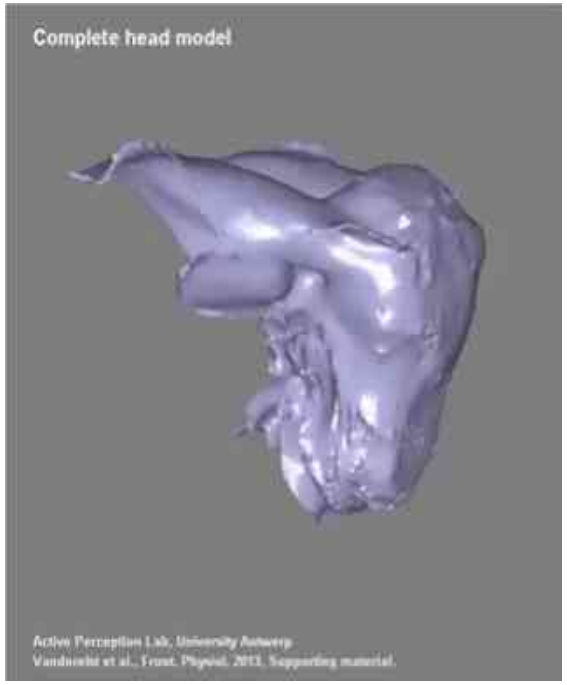
Programming for behavioral scientists

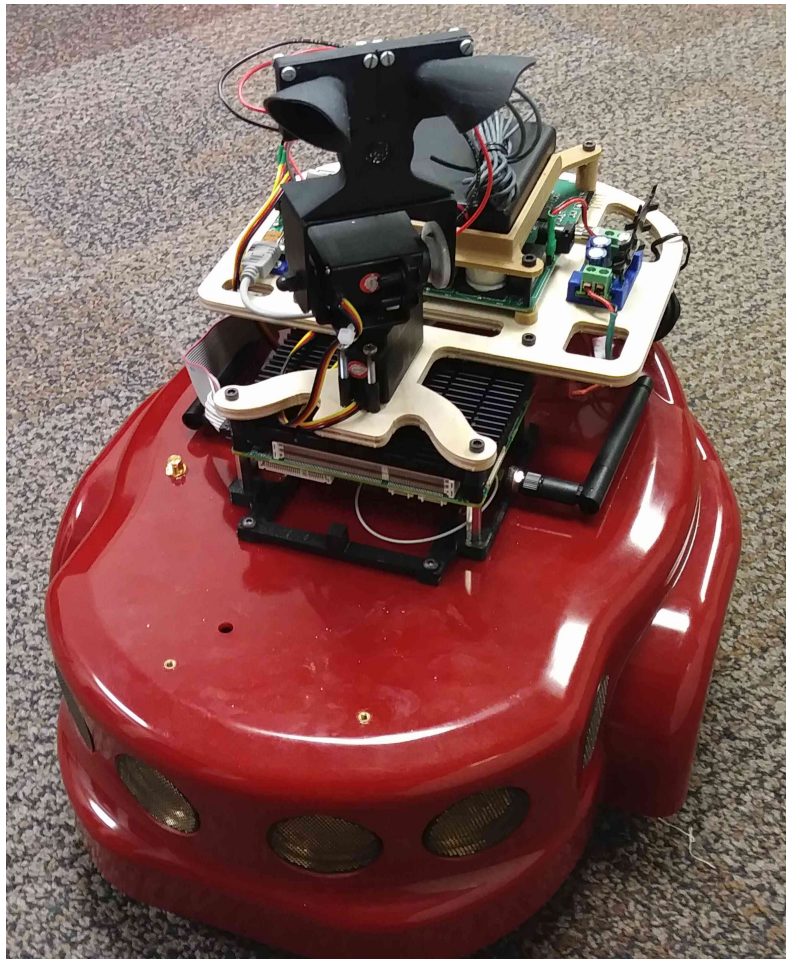
About me

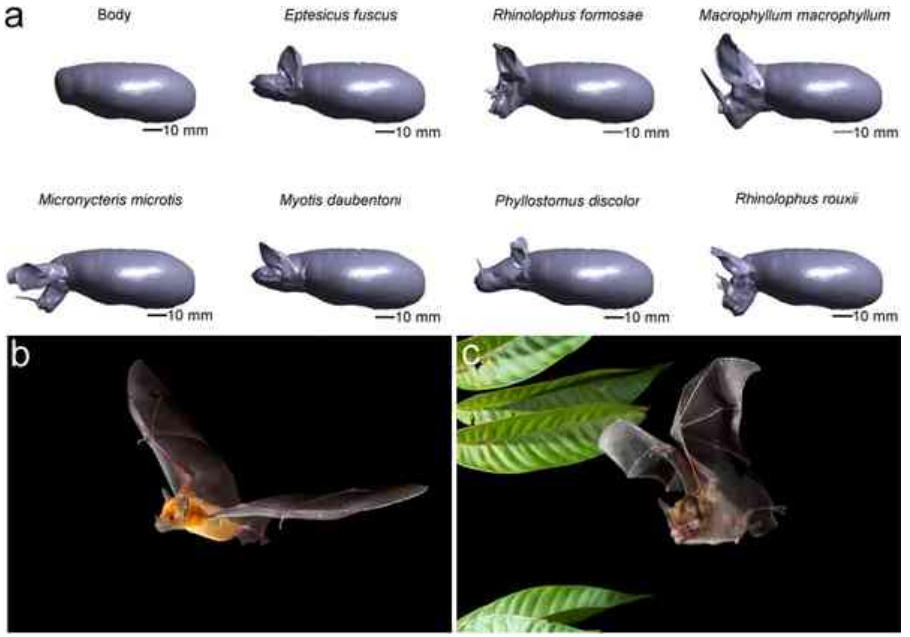
- Education
  - Msc Experimental psychology
  - Msc Artificial intelligence
- Phd models of bat echolocation in engineering lab
- PostDoc Dept. Biology, University of Bristol
- Bristol Robotics Lab
- Started at UC in 2016

