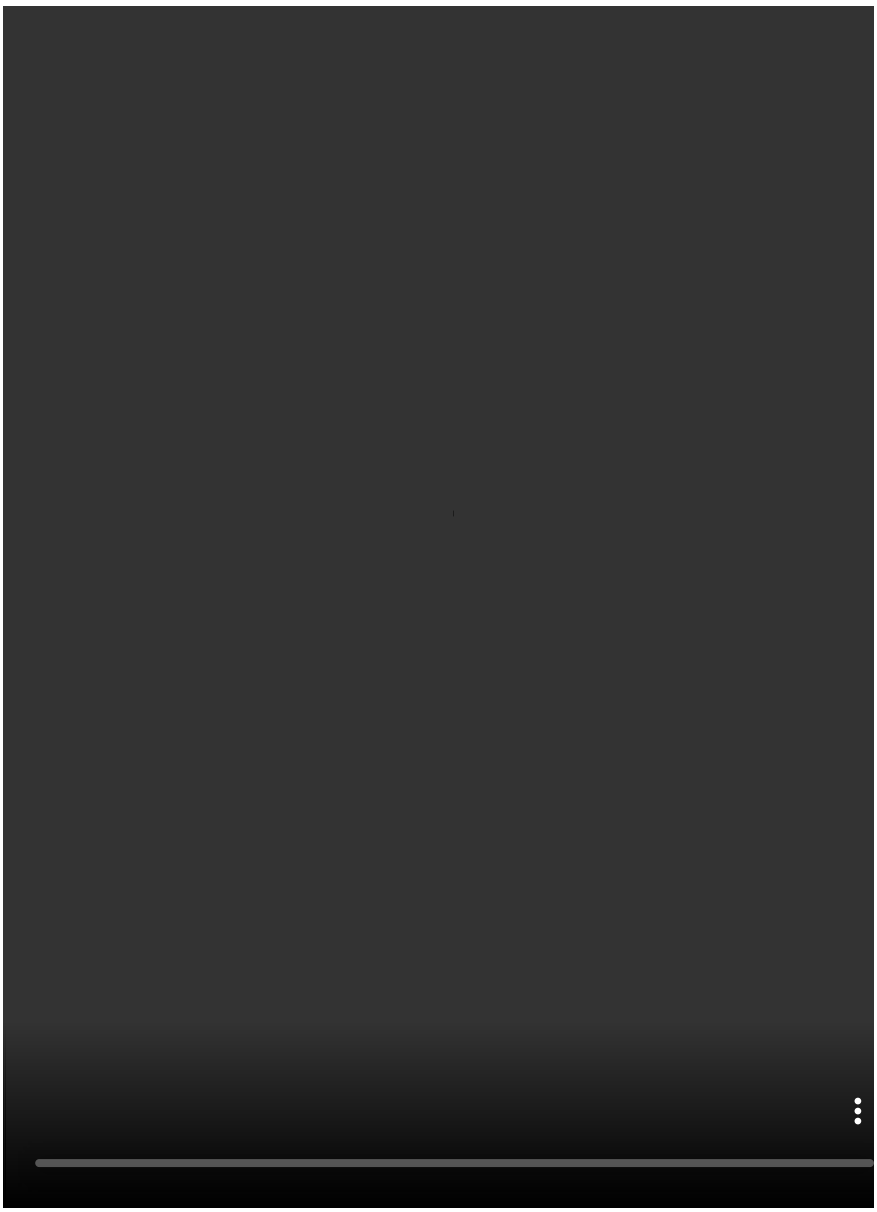
- 文件：puppeteerDemoBaiduSearch.py
- 贴出来是

```python
# Function: pyppeteer (python version puppeteer) do bai
# Author: Crifan Li
# Update: 20210330

import asyncio
from pyppeteer import launch

async def main():
    browser = await launch(headless=False)
    page = await browser.newPage()

    await page.setJavaScriptEnabled(enabled=True)

    baiduUrl = "https://www.baidu.com"
    await page.goto(baiduUrl)
    # await page.screenshot({'path': 'baidu.png'})

    ##########################################################
    # Input text
    ##########################################################
    searchStr = "crifan"

    # SearchInputSelector = "input[id=kw]"
    SearchInputSelector = "input[id='kw']"

    # SearchInputXpath = "//input[@id='kw']"
    # searchInputElem = page.xpath(SearchInputXpath)

    # # Input method 1: selector + click + keyboard typ
    # searchInputElem = await page.querySelector(Search
    # print("searchInputElem=%s" % searchInputElem)
    # await searchInputElem.click()
    # await page.keyboard.type(searchStr)

    # Input method 2: focus then type
    # await page.focus(SearchInputSelector)
    # await page.keyboard.type(searchStr)

    # Input method 3: selector and input once using typ
    await page.type(SearchInputSelector, searchStr, del

    ##########################################################
    # Trigger search
    ##########################################################

    # Method 1: press ENTER key
    await page.keyboard.press('Enter')

    # # Method 2: locator search button then click

    # SearchButtonSelector = "input[id='su']"
    # searchButtonElem = await page.querySelector(Searc
```

```
# searchButtonElem = await page.querySelector(Searc
# print("searchButtonElem=%s" % searchButtonElem)
# await searchButtonElem.click()
# # await searchButtonElem.press("Enter")

##################################################
# Wait page reload complete
##################################################
SearchFoundWordsSelector = 'span.nums_text'
SearchFoundWordsXpath = "//span[@class='nums_text']

# await page.waitForSelector(SearchFoundWordsSelect
# await page.waitFor(SearchFoundWordsSelector)
# await page.waitForXPath(SearchFoundWordsXpath)
# Note: all above exception: 发生异常: ElementHandle
#   so change to following

# # Method 1: just wait
# await page.waitFor(2000) # millisecond

# Method 2: wait element showing
SingleWaitSeconds = 1
while not await page.querySelector(SearchFoundWords
  print("Still not found %s, wait %s seconds" % (Se
  await asyncio.sleep(SingleWaitSeconds)
  # pass

##################################################
# Extract result
##################################################

resultASelector = "h3[class^='t'] a"
searchResultAList = await page.querySelectorAll(res
# print("searchResultAList=%s" % searchResultAList)
searchResultANum = len(searchResultAList)
print("Found %s search result:" % searchResultANum)
for curIdx, aElem in enumerate(searchResultAList):
  curNum = curIdx + 1
  print("%s [%d] %s" % ("-"*20, curNum, "-"*20))
  aTextJSHandle = await aElem.getProperty('textCont
  # print("type(aTextJSHandle)=%s" % type(aTextJSHa
  # type(aTextJSHandle)=<class 'pyppeteer.executior
  # print("aTextJSHandle=%s" % aTextJSHandle)
  # aTextJSHandle=<pyppeteer.execution_context.JSHa
  title = await aTextJSHandle.jsonValue()
  # print("type(title)=%s" % type(title))
  # type(title)=<class 'str'>
  print("title=%s" % title)

  baiduLinkUrl = await (await aElem.getProperty("hr

  print("baiduLinkUrl=%s" % baiduLinkUrl)
```

```
    await browser.close()

asyncio.get_event_loop().run_until_complete(main())
```

