Comparative Computing

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R, Python, Stata, and the shell

Winter Institute in Data Science and Big Data

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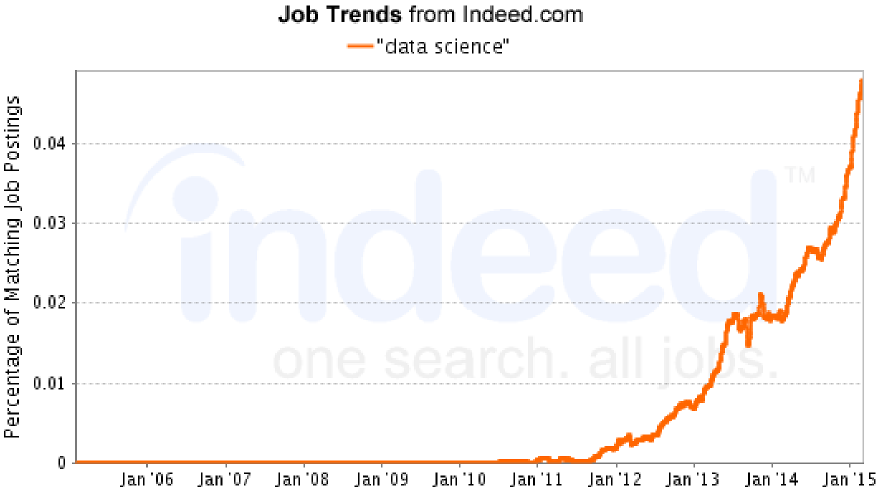
“Data scientist: The sexiest job of the 21st century”



Source: https://hbr.org/2012/10/data-scientist-the-sexiest-job-of-the-21st-century

But what programming language to use?

- Widely spread in academia: `Stata`
- `R` and `Python`
- Often neglected add-on: The `shell`

Stata

- Proprietary (and expensive – \$179/year for single student license)
- No choice of IDE
- Not really used in data science
- Nonetheless: What does it look like?
- Why no love for `Stata`?
  - Hard to analyse multiple datasets
  - Only most expensive versions work with large datasets
  - Limited resources/functionalities (e.g. predictive modelling, web scraping)
  - Not consistent with computer science programming (point-and-click)
  - Not open source
- "Data scientists rely on `Stata` because of its strong programming capabilities, reproducibility, extensibility, and interoperability"

Which leaves us with . . .

R: Lingua franca of statistics

Open-source
For statistical analyses
Academics, researchers, data scientists
Huge support community
1000s of packages (`CRAN`, `GitHub`)
Outstanding visualization
Advanced reporting (`Markdown`)

Can be slow
Steep learning curve
Finding right packages can take time
One IDE: `RStudio`

Source: https://www.datacamp.com/community/tutorials/r-or-python-for-data-analysis

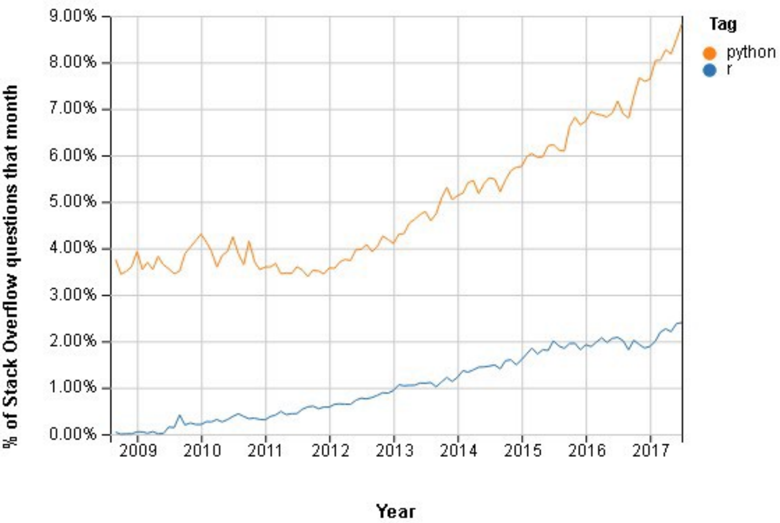
Python: Multi-purpose language

Open-source
For productivity and code readability
Programmers, developers, engineers
Huge support community
100,000s of packages (PyPI)
Moderate learning curve
Fast
Advanced deep/machine learning
Several IDEs: `Spyder`, `Jupyter`, `Rodeo`