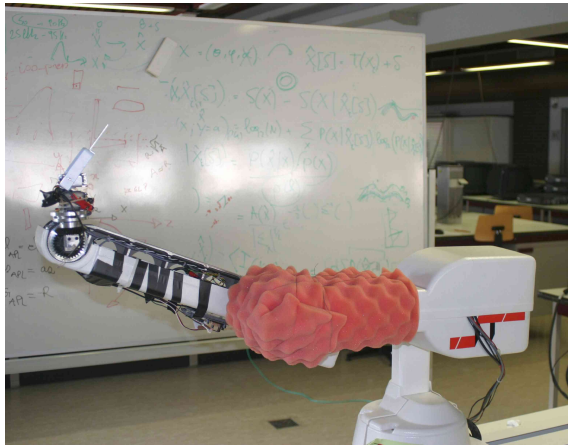
Sonar behavior in bats

Methods


Complete head model
Active Perception Lab, University Antwerp




a
Body
Eptesicus fuscus
Rhinolophus formosae
Macrophyllum macrophyllum
Micronycteris microtis
Myotis daubentoni
Phyllostomus discolor
Rhinolophus rouxii
10 mm
b
c



About you

- Biochemistry/Psychology - BS 1
- Biological Sciences - BS 1
- CECH Baccalaureate - 1
- Criminal Justice 1
- Neuroscience - BS 2
- Neuroscience - BS/Psychology - BS 1
- Political Science/Psychology - BS 1
- Psychology 1
- Psychology - BA 1
- Psychology - BS 31
- UCBA Associate - 1

- Please reach out if you have suggestions/ideas for improving the course. See also later.

