Please download Anaconda:

Anaconda.com

COMPUTER SCIENCE FOR MEDICINE

Plastic Surgery and Neurosurgery Interest Groups
November 16, 2022
Session 1

AGENDA

1

INTRODUCTION

Computers
Operating Systems
Memory
Activity Monitor
Big O Notation
Thinking like a Programmer
Best Practices

2

WALKTHROUGH

Basic Python Syntax
Advanced Topics
Continued Learning

3

Q&A/WORKSHEET

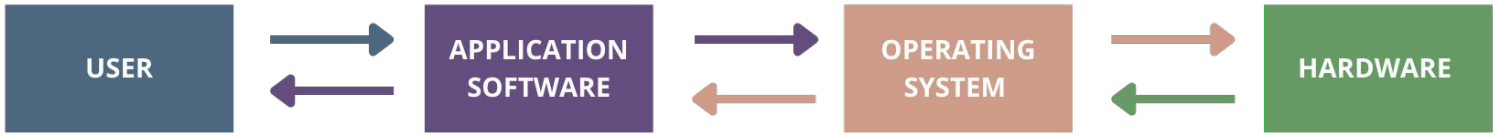
WHAT IS A COMPUTER?

HARDWARE

Physical components of device

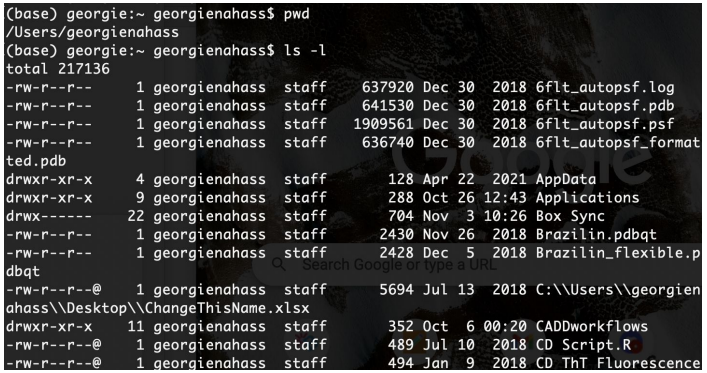
SOFTWARE

Set of instructions you write used by your hardware to execute action



OPERATING SYSTEMS

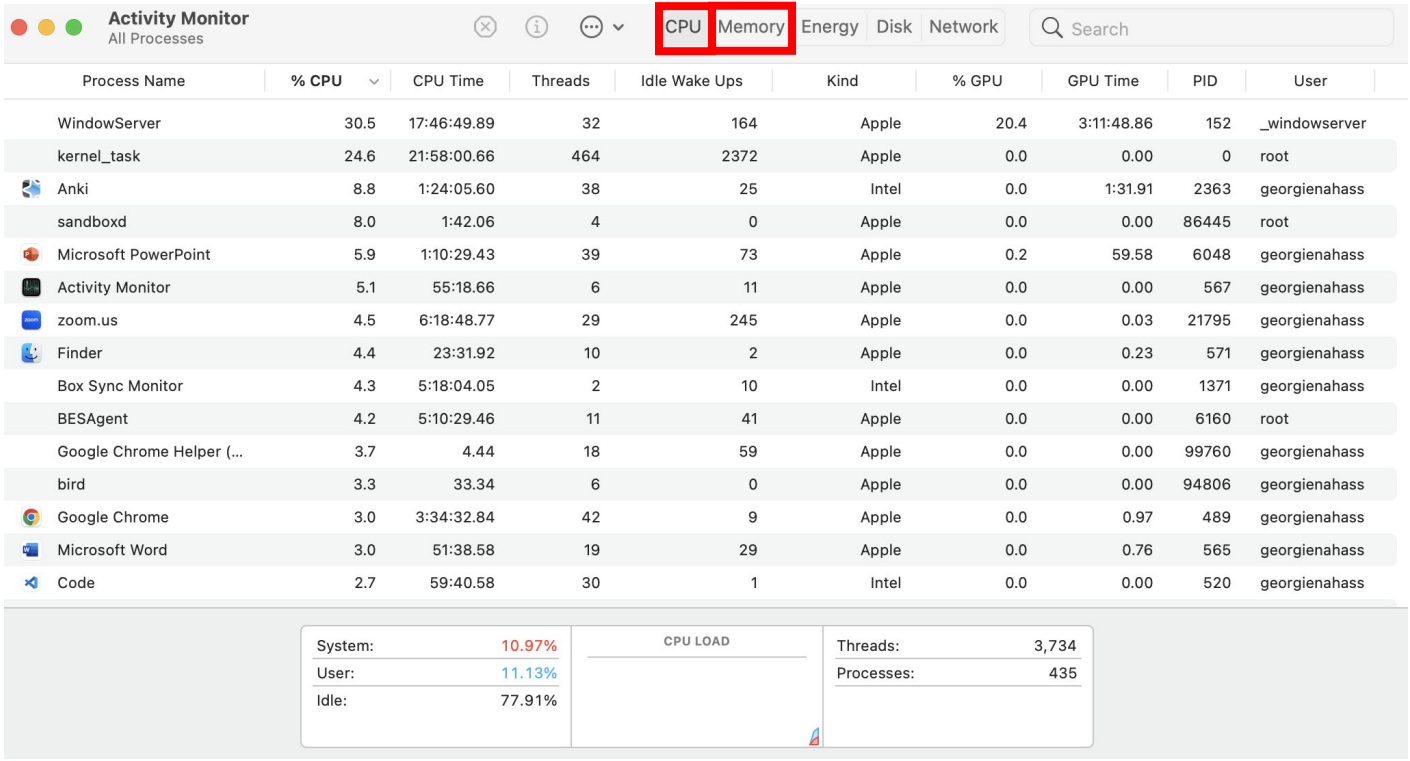
- ***Windows, MacOS, Linux***
- Most important software on a computer
  - Coordinates hardware and software
- Manages memory, storage, CPU, GPU
- ***Command line***: window into your operating system
  - ***Bash*** is the language you will use on Mac and Linux terminals primarily



