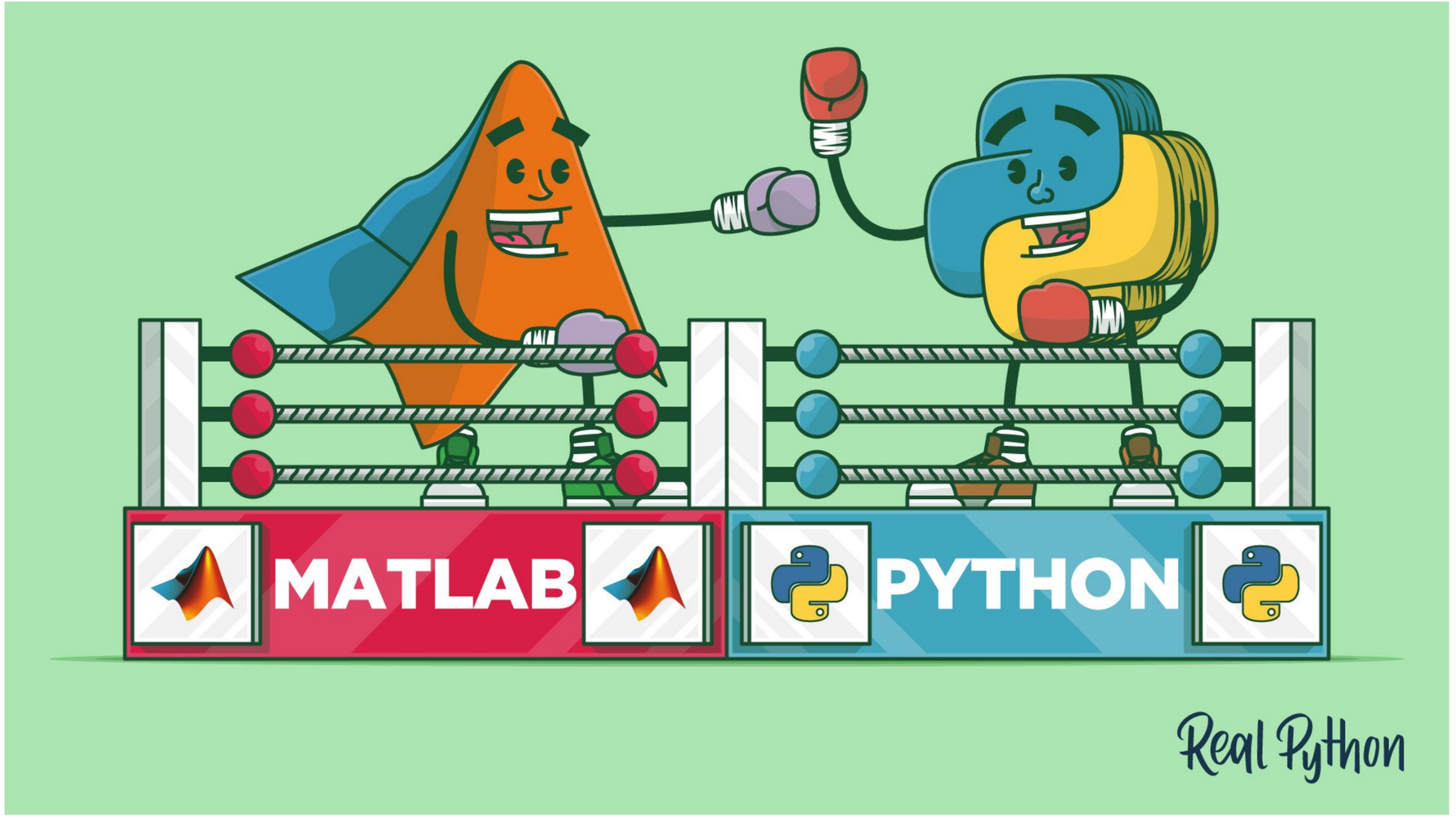
Remarks on other programming languages

Lecture 12



MARN-5895, Fall 2021

Let’s install R

(The installation may take several minutes.)

R

- The **good**: R language is a free and open source language (a counterpart to the commercial S language) specialized for statistical calculations and plots; it is widely used in the social sciences and some areas of biological sciences.

- The **not so good**: R is less suitable than Python/Matlab for general computing, especially in geoscience/oceanography applications; its syntax can be hard to understand at first.

- **Workaround**: statistical capabilities of R can be accessed from Python using the interface module Rpy2.

Matlab

- The **good:** Matrix is a native data-type, so the syntax is friendly to linear algebra calculations. Some functions are highly optimized, which can save programming and computing time. Excellent signal processing and simulation capabilities (Simulink).