PYTHON

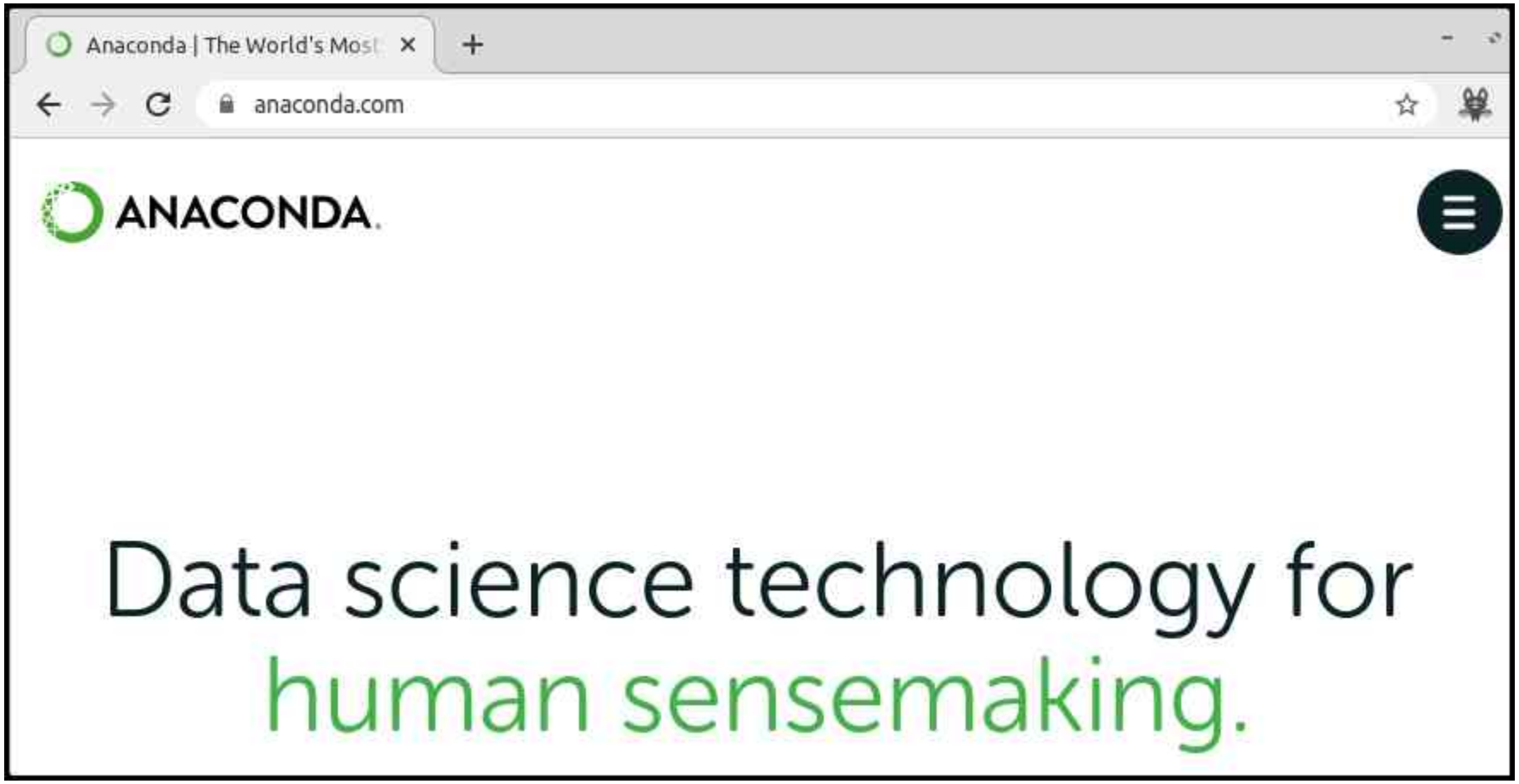
Installing Python

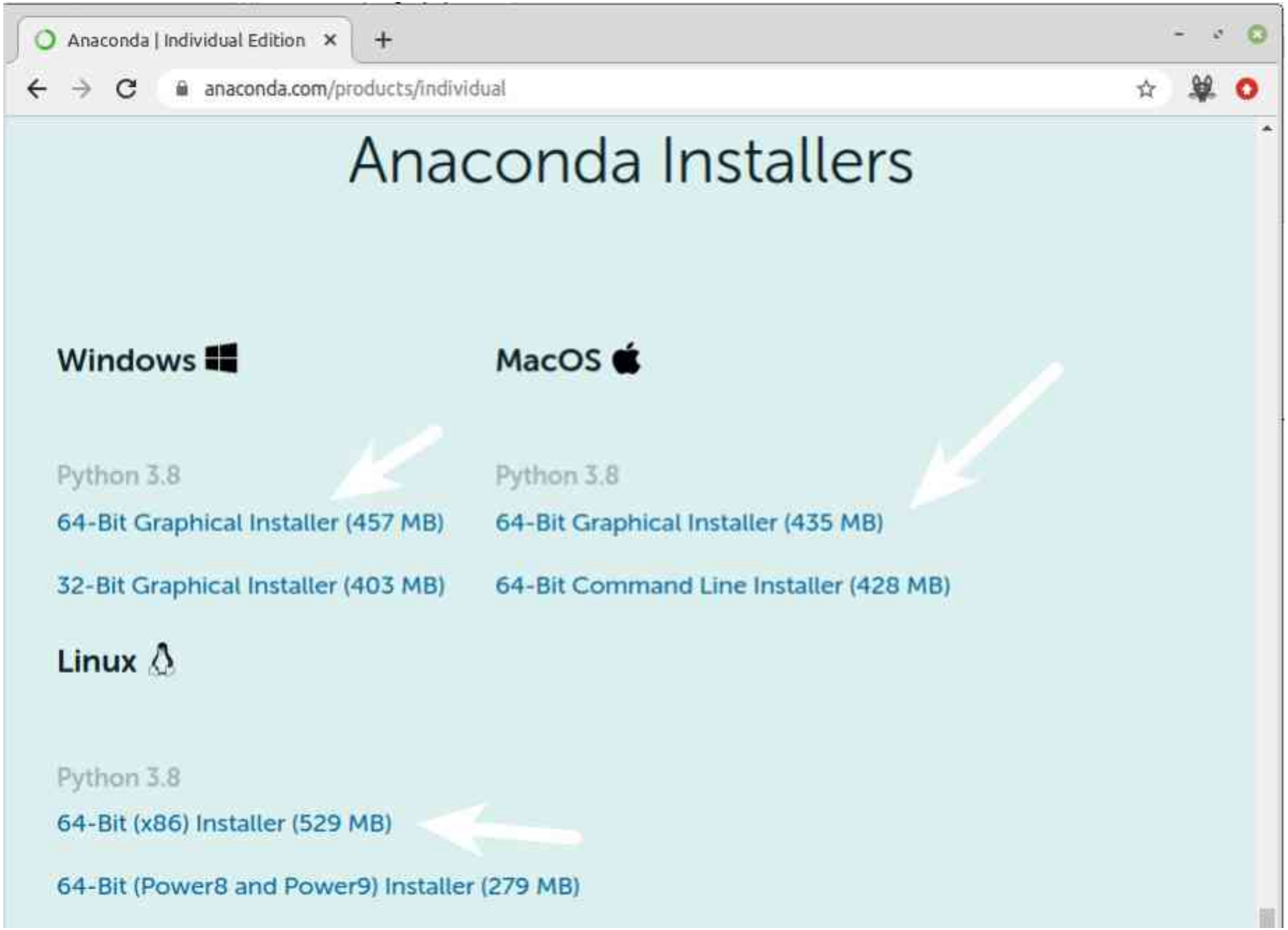
- Mac/Linux: Python might already be installed.
- However, you should still install a ‘user version’ of Python

- The Python website:

Anaconda Python

- Python + scientific packages + package management software




Anaconda | Individual Edition
anaconda.com/products/individual
Anaconda Installers
Windows
Python 3.8
64-Bit Graphical Installer (457 MB)
32-Bit Graphical Installer (403 MB)
MacOS
Python 3.8
64-Bit Graphical Installer (435 MB)
64-Bit Command Line Installer (428 MB)
Linux
Python 3.8
64-Bit (x86) Installer (529 MB)
64-Bit (Power8 and Power9) Installer (279 MB)

What is Python

- General Programming Language
  - This means that in principle it can be used for any programming task.
  - However, it excels at getting things done, quickly and efficiently

Beautiful is better than ugly.

Explicit is better than implicit.

Simple is better than complex.

Complex is better than complicated.

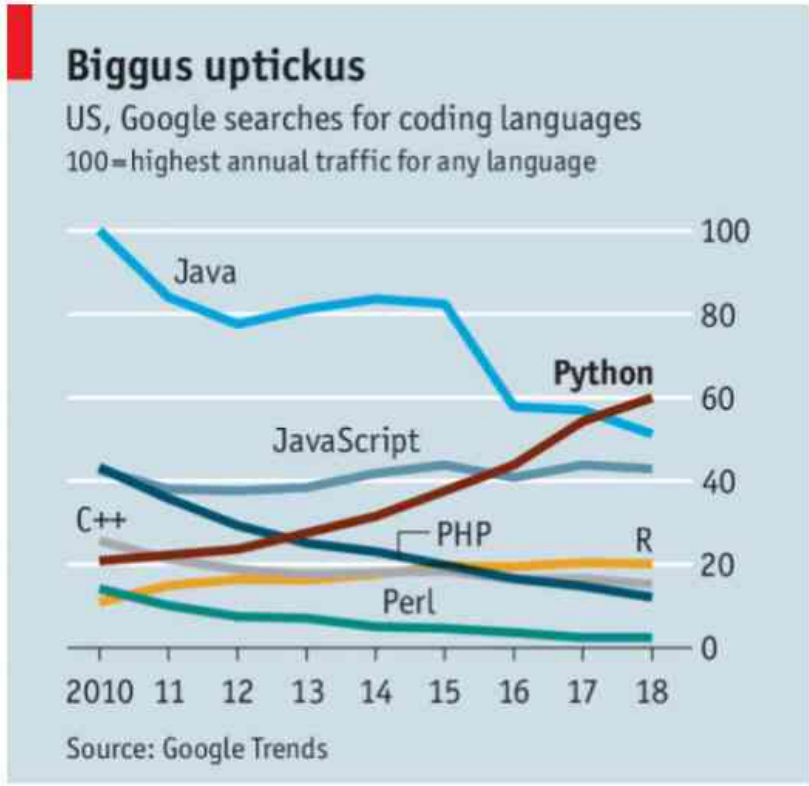
Flat is better than nested.

Sparse is better than dense.

Readability counts.

