Welcome to Foundations of Python

Hamish Gibbs

Introduction

UCL Social Data Institute: Foundations of Python

Course aims

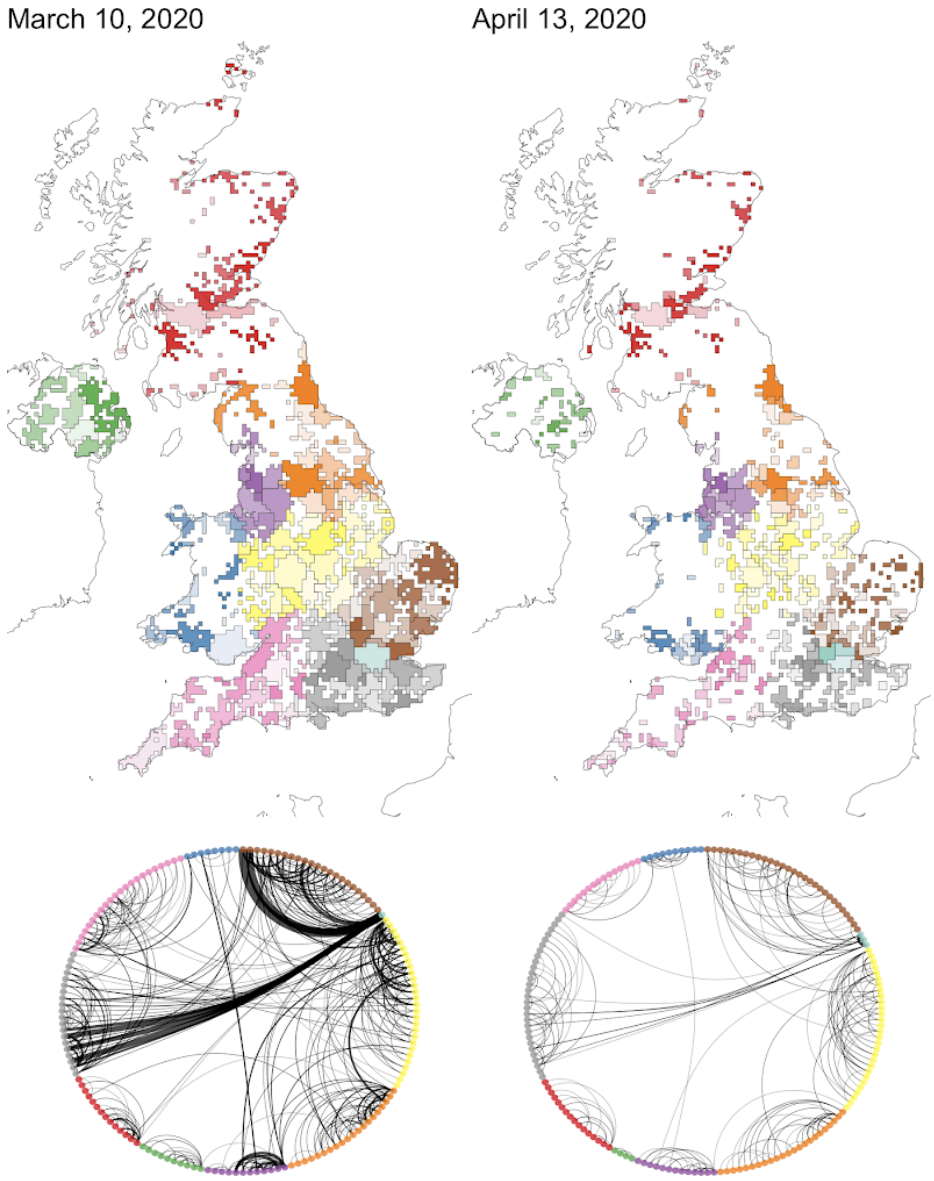
- A foundation in Python programming.
  - *Variables, data structures, control logic, functions, classes.*
- An Introduction to popular Python tools for data science.
  - *pandas, matplotlib, sklearn.*
- *Side quest:* Collaboration tools.
  - *git, GitHub*
- A hands-on data science challenge.
  - Predicting the price of AirBnBs in London.

About you

- Programming experience?
- Statistics experience?
- Any installation problems?