效果：



playwright

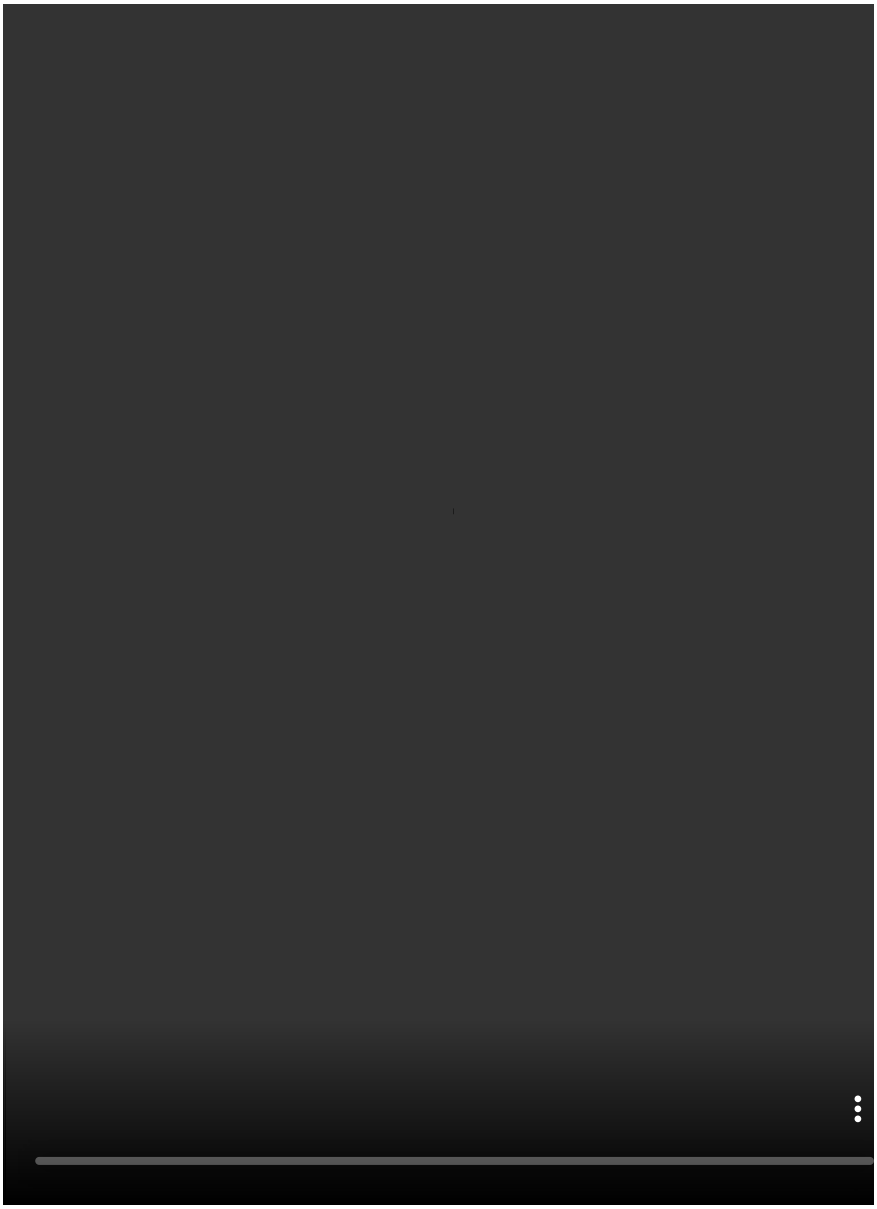
代码：

- 文件：playwrithDemoBaiduSearch.py
- 贴出来是

```python
# Function: Playwright demo baidu search
# Author: Crifan Li
# Update: 20210331

from playwright.sync_api import sync_playwright

# here use sync mode
with sync_playwright() as p:
    chromiumBrowserType = p.chromium
    print("chromiumBrowserType=%s" % chromiumBrowserTyp
    browser = chromiumBrowserType.launch(headless=False
    # chromiumBrowserType=<BrowserType name=chromium ex
    print("browser=%s" % browser)
    # browser=<Browser type=<BrowserType name=chromium
    page = browser.new_page()
    print("page=%s" % page)
    # page=<Page url='about:blank'>

    ######################################################
    # Open url
    ######################################################
    page.goto('http://www.baidu.com')
    print("page=%s" % page)
    # page=<Page url='https://www.baidu.com/'>

    ######################################################
    # Input text
    ######################################################
    searchStr = "crifan"
    SearchInputSelector = "input#kw.s_ipt"

    # page.click(SearchInputSelector)
    page.fill(SearchInputSelector, searchStr)

    ######################################################
    # Trigger search
    ######################################################
    EnterKey = "Enter"

    # Method 1: press Enter key
    # page.keyboard.press(EnterKey)

    # Method 2: locate element then click
    SearchButtonSelector = "input#su"
    page.press(SearchButtonSelector, EnterKey)

    # wait -> makesure element visible
    SearchFoundWordsSelector = 'span.nums_text'
    # SearchFoundWordsXpath = "//span[@class='nums_text
    page.wait_for_selector(SearchFoundWordsSelector, st
```

```
    ##################################################
    # Extract content
    ##################################################
    resultASelector = "h3[class^='t'] a"
    searchResultAList = page.query_selector_all(resultA
    print("searchResultAList=%s" % searchResultAList)
    # searchResultAList=[<JSHandle preview=JSHandle@<a
    searchResultANum = len(searchResultAList)
    print("Found %s search result:" % searchResultANum)
    for curIdx, aElem in enumerate(searchResultAList):
        curNum = curIdx + 1
        print("%s [%d] %s" % ("-"*20, curNum, "-"*20))
        title = aElem.text_content()
        print("title=%s" % title)
        # title=在路上on the way - 走别人没走过的路,让别人有
        baiduLinkUrl = aElem.get_attribute("href")
        print("baiduLinkUrl=%s" % baiduLinkUrl)
        # baiduLinkUrl=http://www.baidu.com/link?url=fB

    # do sceeenshot
    screenshotFilename = 'baidu_search_%s_result.png' %
    page.screenshot(path=screenshotFilename)

    browser.close()
```

效果:



移动端

Android端

uiautomator2

代码：

- 文件：uiautomator2DemoBaiduSearch.py
- 贴出来是

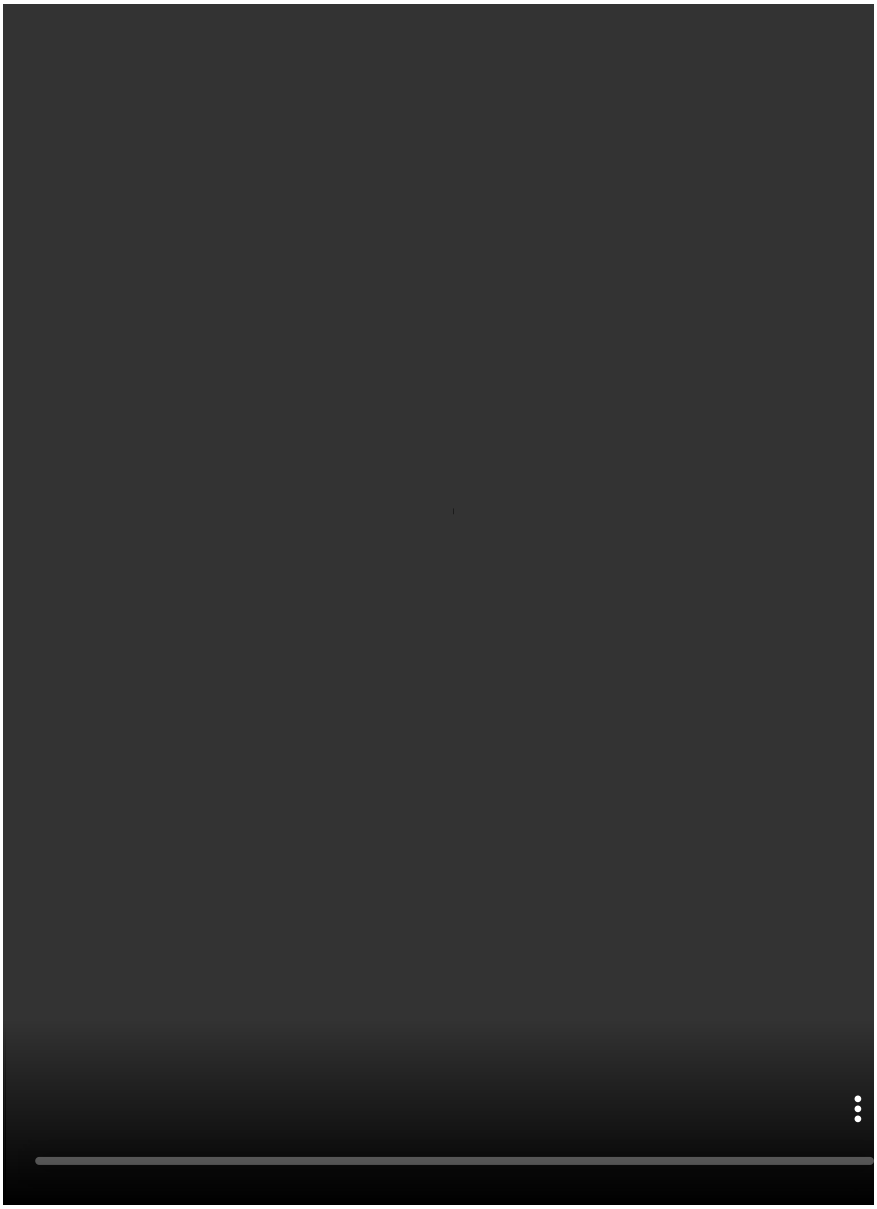
```
# Function: uiautomator2 demo baidu search
# Author: Crifan Li
# Update: 2020417

# import time
import uiautomator2 as u2

d = u2.connect() # connect to device
print("d.info=%s" % d.info)
# d.info={'currentPackageName': 'com.android.browser', 'dis

# for debug: get current app info
# curApp = d.app_current()
# print("curApp=%s" % curApp)

# for debug: get running app list
# activeAppList = d.app_list_running()
# print("activeAppList=%s" % activeAppList)

################################################################
# Launch browser
################################################################
Browser_XiaomiBuiltin = "com.android.browser"
browserPackage = Browser_XiaomiBuiltin
# d.app_start(browserPackage)
d.app_start(browserPackage, stop=True)

# wait util browser launch complete -> appear 我的 tab
# MustShowTabName = "主页"
MustShowTabName = "我的"
# d(text=MustShowTabName).exists(timeout=10)
d(text=MustShowTabName, packageName=browserPackage).exists
print("Browser homepage loaded")

################################################################
# Open baidu homepage
################################################################
SearchInputId = "com.android.browser:id/b4w"

# # open new window
# windowUiObj = d(resourceId="com.android.browser:id/dm")
# windowUiObj.click()

# # click add to new window
# addNewWindowUiObj = d(resourceId="com.android.browser:id/
# addNewWindowUiObj.click()


# for debug
# curPageXml = d.dump_hierarchy(compressed=False, pretty=Fa
```

```
# print("curPageXml=%s" % curPageXml)

# find input box inside address bar

# # Method 1: use driver pass in parameter
# inputUiObj = d(resourceId=SearchInputId, className="andro
# # inputUiObj = d(resourceId=SearchInputId)
# print("type(inputUiObj)=%s" % type(inputUiObj)) # type(in
# print("inputUiObj=%s" % inputUiObj) # inputUiObj=<uiautor
# inputUiObjectInfo = inputUiObj.info
# print("type(inputUiObjectInfo)=%s" % type(inputUiObjectIn
# print("inputUiObjectInfo=%s" % inputUiObjectInfo) # input
# isFoundInput = inputUiObj.exists # True

# # Method 2: use xpath
# inputXpathSelector = d.xpath("//android.widget.TextView[@
# # inputXpathSelector = d.xpath("//*[@resource-id=SearchIn
# print("type(inputXpathSelector)=%s" % type(inputXpathSele
# inputXpathElem = inputXpathSelector.get()
# print("type(inputXpathElem)=%s" % type(inputXpathElem)) #
# print("inputXpathElem=%s" % inputXpathElem) # inputXpathE
# print("type(inputXpathElem.attrib)=%s" % type(inputXpathE
# print("inputXpathElem.attrib=%s" % inputXpathElem.attrib)
# isFoundInput = inputXpathSelector.exists # True


# trigger into input page

# Method 1
inputUiObj = d(resourceId=SearchInputId, className="androi
inputUiObj.click()
print("Clicked search box")

# # Method 2
# inputXpathSelector = d.xpath("//android.widget.TextView[@
# inputXpathSelector.click()

# input baidu homr url
BaiduHomeUrl = "https://www.baidu.com/"
AddressInputId = "com.android.browser:id/bqi"
searchUiObj = d(resourceId=AddressInputId, className="andro
searchUiObj.set_text(BaiduHomeUrl)
print("Inputed baidu homepage url: %s" % BaiduHomeUrl)

# trigger jump to baidu home
EnterKey = "enter"
d.press(EnterKey)
print("Emulated press key %s" % EnterKey)

# wait util baidu home loaded
# d(text="百度一下", resourceId="com.android.browser:id/bq3"
```

```
d(text="百度一下,你就知道", className="android.view.View").ex
print("Baidu home loaded")

##############################################################
# Input text
##############################################################
searchStr = "crifan"

baiduSearchKeywordUiObj = d(resourceId="index-kw", classNar
baiduSearchKeywordUiObj.set_text(searchStr)
print("Inputed baidu search text %s" % searchStr)

##############################################################
# Trigger baidu search
##############################################################

# # Method 1: press key
# TriggerSearchKey = "enter" # work
# # TriggerSearchKey = "search" # not work
# # TriggerSearchKey = "go" # not work
# # TriggerSearchKey = "done" # not work
# d.press(TriggerSearchKey)
# print("Emulated press key %s" % TriggerSearchKey)

# Method 2: find 百度一下 button then click
baiduSearchButtonUiObj = d(resourceId="index-bn", classNam
baiduSearchButtonUiObj.click()
print("Clicked baidu search button")

##############################################################
# Extract search result content
##############################################################

# Special: for fixbug of get page xml is not latest, so us
d.service("uiautomator").stop()
d.service("uiautomator").start()
# time.sleep(1)

# for debug
# get page source xml
# curPageXml = d.dump_hierarchy(compressed=False, pretty=Fa
# print("curPageXml=%s" % curPageXml)
# with open("baidu_search_%s_result_pageSource_reloaded.xm
#     fp.write(curPageXml)

d(resourceId="results").exists(timeout=10)

# Note: following syntax can NOT find elements
# resultsSelector = d.xpath("//*[@resource-id='results']")
# titleButtonSelectorList = resultsSelector.xpath("//andro
# titleButtonSelectorList = resultsSelector.xpath(".//andr
```

```
# Xpath chain search can find elements
titleButtonElementList = d.xpath("//*[@resource-id='results
titleButtonNum = len(titleButtonElementList)
print("Found %s search result title" % titleButtonNum)

# descriptionElementList = d.xpath("//*[@resource-id='resu
descriptionElementList = d.xpath("//*[@resource-id='results
descriptionNum = len(descriptionElementList)
print("Found %s description" % descriptionNum)

# # sourceWebsiteElementList = d.xpath('//*[@resource-id="r
# sourceWebsiteElementList = d.xpath('//*[@resource-id="res
# sourceWebsiteNum = len(sourceWebsiteElementList)
# print("Found %s source website" % sourceWebsiteNum)

for curIdx, eachTitleButtonElement in enumerate(titleButtor
    curNum = curIdx + 1
    print("%s  [%d/%d] %s" % ("-"*20, curNum, titleButtonNu
    # eachTitleButtonElemAttrib = eachTitleButtonElement.at
    # print("title attrib: %s" % eachTitleButtonElemAttrib)
    # curTitle = eachTitleButtonElemAttrib["text"]
    curTitle = eachTitleButtonElement.text
    print("title=%s" % curTitle)

    curDescriptionElem = descriptionElementList[curIdx]
    curDescription = curDescriptionElem.text
    print("description=%s" % curDescription)

    # curSourceWebsiteElem = sourceWebsiteElementList[curId
    # curSourceWebsite = curSourceWebsiteElem.text
    # print("curSourceWebsite=%s" % curSourceWebsite)

print("Demo baidu search complete")
```

效果:



iOS端

facebook-wda

代码：

- 文件：facebookWdaDemoBaiduSearch.py
- 贴出来是

```
# Function: facebook-wda demo baidu search
# Author: Crifan Li
# Update: 20210410

import wda

# for debug
# Enable debug will see http Request and Response
# wda.DEBUG = True

c = wda.Client('http://localhost:8100')

curStatus = c.status()
print("curStatus=%s" % curStatus)
```