Popularity

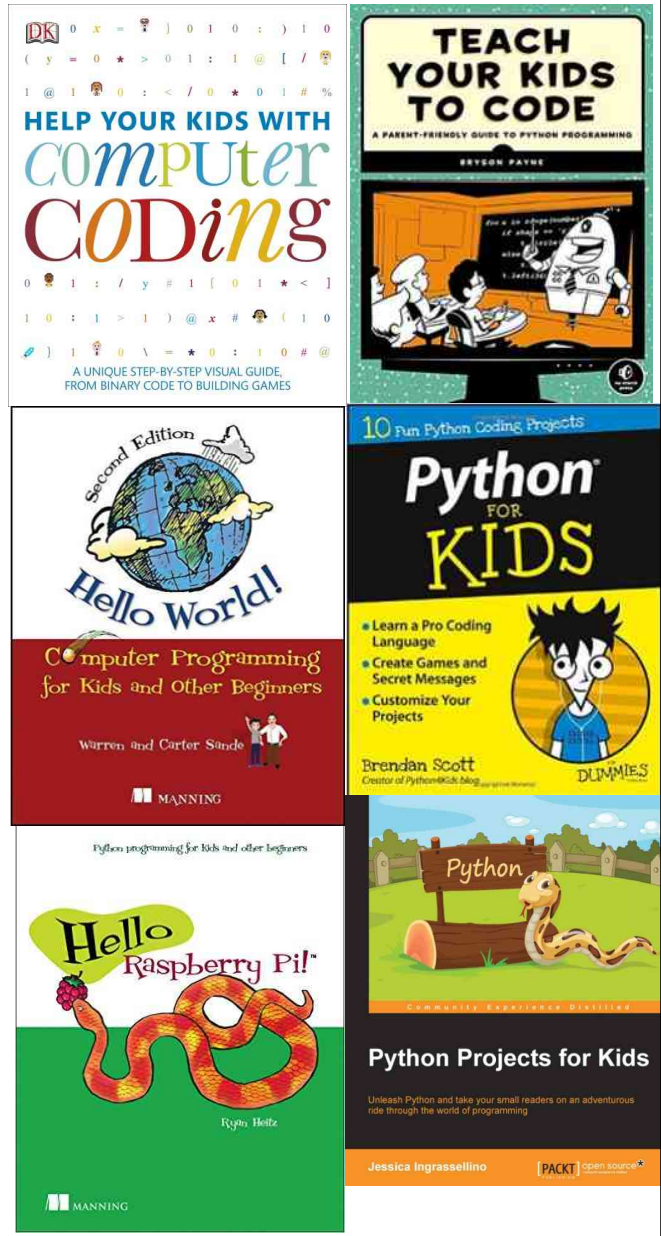
Language Rank	Types	Spectrum Ranking
1. Python		100.0
2. C++		99.7
3. Java		97.5
4. C		96.7
5. C#		89.4
6. PHP		84.9
7. R		82.9
8. JavaScript		82.6
9. Go		76.4
10. Assembly		74.1



Why it is a good choice

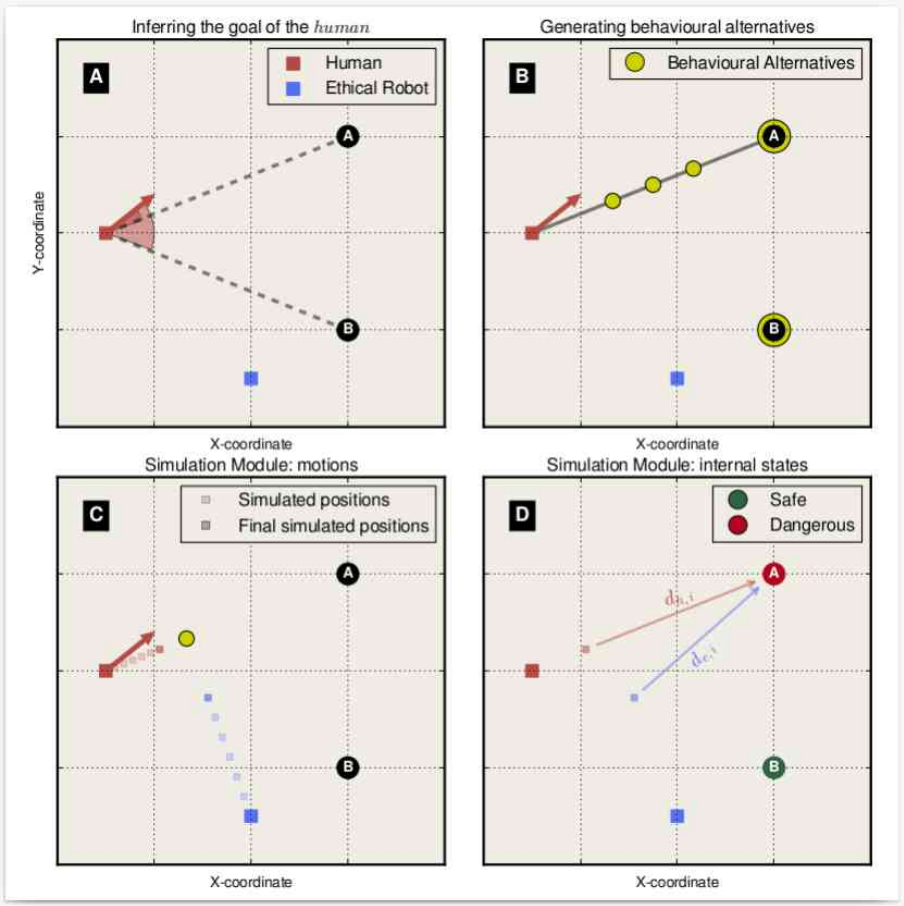
- Easy(ish):
  - Its design makes it very readable
  - High level programming language
  - Python has a gentle learning curve
- But powerful:
  - Many libraries – for real world tasks
  - Applicable to a wide range/size of problems

