Guide to Jupyter

January 6, 2025

1 Jupyter Lab

1.1 A Quick Start Guide

Welcome to the wonderful world of Jupyter lab!
This is a Data Science playground where you can easily write code and investigate the results. It's an ideal environment for:
- Research & Development - Prototyping - Learning (that's us!)

It's not typically used for shipping production code, and in Week 8 we'll explore the bridge between Jupyter and python code.

A file in Jupyter Lab, like this one, is called a **Notebook**.

A long time ago, Jupyter used to be called "IPython", and so the extensions of notebooks are ".ipynb" which stands for "IPython Notebook".

On the left is a File Browser that lets you navigate around the directories and choose different notebooks. But you probably know that already, or you wouldn't have got here!

The notebook consists of a series of square boxes called "cells". Some of them contain text, like this cell, and some of them contain code, like the cell below.

Click in a cell with code and press `Shift + Return` (or `Shift + Enter`) to run the code and print the output.

Do that now for the cell below this:

[1]:
```
# Click anywhere in this cell and press Shift + Return

2 + 2
```

[1]: 4

1.2 Congrats!

Now run the next cell which sets a value, followed by the cells after it to print the value

[2]:
```
# Set a value for a variable

favorite_fruit = "bananas"
```

[3]:
```
# The result of the last statement is shown after you run it

favorite_fruit
```

[3]:
```
'bananas'
```

[4]:
```
# Use the variable

print(f"My favorite fruit is {favorite_fruit}")
```

```
My favorite fruit is bananas
```

[5]:
```
# Now change the variable

favorite_fruit = f"anything but {favorite_fruit}"
```

1.3 Now go back and rerun the cell with the print statement, two cells back

See how it prints something different, even though favorite_fruit was changed further down in the notebook?

The order that code appears in the notebook doesn't matter. What matters is the order that the code is **executed**. There's a python process sitting behind this notebook in which the variables are being changed.

This catches some people out when they first use Jupyter.

[6]:
```
# Then run this cell twice, and see if you understand what's going on

print(f"My favorite fruit is {favorite_fruit}")

favorite_fruit = "apples"
```

```
My favorite fruit is anything but bananas
```

2 Explaining the 'kernel'

Sitting behind this notebook is a Python process which executes each cell when you run it. That Python process is known as the Kernel. Each notebook has its own separate Kernel.

You can go to the Kernel menu and select "Restart Kernel".

If you then try to run the next cell, you'll get an error, because favorite_fruit is no longer defined. You'll need to run the cells from the top of the notebook again. Then the next cell should run fine.

[7]:
```
print(f"My favorite fruit is {favorite_fruit}")
```

```
My favorite fruit is apples
```

3 Adding and moving cells

Click in this cell, then click the [+] button in the toolbar above to create a new cell immediately below this one. Copy and paste in the code in the prior cell, then run it! There are also icons in the top right of the selected cell to delete it (bin), duplicate it, and move it up and down.

[8]:
```
print(f"My favorite fruit is {favorite_fruit}")
```

```
My favorite fruit is apples
```

4 Cell output

When you execute a cell, the standard output and the result of the last statement is written to the area immediately under the code, known as the 'cell output'. When you save a Notebook from the file menu (or command+S), the output is also saved, making it a useful record of what happened.

You can clean this up by going to Edit menu » Clear Outputs of All Cells, or Kernel menu » Restart Kernel and Clear Outputs of All Cells.

[9]:
```
spams = ["spam"] * 1000
print(spams)

# Might be worth clearing output after running this!
```

```
['spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam',
'spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam',
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'spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam', 'spam']
```

5 Using markdown

So what's going on with these areas with writing in them, like this one? Well, there's actually a different kind of cell called a 'Markdown' cell for adding explanations like this. Click the + button to add a cell. Then in the toolbar, click where it says 'Code' and change it to 'Markdown'.

Add some comments using Markdown format, perhaps copying and pasting from here:

```
# This is a heading
## This is a sub-head
### And a sub-sub-head

I like Jupyter Lab because it's
- Easy
- Flexible
- Satisfying
```

And to turn this into formatted text simply with Shift+Return in the cell. Click in the cell and press the Bin icon if you want to remove it.

6 This is a heading

6.1 This is a sub-head

6.1.1 And a sub-sub-head

I like Jupyter Lab because it's - Easy - Flexible - Satisfying

7 The exclamation point

There's a super useful feature of jupyter labs; you can type a command with a ! in front of it in a code cell, like:

!pip install [some_package]

And it will run it at the command line (as if in Windows Powershell or Mac Terminal) and print the result

[10]:
```
# list the current directory

!ls
```

```
Guide to Jupyter.ipynb    day1.ipynb                diagnostics.py
Intermediate Python.ipynb day1.pdf                  solutions
Intermediate Python.pdf   day2 EXERCISE.ipynb      troubleshooting.ipynb
__pycache__               day2 EXERCISE.pdf         week1
EXERCISE.ipynb
community-contributions   day5.ipynb
```

[11]:
```
# ping cnn.com - press the stop button in the toolbar when you're bored

!ping cnn.com
```

```
PING cnn.com (151.101.3.5): 56 data bytes
64 bytes from 151.101.3.5: icmp_seq=0 ttl=59 time=43.258 ms
64 bytes from 151.101.3.5: icmp_seq=1 ttl=59 time=31.617 ms
64 bytes from 151.101.3.5: icmp_seq=2 ttl=59 time=47.386 ms
64 bytes from 151.101.3.5: icmp_seq=3 ttl=59 time=44.576 ms
64 bytes from 151.101.3.5: icmp_seq=4 ttl=59 time=30.427 ms
64 bytes from 151.101.3.5: icmp_seq=5 ttl=59 time=36.231 ms
64 bytes from 151.101.3.5: icmp_seq=6 ttl=59 time=39.758 ms
^C

--- cnn.com ping statistics ---
7 packets transmitted, 7 packets received, 0.0% packet loss
round-trip min/avg/max/stddev = 30.427/39.036/47.386/6.045 ms
```

[ ]:
```
# This is a useful command that ensures your Anaconda environment
# is up to date with any new upgrades to packages;
# But it might take a minute and will print a lot to output
```

```
!conda env update -f ../environment.yml --prune
```

8 Minor things we encounter on the course

This isn't necessarily a feature of Jupyter, but it's a nice package to know about that is useful in Jupyter Labs, and I use it in the course.

The package `tqdm` will print a nice progress bar if you wrap any iterable.

[12]:
```
# Here's some code with no progress bar
# It will take 10 seconds while you wonder what's happpening..

import time

spams = ["spam"] * 1000

for spam in spams:
    time.sleep(0.01)
```

[13]:
```
# And now, with a nice little progress bar:

import time
from tqdm import tqdm

spams = ["spam"] * 1000

for spam in tqdm(spams):
    time.sleep(0.01)
```

```
100%|
                                    | 1000/1000
[00:10<00:00, 94.53it/s]
```

[14]:
```
# On a different topic, here's a useful way to print output in markdown

from IPython.display import Markdown, display

display(Markdown("# This is a big heading!\n\n- And this is a bullet-point\n-␣
 ↪So is this\n- Me, too!"))
```

9 This is a big heading!

- And this is a bullet-point
- So is this
- Me, too!

10 That's it! You're up to speed on Jupyter Lab.

10.1 Want to be even more advanced?

If you want to become a pro at Jupyter Lab, you can read their tutorial here. But this isn't required for our course; just a good technique for hitting Shift + Return and enjoying the result!