注：由于苹果开发者过期，导致：未完待续

详见：

【未解决】Mac中用facebook-wda自动操作安卓手机浏览器实现百度搜索

调试页面元素

在(用 `selenium` 、 `puppeteer` 、 `playwright` 等)自动化操作浏览器期间，往往涉及到：

搞清楚当前页面中的某些元素的html源码，以便于转换成 `xpath` 或 `css selector` 等方式去定位查找元素。

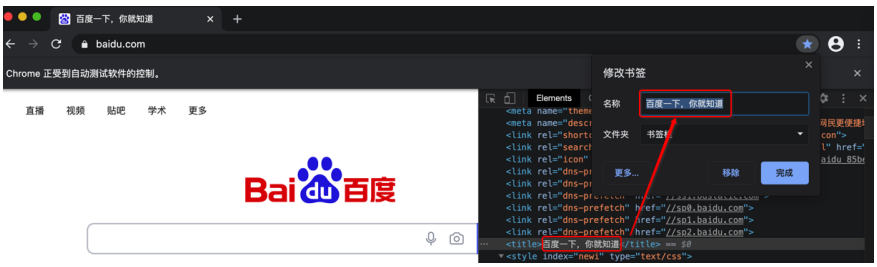
而调试页面元素的最常用办法就是： `Chrome` 的 `开发者工具`

其中： `Chrome` = `Chromium`

下面通过此处用到的实例例子来说明，具体如何操作。

用Chrome或Chromium查看百度首页中各元素的html源码

查看百度首页title标题

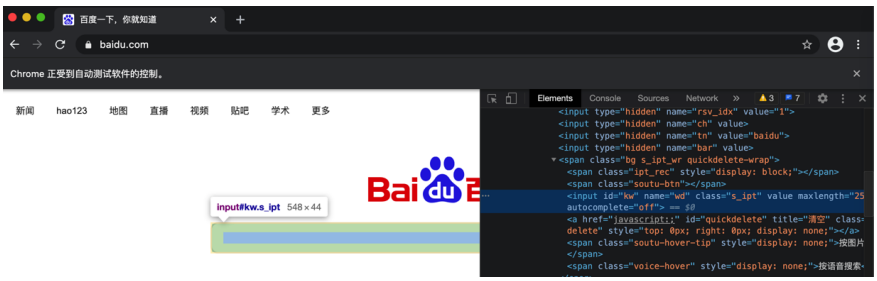


即： `百度一下，你就知道`

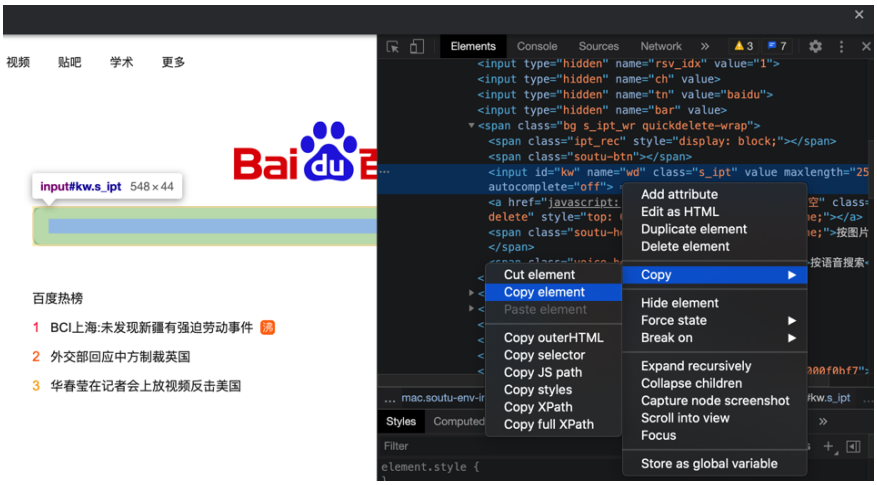
找到输入框对应的元素

可以右键 输入框 检查

打开 Chrome的 开发者工具



可以看到对应的html，且可以右键去Copy拷贝出来对应html



另外 Playwright调用的Chromium中效果是：

拷贝出来是：

```
<input id="kw" name="wd" class="s_ipt" value="" maxlength="
```

后来注意到：

Chromium中 调试工具已实时显示出 定位元素的Selector的，可以写成：

```
input#kw.s_ipt
```

其中：

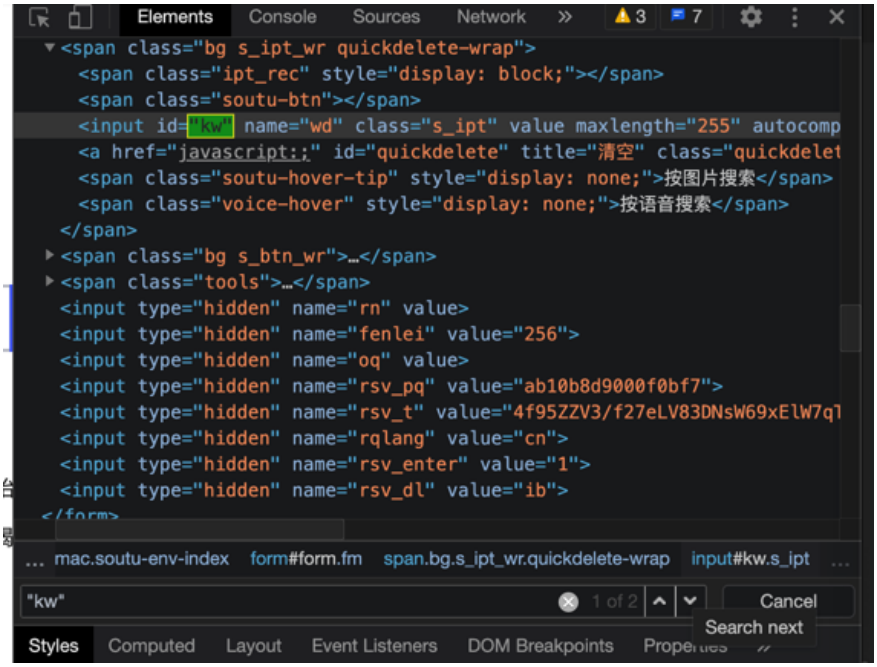
- `input` ：元素名 `tag`
- `kw` ：是 `id`
- `s_ipt` ：是 `class`

—> 后续代码中定位元素的CSS的Selector，则可以借鉴，甚至直接用这个写法

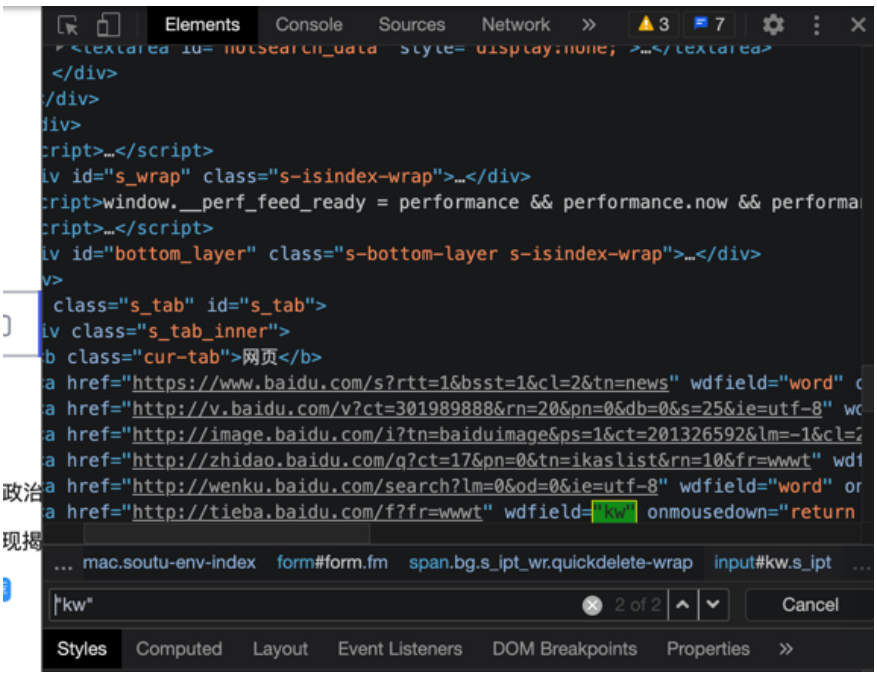
确认id是否唯一

此处可以通过查找，确认此处的id值 `kw` 是否唯一：

去搜一下此处的id： `kw`



此处可以看到搜到了2个，不过很明显，另外一个不是id：



证明对于： `id="kw"` 是唯一的

->后续代码，可以直接用 `id="kw"` 去定位元素（而可以不用其他属性，比如class等值）

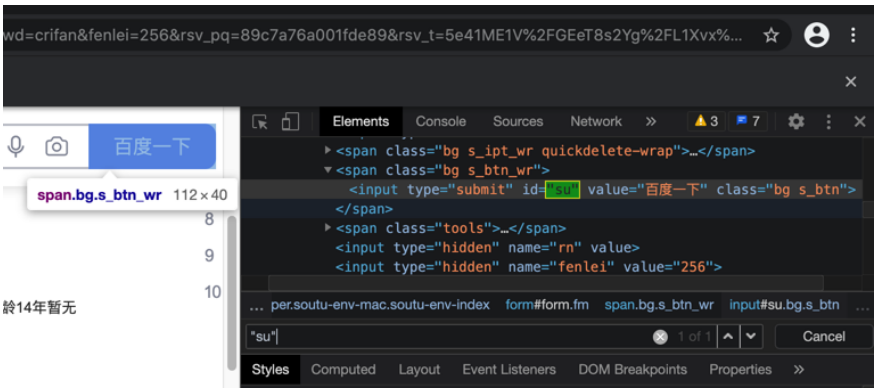
找 百度一下 按钮的html

找 百度一下 按钮，和之前类似，去 右键检查：

可以看到html是：

```
<input type="submit" id="su" value="百度一下" class="bg s_bt
```

且搜了下，确保只有一个："su"



找到百度搜索页面肯定会出现的元素：百度为您找到相关结果约

去找百度搜索后，确保会出现的内容

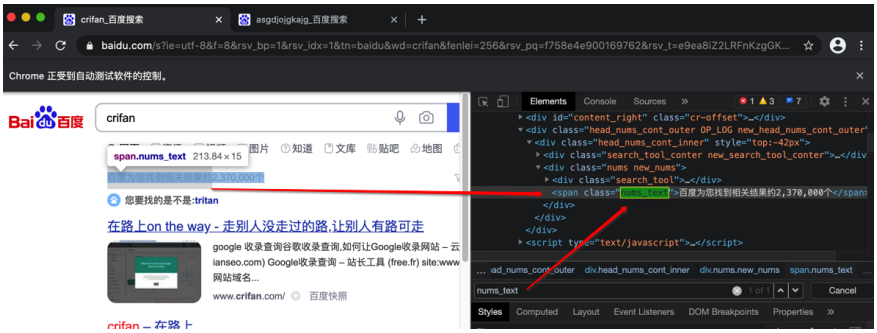
找到这个：

```
百度为您找到相关结果约xxx个
```

且去确认了，故意搜不到内容，页面也会出现这个：

去看看其html：

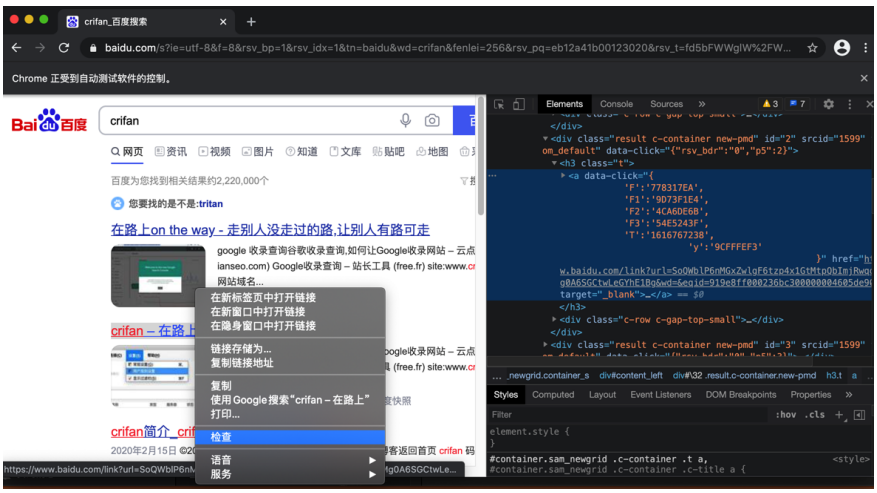
```
<span class="nums_text">百度为您找到相关结果约2,370,000个</spar
```