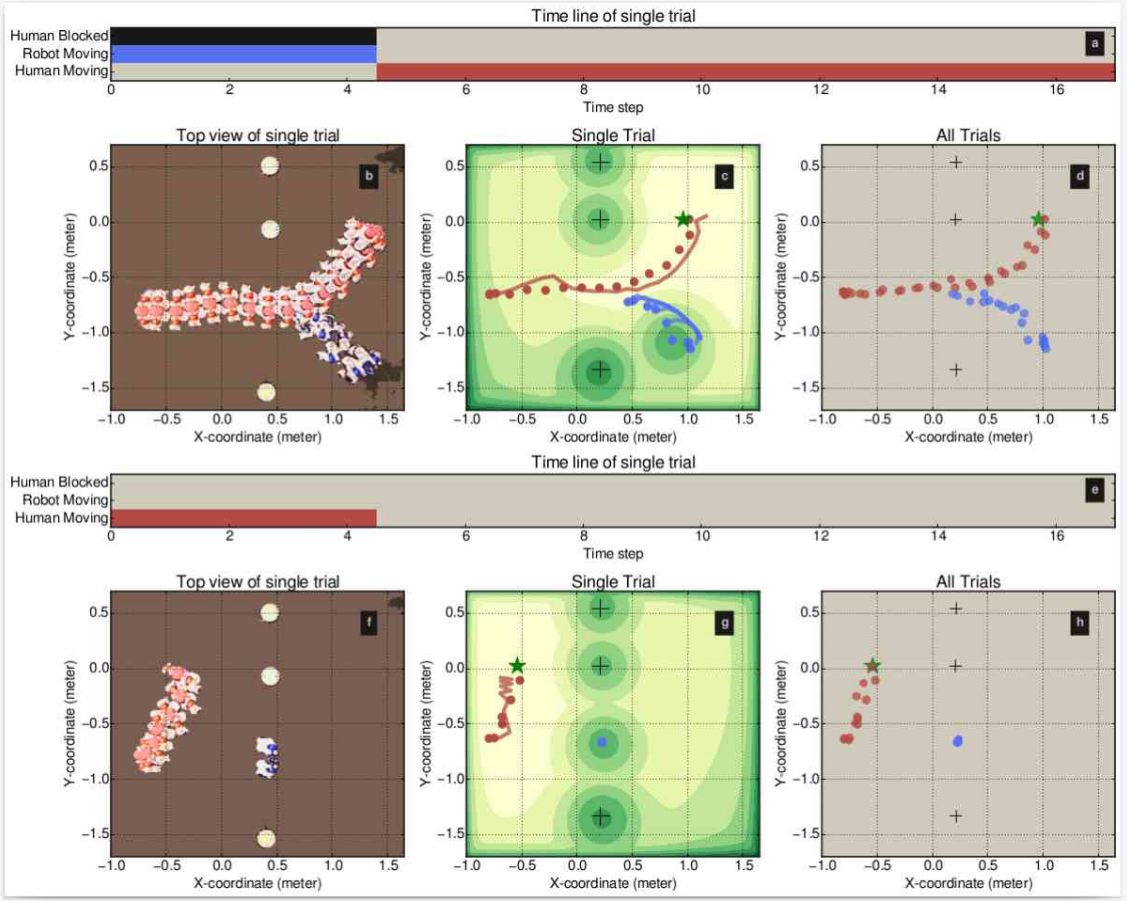
- Python is valued by employers
- It's free