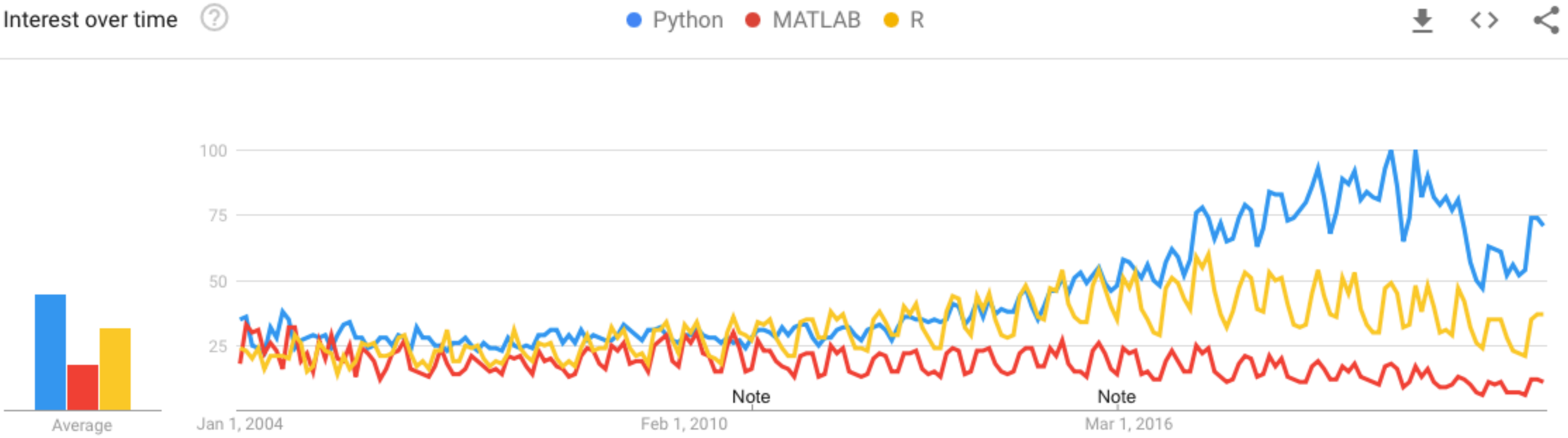
- The **bad**: Matlab is proprietary, closed-source software. You need to buy a costly license and cannot see/change critical functions. Hard to access datasets directly from the Web. Memory management isn't optimal. Matlab syntax is prone to sloppy coding practices.

- The **in-between**: good toolboxes for oceanographic research are available; some oceanographic labs/groups still use Matlab as their primary language.

Why Python?

- In general, Python is fundamentally a better programming language than Matlab, R and Julia.
- It’s a multi-purpose language, with a beautiful native syntax that keeps code clean and organized.
- It wraps well compiled code written in C and Fortran.
- Python is free and and open source software, which is especially important for research applications.
- Its oceanographic and geosciences applications have matured.
- The scientific Python “ecosystem” is dynamic and friendly.

Interest over time related to science/research as measured by Web searches (in millions/month) from US IP addresses



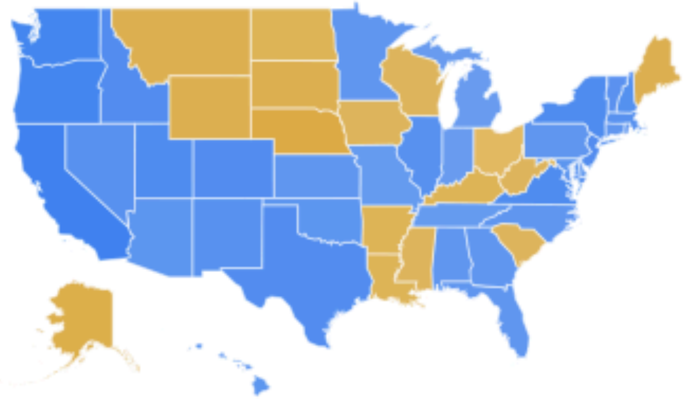
From Google Trends

Breakdown by state

Compared breakdown by subregion

Subregion

Python MATLAB R



Color intensity represents percentage of searches LEARN MORE

Sort: Interest for Python

1	California	
2	Washington	
3	Oregon	
4	Virginia	
5	Utah	

Showing 1-5 of 51 subregions

Connecticut

Python	44%
MATLAB	15%
R	41%

Percentages calculated out of searches for all 3 terms in Connecticut

Final thoughts

- I started coding in Visual Basic, then transitioned to C and C++ in high school and early college, then learned Fortran in my first internship, then began using Matlab sophomore year in college.
- My Master's thesis (2011-2013) was done fully in Matlab.
- I've used Python almost exclusively since I started my PhD in 2013, but I'm now eying two emerging languages: **Julia** and **Rust**.
- **The bottom line:** programming languages come and go**. Learning computational thinking** helps in the transition to a new language.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ACTUALLY, THIS IS JUST THE BEGINNING
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