百度搜索的每条结果的html

去搞清楚，本身此处的每条搜索结果的内容的html是什么

右键 检查：

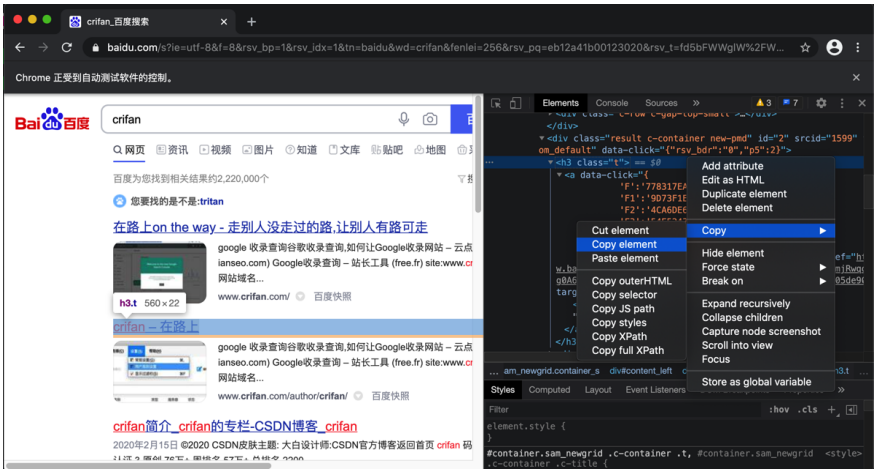


找到是：

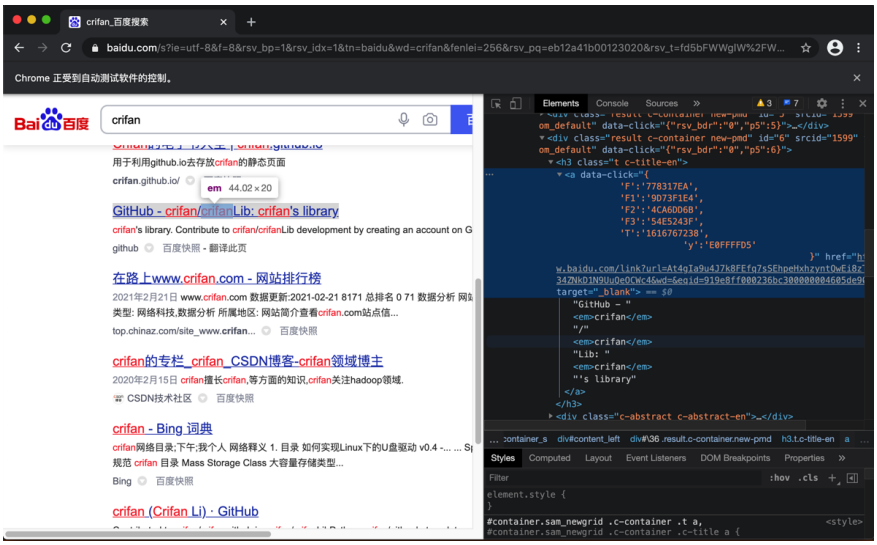
```
<a data-click="{
                'F':'778317EA',
                'F1':'9D73F1E4',
                'F2':'4CA6DE6B',
                'F3':'54E5243F',
                'T':'1616767238',
                    'y':'9CFFFEF3'
                                }" href="https://www.baidu.
```

上层父节点的元素是：

```
<h3 class="t"><a data-click="{
                'F':'778317EA',
                'F1':'9D73F1E4',
                'F2':'4CA6DE6B',
                'F3':'54E5243F',
                'T':'1616767238',
                    'y':'9CFFFEF3'
                                    }" href="https://www.baidu.
```



多看看几个结果，是否都是同样格式：

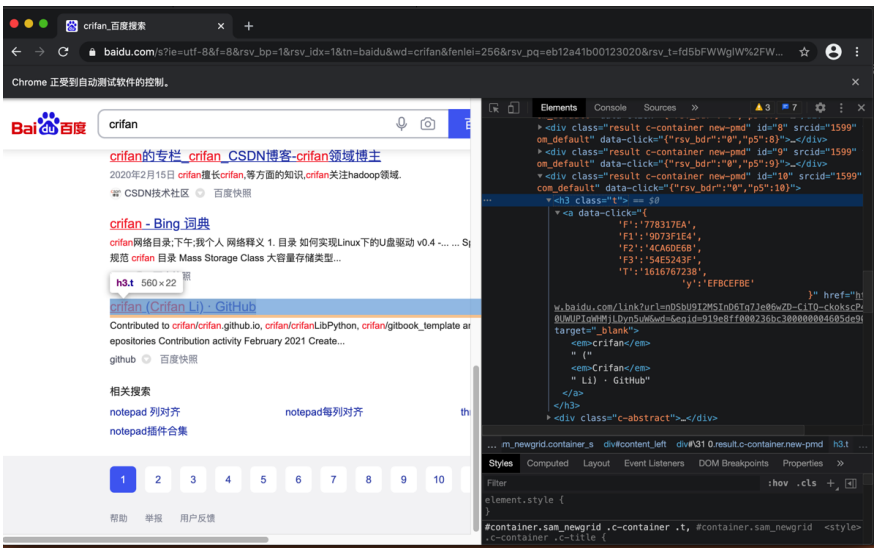


这个稍微复杂点：

```
<h3 class="t c-title-en"><a data-click="{
            'F':'778317EA',
            'F1':'9D73F1E4',
            'F2':'4CA6DD6B',
            'F3':'54E5243F',
            'T':'1616767238',
                    'y':'E0FFFFD5'
                                    }" href="ht
```

以及另外一个：

```
<h3 class="t"><a data-click="{
            'F':'778317EA',
            'F1':'9D73F1E4',
            'F2':'4CA6DE6B',
            'F3':'54E5243F',
            'T':'1616767238',
                    'y':'EFBCEFBE'
                                    }" href="ht
```