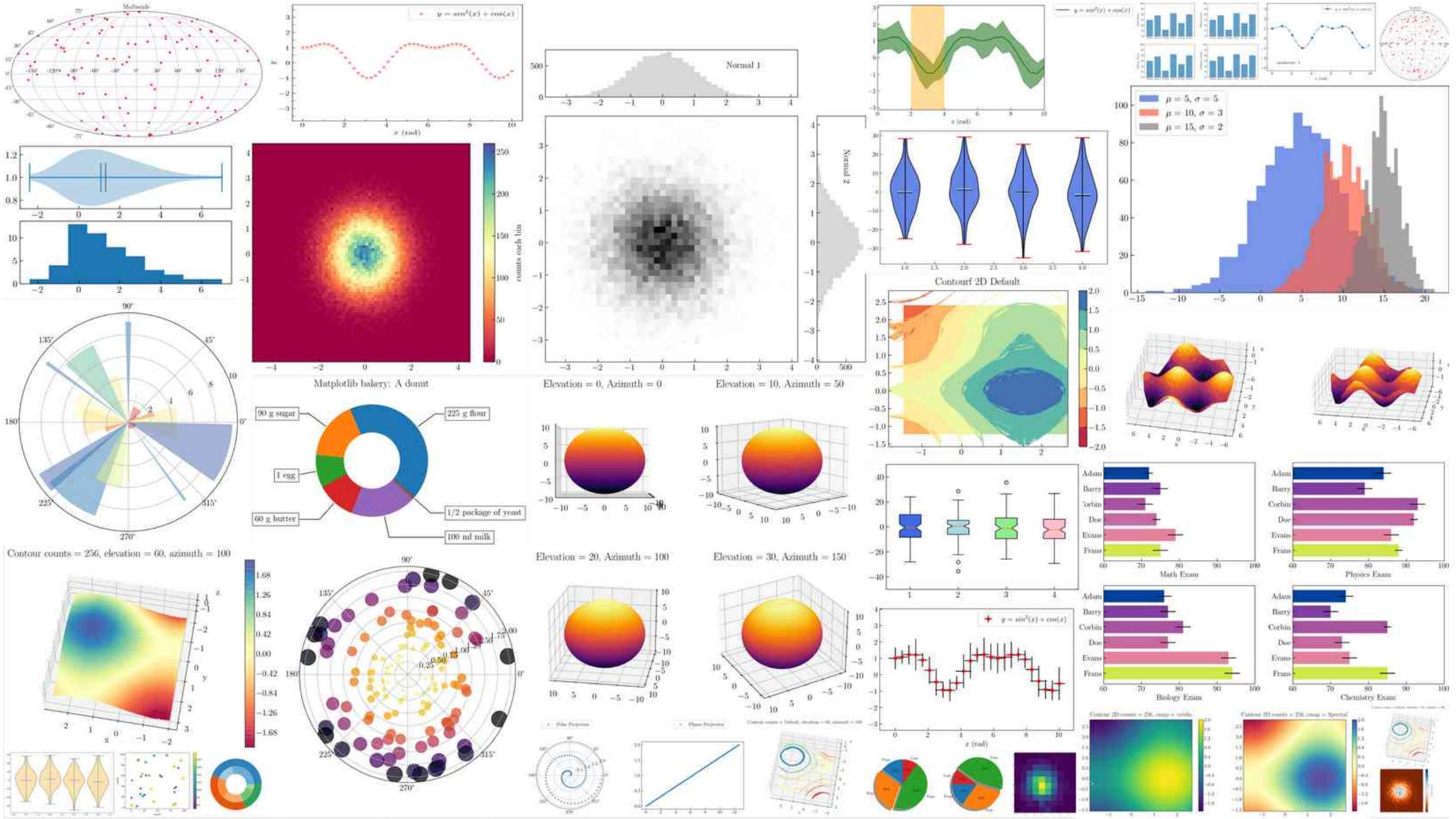


COURSE CONTENT

Data analysis and visualization

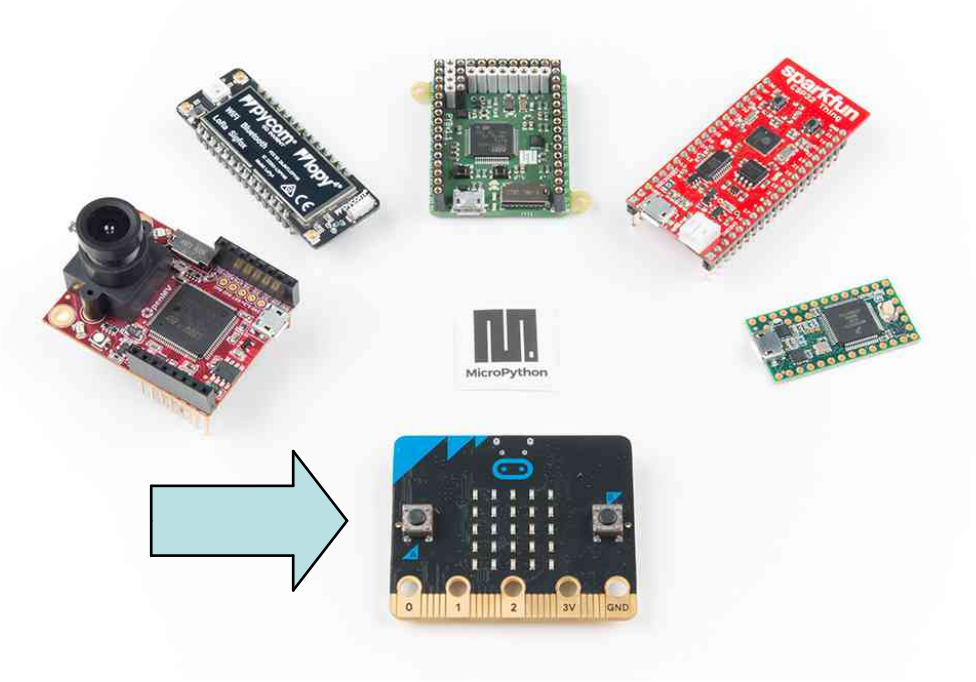





Mollweide
$y = \sin^2(x) + \cos(x)$
x (rad)
Normal 1
Normal 2
counts each bin
$\mu = 5, \sigma = 5$
$\mu = 10, \sigma = 3$
$\mu = 15, \sigma = 2$
Contourf 2D Default
Matplotlib bakery: A donut
90 g sugar
225 g flour
1 egg
60 g butter
1/2 package of yeast
100 ml milk
Elevation = 0, Azimuth = 0
Elevation = 10, Azimuth = 50
Elevation = 20, Azimuth = 100
Elevation = 30, Azimuth = 150
Contour counts = 256, elevation = 60, azimuth = 100
Adam
Barry
Corbin
Doe
Evans
Frans
Math Exam
Physics Exam
Biology Exam
Chemistry Exam

Some virtual hardware programming

- Python is increasingly popular for programming hardware.
  - micropython/circuitpython
- We will virtually program one of these devices to practice.