Convoluted static visualization
Few(er) data science packages
Finding right packages can take time
Syntax changes between `Python` 2 and 3

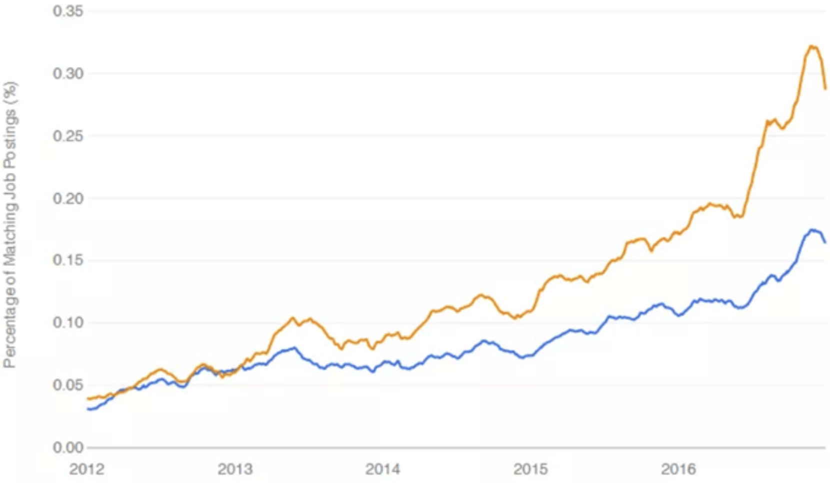
Source: https://www.datacamp.com/community/tutorials/r-or-python-for-data-analysis

Popularity



Source: https://dzone.com/articles/r-or-python-data-scientists-delight

Jobs



Source: https://www.guru99.com/r-vs-python.html

Application

- Fit logistic regression, predict flower species based on measured features

Application

- Bootstrapping: Randomly resample 100,000 times from a population

Application

- File loading (4.8 GB)

```r
library(tidyverse)
start_time <- Sys.time()
df <- read_csv("file_loading/library-collection-inventory.csv")
end_time <- Sys.time()
end_time - start_time
# Time difference of 6.814214 mins
```

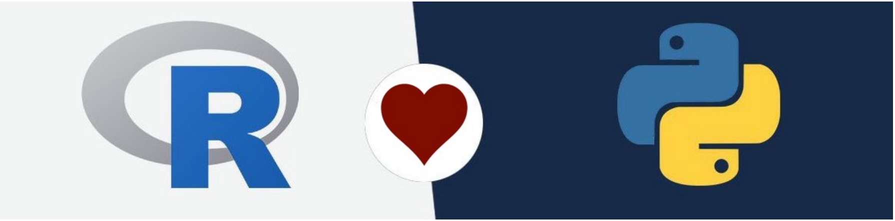
```python
import time
import pandas as pd
start = time.time()
y1 = pd.read_csv('file_loading/library-collection-inventory.csv')
end = time.time()
print("Time difference of " + str(end - start) + " seconds")
# Time difference of 130.32760381698608 seconds
```

And the winner is . . .

. . . there isn't one

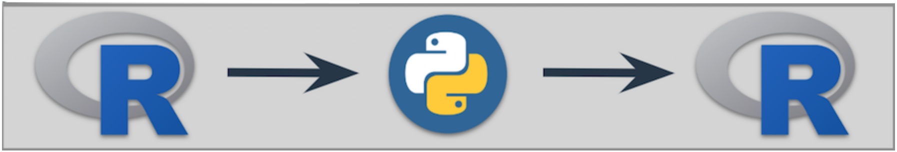
- One language isn't better than the other
- Both have pros and cons
- It all depends on what you need it for
    - What problems do you want to solve?
    - Which language do you have support for?
    - What are the net costs of learning the language?
- Researcher/Data Scientist? → `R`
- Developer/Programmer? → `Python`
- Best solution?

Use both!



Interwoven code: Machine learning

- Application: Build a random forest model that predicts wine quality
  - R for exploration because of tidyverse efficiency
  - Python for machine learning because of sklearn pipeline capability
  - R for visualization because of Markdown and ggplot2



Adapted from: https://www.business-science.io/business/2018/10/08/python-and-r.html

Add-on: the `shell`

- Open-source
- Around since the dawn of computers (more or less)
- Hugely beneficial
  - Remote machines
  - Cloud computing
  - Scripts that run for a long time