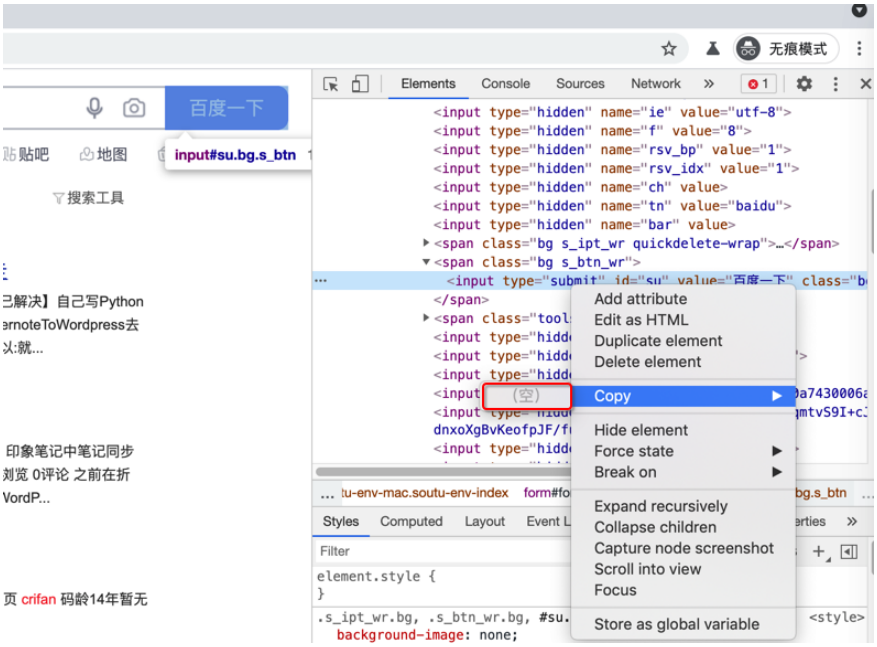


常见问题

Playwright的Chromium中无法右键拷贝元素html

Playwright的Chromium中，虽然能打开 `开发者工具`

但是，右键无法复制copy元素的html，右键的copy是空



PC端

PC端 = 电脑端，的自动化操作，此处主要指的是：

- Web端 = 浏览器

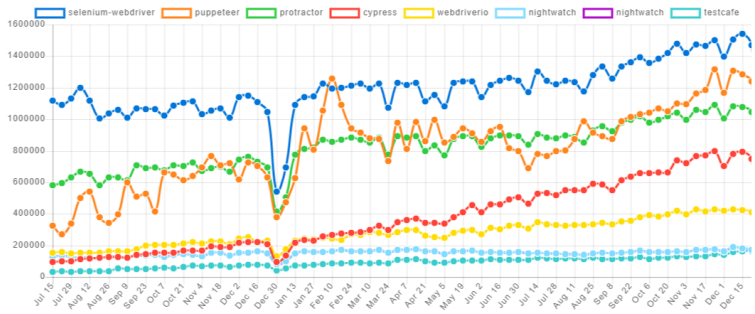
的自动化操作，代替人手，自动操作浏览器。

Web端

- Web端自动化操作
  - 目的：模拟人手工去操作浏览器
- 常见框架有
  - Selenium
  - puppeteer
  - Playwright

Selenium vs puppeteer

下面总结一下相关对比：

- 两者趋势
  - 

具体区别：

- `Selenium`
  - Logo
    - 
  - 有些网站能检测到是WebDriver，就无法继续爬取了
    - 注：通过 `webdriver` 对浏览器的每一步操作都会留下特殊的痕迹，会被很多网站识别到
      - 规避办法：必须通过重新编译chrome的webdriver才能实现
        - 麻烦得让人想哭
    - 某人评论：Selenium速度慢，现在都改用 `puppeteer` 了
  - 资料
    - 官网
      - SeleniumHQ Browser Automation

        - Python版本
            - PyPI
                - selenium · PyPI
            - 文档
                - Selenium with Python — Selenium Python Bindings 2 documentation
    - `webdriver`
        - 常见
            - Phantomjs
                - 官网
        - 资料
            - selenium-webdriver
    - 优势
        - 历史悠久：2004年发布
            - 目前最主流的浏览器（web页面）自动化工具
        - 支持众多浏览器：`Chrome`、`Firefox`、`Safari`、`IE`、`Opera`等
        - 支持众多编程语言：`Java`、`C#`、`Python`、`Ruby`等
        - 通过`Selenium IDE`支持录制功能
        - 支持测试平台：`Web`、（通过`Appium`）支持移动端
    - 缺点
        - 速度相对(`Puppeteer`)慢一点
        - 安装和设置相对(`Puppeteer`)麻烦一些
        - 不支持跨平台
        - 截图只支持图片
- `Puppeteer`
    - Logo
        - 

    - 发布时间：2017年
    - 开发者：`Google`
    - 目标：简化前端测试(front-end test)和开发
    - 支持浏览器：`Chrome`、`Chromium`
    - 支持语言：`Javascript (Node.js)`
    - 优势
        - 速度相对快一些
        - 安装和设置相对简单

        - 支持跨平台
        - 截图支持图片和PDF
    - 缺点
        - 测试平台只支持：`Web`
    - 相关
        - `pyppeteer`
            - 是什么：`Puppeteer` 的 `python` 的 `binding`
                - Unofficial Python port of puppeteer JavaScript (headless) chrome/chromium browser automation library
            - 好处
                - 可以绕过很多网站对于WebDriver的检测
                - 可以对 `js加密` 降维打击
                    - 完全无视 `js加密` 手段
            - 文档
                - API Reference — Pyppeteer 0.0.25 documentation
            - 官网
                - GitHub
                    - miyakogi/pyppeteer: Headless chrome/chromium automation library (unofficial port of puppeteer)
                    - 注：代码已归档，变只读了
                - pypi
                    - pyppeteer · PyPI

Selenium

详见专门教程：

Selenium知识总结

puppeteer

背景

前端就有了对 `headless` 浏览器的需求，最多的应用场景有两个

1. `UI自动化测试` ： 摆脱手工浏览点击页面确认功能模式
2. `爬虫` ： 解决页面内容异步加载等问题

前端经常使用的莫过于

- `PhantomJS`
  - http://phantomjs.org/
- `selenium + webdriver`
  - http://seleniumhq.github.io/selenium/docs/api/javascript/

但两个库有一个共性：

- 难用
  - 环境安装复杂
  - API 调用不友好

2017 年 Chrome 团队连续放了两个大招

- Headless Chromium
  - https://chromium.googlesource.com/chromium/src/+/lkgr/headless/README.md
- NodeJS API Puppeteer
  - https://github.com/GoogleChrome/puppeteer

-> 直接让 PhantomJS 和 Selenium IDE for Firefox 作者悬宣布没必要继续维护其产品

我们手工可以在浏览器上做的事情 Puppeteer 都能胜任

1. 生成网页截图或者 PDF
2. 爬取大量异步渲染内容的网页，基本就是人肉爬虫
3. 模拟键盘输入、表单自动提交、UI 自动化测试

puppeteer资料

- 官网
  - github
    - puppeteer/puppeteer: Headless Chrome Node.js API
      - https://github.com/puppeteer/puppeteer
  - google

        - Puppeteer | Tools for Web Developers | Google Developers
            - https://developers.google.com/web/tools/puppeteer
- 优势
    - 可以用TypeScript编写测试
    - Devs还可以在运行测试时连接Chrome DevTools

`Python 版 puppeteer：pyppeteer`

`puppeteer` 是基于（NodeJS的） `js` 语言的

对应的Python版本的库是：`pyppeteer`

- PyPI
    - pyppeteer · PyPI
        - https://pypi.org/project/pyppeteer/
- Github
    - 旧版 = miyakogi版
        - miyakogi/pyppeteer: Headless chrome/chromium automation library (unofficial port of puppeteer)
            - https://github.com/miyakogi/pyppeteer
                - 已经archive了
                    - 最后更新：8 May 2020
        - 对应文档
            - API Reference — Pyppeteer 0.0.25 documentation
                - https://miyakogi.github.io/pyppeteer/reference.html
            - Pyppeteer's documentation — Pyppeteer 0.0.25 documentation
                - https://miyakogi.github.io/pyppeteer/index.html
            - pyppeteer.page — Pyppeteer 0.0.25 documentation
                - https://miyakogi.github.io/pyppeteer/_modules/pyppeteer/page.html
    - 新版 = pyppeteer版
        - pyppeteer/pyppeteer: Headless chrome/chromium automation library (unofficial port of puppeteer)
            - https://github.com/pyppeteer/pyppeteer
                - 但是是非官方的
                    - 最后更新：2021 9 Jan
        - 对应文档
            - API Reference — Pyppeteer 0.0.25 documentation
                - https://pyppeteer.github.io/pyppeteer/reference.html

初始化环境

此处介绍如何（在Mac中）初始化 `pyppeteer` 开发环境。

下载和安装 `pyppeteer`

- Mac中安装 `pyppeteer`

```
pip install pyppeteer
```

- 用 `pyppeteer-install` 去下载浏览器内核

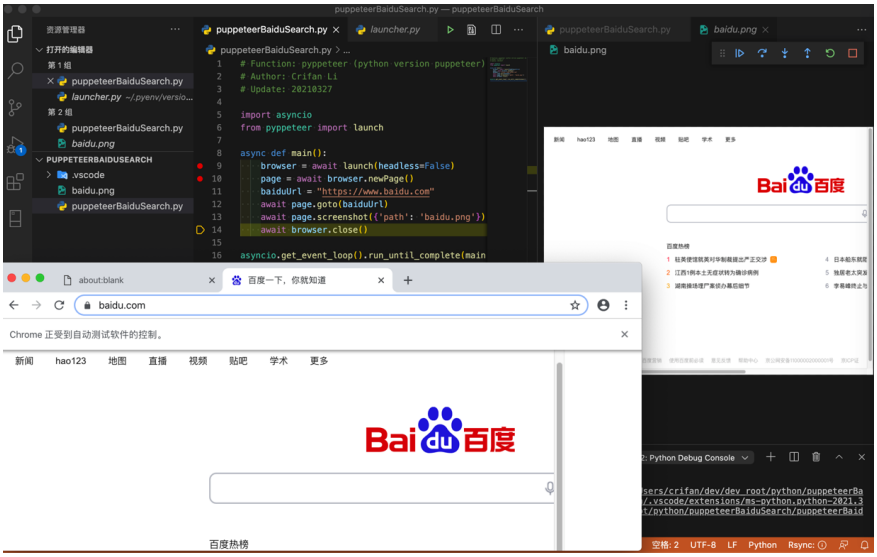
```
pyppeteer-install
```

  - 可以看到下载了chrome
    - 此处位置是：`/Users/crifan/Library/Application Support/pyppeteer/local-chromium/588429`