Goal: from data to stories

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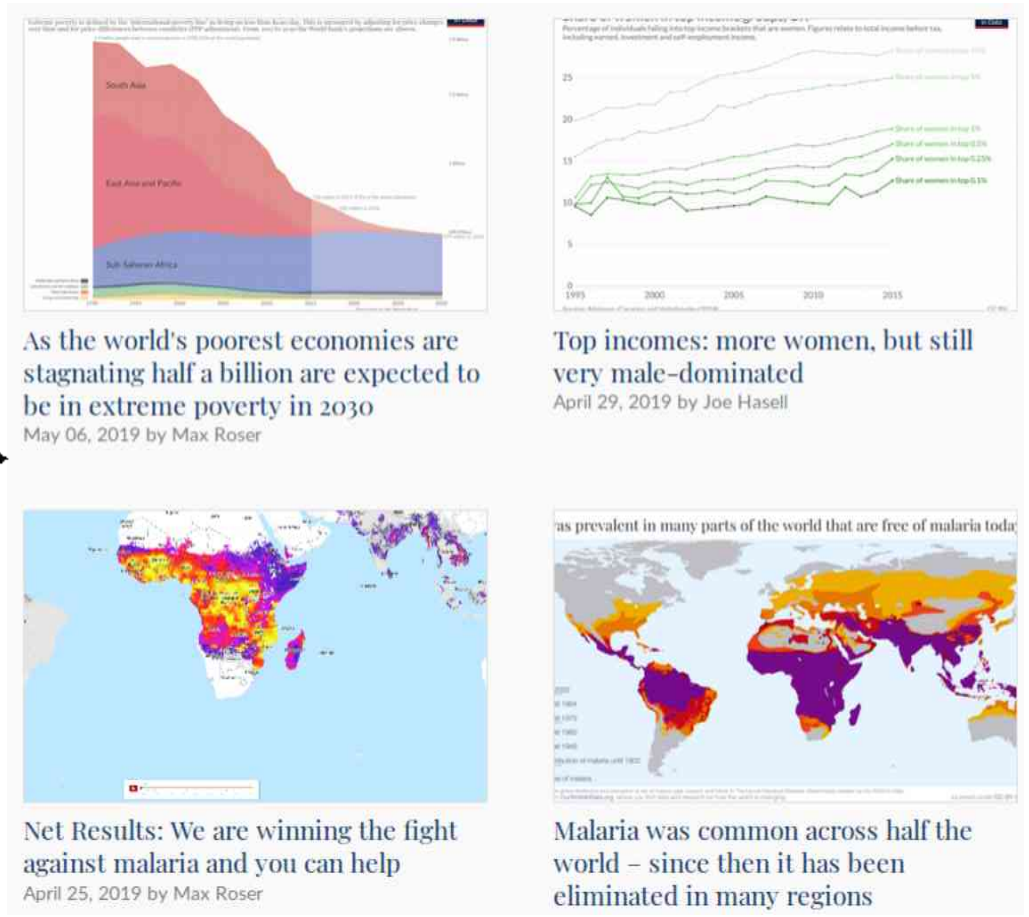
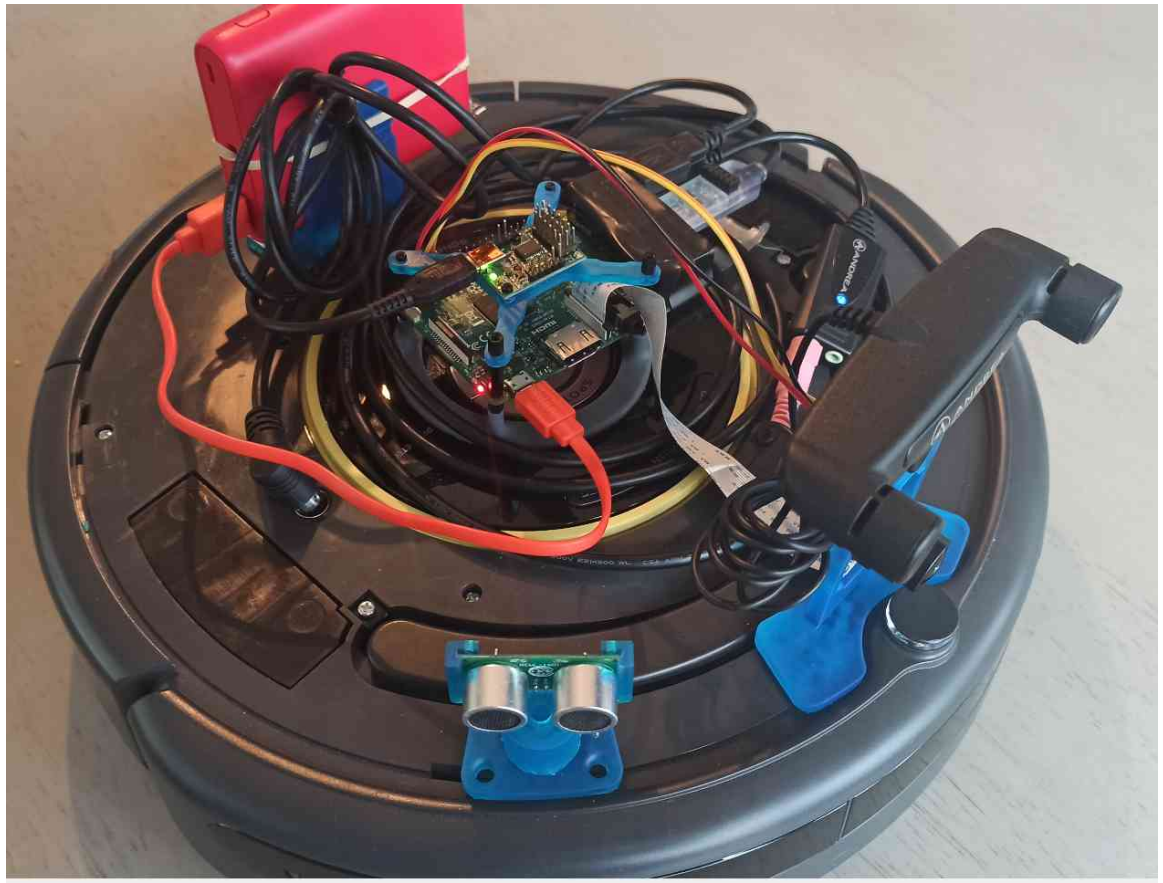


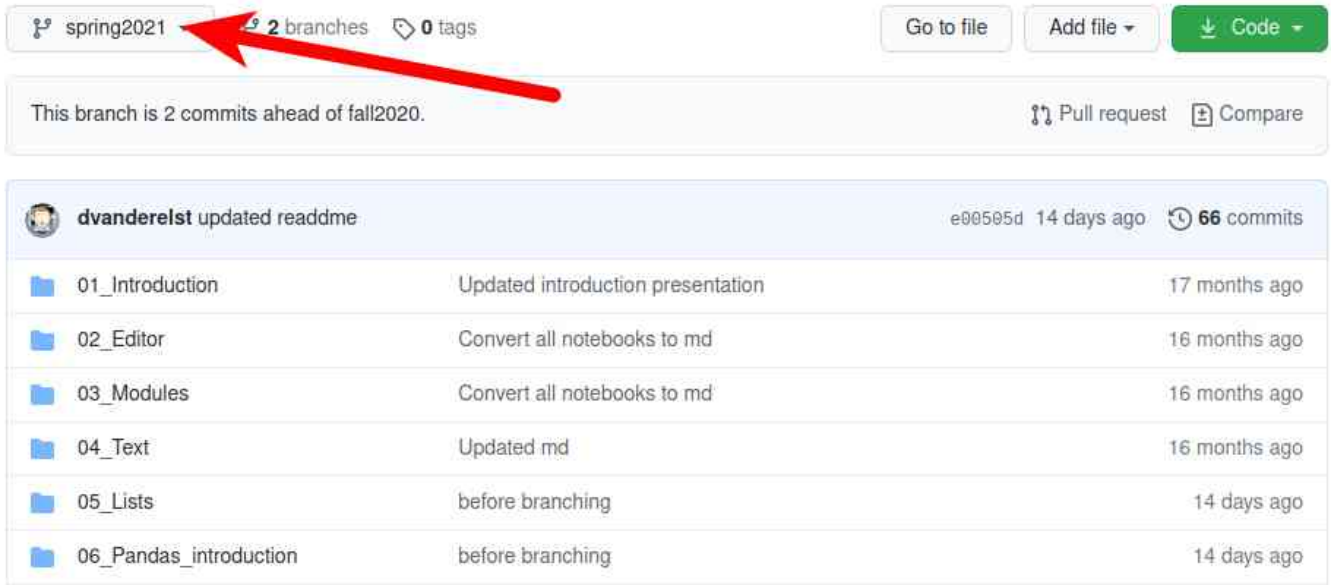
Beyond data analysis

- Robotics
- Machine Learning
- Website programming
- Microcontrollers
- Raspberry Pi
- …