About me

- Final year PhD student
  - *Supervised by James Cheshire*
- My research interests:
  - *Human mobility, disease transmission, bias & uncertainty*
- Python experience:
  - *9 years*



Course format

- *This is a short course!*
- Days 1 – 3: lectures and practicals.
  - Practical sessions rely on existing Python tutorials.
  - Once you have worked through a practical, try to play around with the concepts it introduces until you *“get it”*.
- Day 4: Working together on a collaborative challenge.

Schedule

- **Day 1:** Python basics.
  - Variables, data structures (`list`, `dict`), control logic (`if`, `for`, `while`).
- **Day 2:** Abstraction & composition.
  - Functions (`def`), Classes (`class`).
  - *Also:* Using `.py` files, not `.ipynb`.

Schedule

- **Day 3:** Python data science.
  - `pandas`, `numpy`, `matplotlib`.
  - *Also:* Collaboration with `git` and GitHub.
- **Day 4:** Challenge: regression analysis.
  - Predicting the price of London AirBnBs using Inside AirBnB data.

Learning python

Source: Sarah's Scribbles

Learning python

- Practice is the most important ingredient to becoming a good programmer.
- It is easier to “practice” if you find *personally compelling* reasons to use Python.
  - Coursework, side projects, random curiosity, automating things in your life.
- Programming is all about trial and error.

AI

- New AI programming assistants:
  - *Chat GPT, GitHub Copilot, Copilot Chat.*
- I recommend using them all, especially as a study aid.
  - **Bad idea:** Using AI to *generate* code you can't understand.
  - **Good idea:** Using AI to *explain* code you can't understand.

Any questions?

Basic data types

Integer

```r
as.integer(10) # R
```

```python
int(10) # Python
```

Float

```r
as.numeric(10.3) # R
```

```python
float(10.3) # Python
```

String

```r
as.character("Hello") # R
```

```python
str("Hello") # Python
```

Type checking

```r
class("Hello") # R
```

```python
type("Hello") # Python
```

Tutorial #1: Variables

- Variables, expressions, and statements
- Core concepts:
  - Variable assignment and basic math

```
minute = 20
minute + 32
```

  - Working with strings

```
first = '100'
second = '150'
print(first + second)
```

  - Sub setting strings

```
word = 'Python'
word[0]
```

Tutorial #2: Lists

- An informal introduction to python §3.1.3
- Core concepts:
  - List indexing

```
squares = [1, 4, 9, 16, 25]
squares[0]
```

  - List manipulation

```
squares + [36, 49, 64, 81, 100]
squares.append(10)
```

  - List mutability

```
rgb = ["Red", "Green", "Blue"]
rgba = rgb
id(rgb) == id(rgba)  # they reference the same object
```

One more data structure: tuples

- A `tuple` is an immutable collection of values.

```
1 coord = (0, 1) # a single tuple
2 coords = [coord, coord] # a list of tuples
```

- Unlike a `list`, the values in a `tuple` cannot be changed.
  - This means no `.append()` or `.sort()` methods (which both change the values in a `list`).
- Tuples are faster than lists and good when you have a collection of values that won't have to change once it has been created.

Just one more data structure: set

- A `set` is an unordered collection with no duplicate elements.

```
1 set1 = {0, 1} # a set
2 set2 = set([0, 1]) # creating a set from a list
```

- A `set` is mutable (its values can be changed).
- It is very quick to check if an element is in a `set`:

```
1 1 in {0, 1} # I'm faster!
2 1 in [0, 1]
```

  - This doesn't matter for a collection of 2 values, but matters a lot for larger collections.

Tutorial #3: Dictionaries

- Dictionaries §1
  - *To start, only work on the first section of this tutorial!*
  - *If you "get it," try some of the exercises in Tutorial #1, or move on to this afternoon's tutorials.*
- Core concepts:
  - The `{key: value}` format of dictionaries

```
1 eng2sp = dict()
2 eng2sp['one'] = 'uno'
3 eng2sp['one']
```

  - The `.items()`, `.keys()`, and `.values()` methods

Using Python

- Interactive shell

```
1 >>> print("Hello")
2 Hello
```

  - *Clunky, ephemeral, hard to use for anything 'real'.*

- Google Colab
  - Google-hosted version of a Jupyter Notebook
  - *A very easy way to start!*
- Visual Studio Code
  - A "serious" integrated development environment.
  - *Good for larger projects, collaboration.*

Setting up Colab

- Does everyone have a Google account?
- Go to colab.research.google.com.
- Open a new notebook.

- Rename your notebook.
- Get started!