测试代码

```
import asyncio
from pyppeteer import launch

async def main():
    browser = await launch(headless=False)
    page = await browser.newPage()
    baiduUrl = "https://www.baidu.com"
    await page.goto(baiduUrl)
    await page.screenshot({'path': 'baidu.png'})
    await browser.close()

asyncio.get_event_loop().run_until_complete(main())
```

即可，启动Chromium浏览器，并打开百度，和本地截图：



常见问题

pyppeteer代码正常运行，但没有启动Chrome浏览器

现象：`pyppeteer` 代码

```
browser = await launch()
```

是正常运行了，但是没看到Chrome浏览器启动

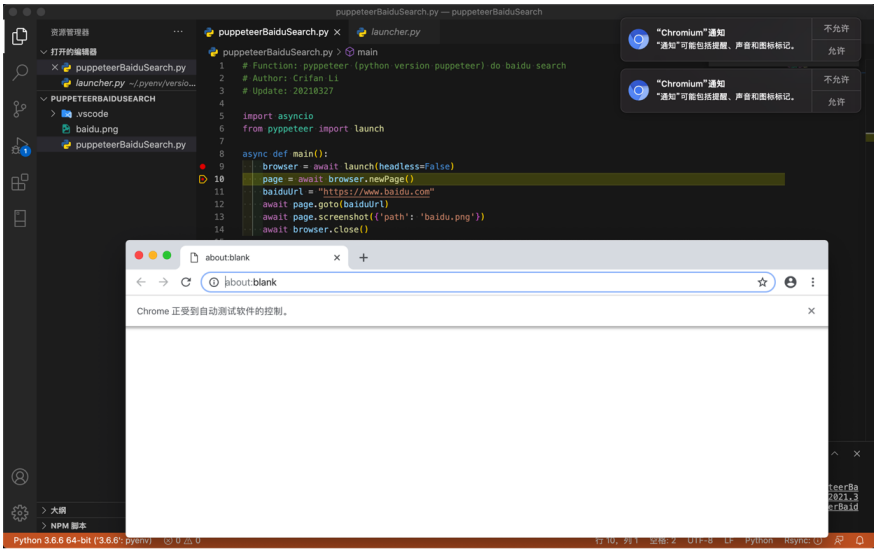
原因：puppeteer（pyppeteer）默认是启动 无头模式，所以内部其实启动了，只是没有界面显示，即看不到Chrome浏览器启动而已。

解决办法：加上参数，取消无头模式

代码：

```
browser = await launch(headless=True)
```

即可看到Chrome浏览器



参数传递方式也可以用dict字典方式

也可以写成dict字典的方式传参

```
browser = await launch({'headless': False})
```

效果是一样的

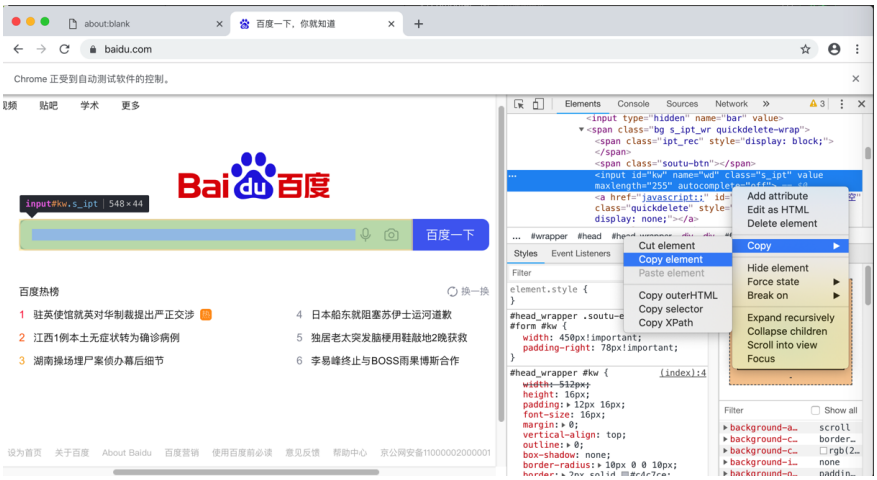
查找定位元素

查找元素相关函数：

- pyppeteer
  - `Page.querySelector()`
    - 别名：`Page.J()`
  - `Page.querySelectorAll()`
    - 别名：`Page.JJ()`
  - `Page.xpath()`
    - 别名：`Page.Jx()`

单个查找 `xpath`

对于页面：



对应html：

```
<input id="kw" name="wd" class="s_ipt" value="" maxlength="
```

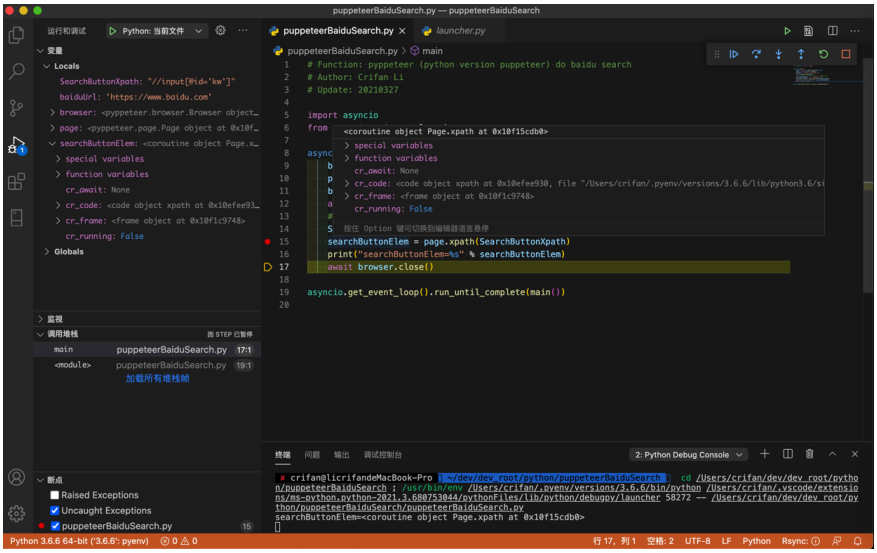
代码：

```
SearchButtonXpath = "//input[@id='kw']"
searchButtonElem = page.xpath(SearchButtonXpath)
print("searchButtonElem=%s" % searchButtonElem)
```

输出：

```
searchButtonElem=<coroutine object Page.xpath at 0x10f15cdb
```

调试效果：



批量查找 querySelectorAll

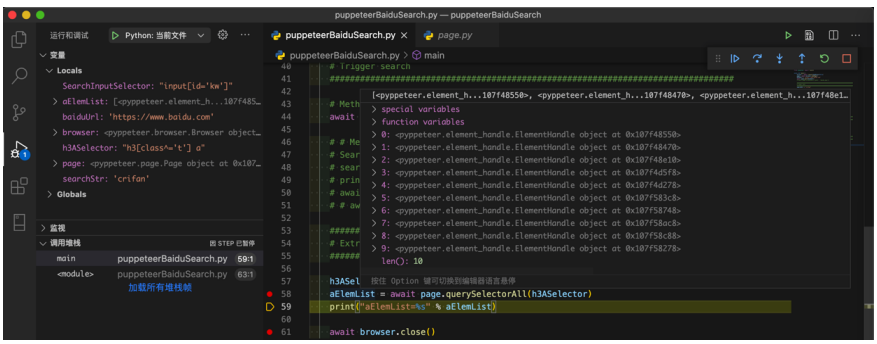
对于html

```
<h3 class="t"><a data-click="{
    'F':'778317EA',
    'F1':'9D73F1E4',
    'F2':'4CA6DE6B',
    'F3':'54E5243F',
    'T':'1616767238',
        'y':'EFBCEFBE'
            }" href="https://www.baidu.com/link?url=nDSbU9
```

想要查找=定位（所有的）元素 a

```
    h3ASelector = "h3[class^='t'] a"
    aElemList = await page.querySelectorAll(h3ASelector)
    print("aElemList=%s" % aElemList)
```