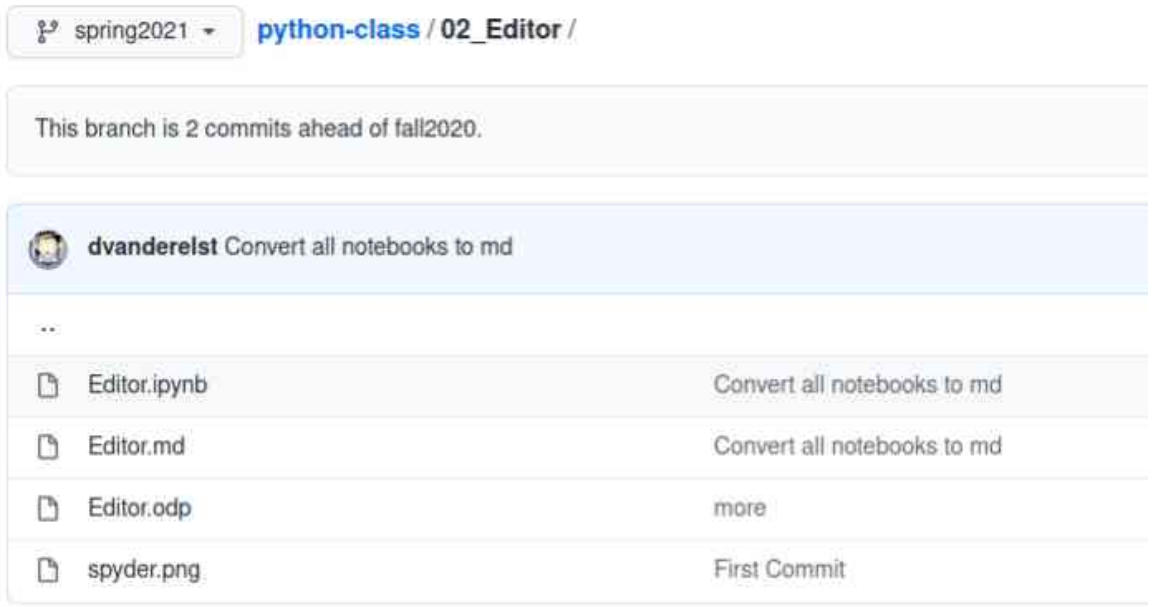
Materials

- All materials are on GitHub.com
  - https://github.com/dvanderelst-python-class/python-class
- Select correct version:



Course notes

- ipynb files:
  - Course notes
- md files:
  - backup



Planning

Part 1: Basics

- Basics of data analysis in Python
  - Reading in data
  - Selecting data
  - Statistical tests
  - Plotting of data

Part 2: data analysis

- Analysis of real world data:
  - Poverty in the USA
  - Use of force by police
  - Health in developing countries
  - Smoking behavior
  - Climate
  - Price of real estate

Grading

Part 1

- Homework to help you practice
- We will go over these together
- No grading
- But I strongly advise you complete

Part 2

- Data analysis assignments
- Upload code + output
- Graded on scale 0-5

Subject to change. There are quite a lot of you and normally, I would teach this in-person. We might have to revisit this. See also next slide.

Contact

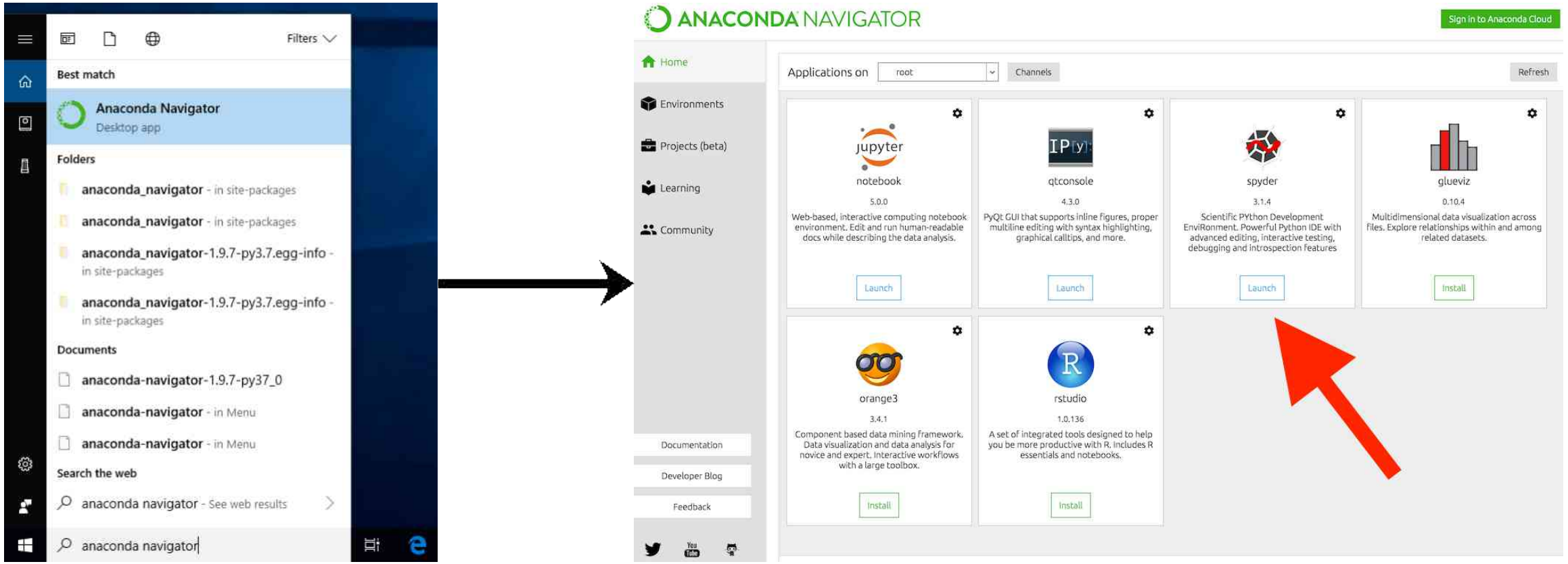
- vanderdt@ucmail.uc.edu
- Office hours:
  - https://vanderdt-office-hours.appointlet.com/b/dieter

- Please share suggestions/remarks/concerns.
- This is your course. And we need to make it work.

- http://cincinnati.ca1.qualtrics.com/jfe/form/SV_2bBX3fl2wpEvz49

Zoom meeting recordings

- I will record the zoom meetings
- Share via Canvas
- Please remind me if I forget to start the recording

Homework

- Install python from anaconda.com
- Make sure you can start Spyder