即可找到元素：



输入文字

TODO：

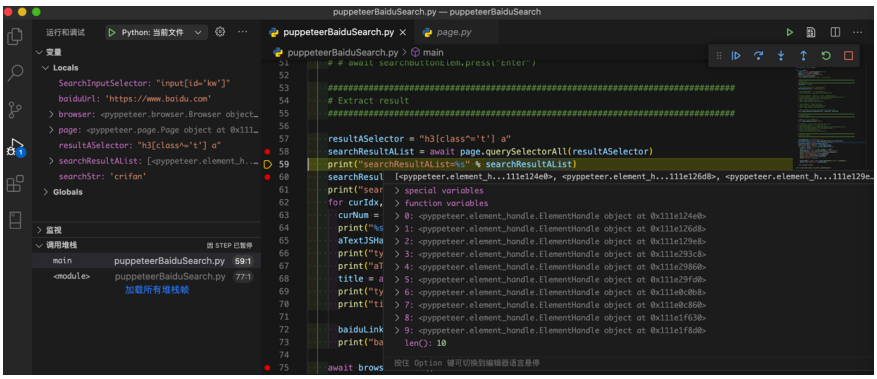
【已解决】pyppeteer如何给输入框中输入文字

等待元素出现

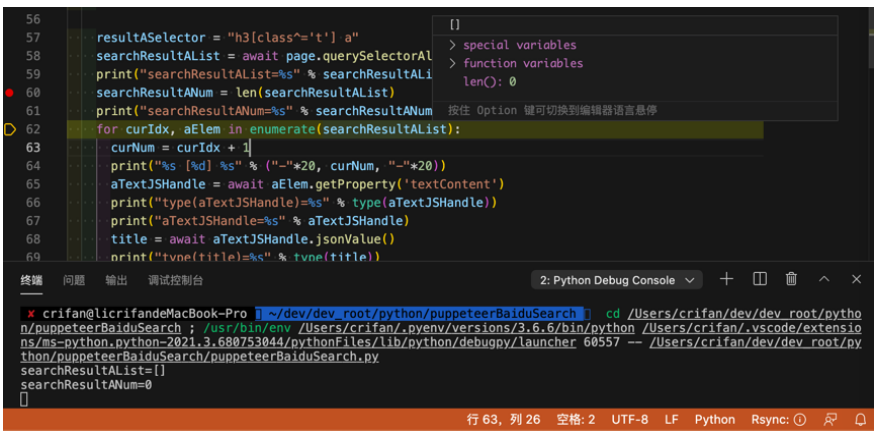
现象：代码：

```
resultASelector = "h3[class^='t'] a"
searchResultAList = await page.querySelectorAll(resultA
```

调试时可以正常运行，可以找到元素：



直接运行时，却找不到元素了：



原因：页面重新加载了，但是内容还没显示出来。所以找不到元素。

解决办法：等待页面加载完毕。再去查找元素，就可以找到了。

如何确保页面加载完毕?

核心逻辑：找到页面加载完毕，一定会显示（出现）的元素，去等待其出现，即可。

此处，百度搜索后，一定会出现（显示）的元素是：

```
<span class="nums_text">百度为您找到相关结果约2,370,000个</spar
```

对应等待元素出现的代码是：

```
    SearchFoundWordsSelector = 'span.nums_text'
    SearchFoundWordsXpath = "//span[@class='nums_text']"

    # Method 2: wait element showing
    SingleWaitSeconds = 1
    while not await page.querySelector(SearchFoundWordsSele
      print("Still not found %s, wait %s seconds" % (Searc
      await asyncio.sleep(SingleWaitSeconds)
```

waitFor系列的所有函数都无效

经过实际测试， `waitFor` 系列的各个函数，此处都无效

```
    # await page.waitForSelector(SearchFoundWordsSelector)
    # await page.waitFor(SearchFoundWordsSelector)
    # await page.waitForXPath(SearchFoundWordsXpath)
    # Note: all above exception: 发生异常: ElementHandleErro
```

都会报错： `ElementHandleError Evaluation failed: TypeError: MutationObserver is not a constructor`

获取元素属性

获取元素属性可以用：`someElement.getProperty('propertyName')`

举例：

```
<h3 class="t"><a data-click="{
    'F':'778317EA',
    'F1':'9D73F1E4',
    'F2':'4CA6DE6B',
    'F3':'54E5243F',
    'T':'1616767238',
        'y':'EFBCEFBE'
            }" href="https://www.baidu.com/link?url=nDSbU9
```

中的 `a` 元素中的 `href` 和文本值

对于已经找到元素的列表：

```
    resultASelector = "h3[class^='t'] a"
    searchResultAList = await page.querySelectorAll(resultA
    # print("searchResultAList=%s" % searchResultAList)
    searchResultANum = len(searchResultAList)
    print("Found %s search result:" % searchResultANum)
```

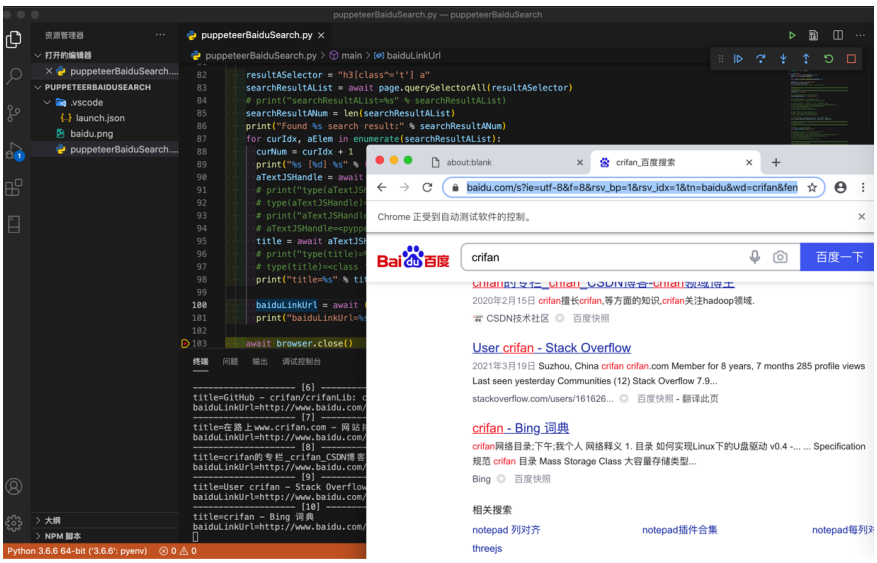
后去获取文本值 `text` 和属性值 `href`：

```
    for curIdx, aElem in enumerate(searchResultAList):
      curNum = curIdx + 1
      print("%s [%d] %s" % ("-"*20, curNum, "-"*20))
      aTextJSHandle = await aElem.getProperty('textContent
      # print("type(aTextJSHandle)=%s" % type(aTextJSHandle
      # type(aTextJSHandle)=<class 'pyppeteer.execution_cor
      # print("aTextJSHandle=%s" % aTextJSHandle)
      # aTextJSHandle=<pyppeteer.execution_context.JSHandle
      title = await aTextJSHandle.jsonValue()
      # print("type(title)=%s" % type(title))
      # type(title)=<class 'str'>
      print("title=%s" % title)

      baiduLinkUrl = await (await aElem.getProperty("href"
      print("baiduLinkUrl=%s" % baiduLinkUrl)
```

输出：

```
Found 10 search result:
-------------------- [1] --------------------
title=在路上on the way - 走别人没走过的路,让别人有路可走
baiduLinkUrl=http://www.baidu.com/link?url=eGTzEXXlMw-hnvX
-------------------- [2] --------------------
title=crifan - 在路上
baiduLinkUrl=http://www.baidu.com/link?url=l6jXejlgARrWj34
...
```

效果：



Playwright

- `Playwright`
  - 一句话简介：微软开源`Python`自动化神器`Playwright`
    - 微软新出的`Python`库
      - 仅用一个API即可自动执行`Chromium`、`Firefox`、`WebKit`等主流浏览器自动化操作

安装

- 安装playwright库
  - `pip install playwright`
- 安装浏览器驱动文件（安装过程稍微有点慢）
  - `python -m playwright install`

移动端

详见专门教程：

移动端自动化测试概览

Android

uiautomator2

详见专门教程：

安卓自动化测试利器：uiautomator2

iOS

facebook-wda

详见专门教程：

iOS自动化测试利器：facebook-wda

附录

下面列出相关参考资料。

参考资料

- 【未解决】Mac中用facebook-wda自动操作安卓手机浏览器实现百度搜索
- 【已解决】pyppeteer中提取百度搜索结果中的信息
- 【已解决】pyppeteer中page.querySelectorAll运行时无法获取到结果
- 【规避解决】pyppeteer不调试直接运行waitForSelector报错：ElementHandleError Evaluation failed TypeError MutationObserver is not a constructor at pollMutation
- 【已解决】Mac中初始化搭建Python版puppeteer的pyppeteer的开发环境
- 【已解决】pyppeteer如何给输入框中输入文字
-
- 网络爬虫之使用pyppeteer替代selenium完美绕过webdriver检测 阅读目录 - 知乎
- 爬虫神器pyppeteer，对 js 加密降维打击 - 掘金
- pyppeteer(python版puppeteer)基本使用 - 白灰 - 博客园
- Selenium 凭什么成为 Web 自动化测试的首选？（内附图谱）| 极客时间
- 为什么puppeteer比selenium好? - 掘金
- Selenium vs Puppeteer: testing the testing tools
- Selenium vs. Puppeteer for Test Automation: Is a New Leader Emerging? - Flood
- Selenium vs. Puppeteer - When to Choose What? | TestProject
- Puppeteer: 更友好的 Headless Chrome Node API - 知乎
- 微软开源 Python 自动化神器 Playwright - 知乎
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