MEMORY

- ***Memory vs. Storage***
  - Memory = short term data (RAM, chrome tabs, variable storage in code)
  - Storage = long term data (excel, word, etc)
- ***CPU vs. GPU***
  - CPU = Computer Processing Unit (slower, more versatile – *use this when in doubt*)
  - GPU = Graphics Processor Unit (faster, less versatile)
- Know how much your computer has (and how to manage it!)

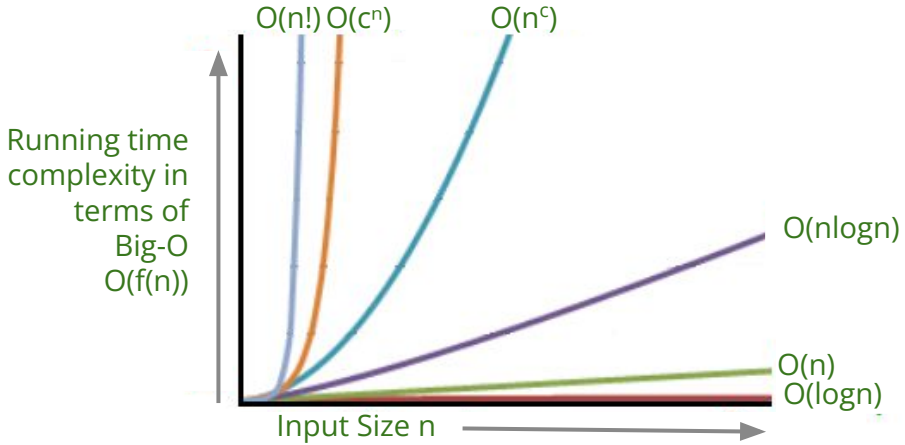
ACTIVITY MONITOR/TASK MANAGER



Process Name	% CPU	CPU Time	Threads	Idle Wake Ups	Kind	% GPU	GPU Time	PID	User
WindowServer	30.5	17:46:49.89	32	164	Apple	20.4	3:11:48.86	152	_windowserver
kernel_task	24.6	21:58:00.66	464	2372	Apple	0.0	0.00	0	root
Anki	8.8	1:24:05.60	38	25	Intel	0.0	1:31.91	2363	georgienahass
sandboxd	8.0	1:42.06	4	0	Apple	0.0	0.00	86445	root
Microsoft PowerPoint	5.9	1:10:29.43	39	73	Apple	0.2	59.58	6048	georgienahass
Activity Monitor	5.1	55:18.66	6	11	Apple	0.0	0.00	567	georgienahass
zoom.us	4.5	6:18:48.77	29	245	Apple	0.0	0.03	21795	georgienahass
Finder	4.4	23:31.92	10	2	Apple	0.0	0.23	571	georgienahass
Box Sync Monitor	4.3	5:18:04.05	2	10	Intel	0.0	0.00	1371	georgienahass
BESAgent	4.2	5:10:29.46	11	41	Apple	0.0	0.00	6160	root
Google Chrome Helper (...	3.7	4.44	18	59	Apple	0.0	0.00	99760	georgienahass
bird	3.3	33.34	6	0	Apple	0.0	0.00	94806	georgienahass
Google Chrome	3.0	3:34:32.84	42	9	Apple	0.0	0.97	489	georgienahass
Microsoft Word	3.0	51:38.58	19	29	Apple	0.0	0.76	565	georgienahass
Code	2.7	59:40.58	30	1	Intel	0.0	0.00	520	georgienahass

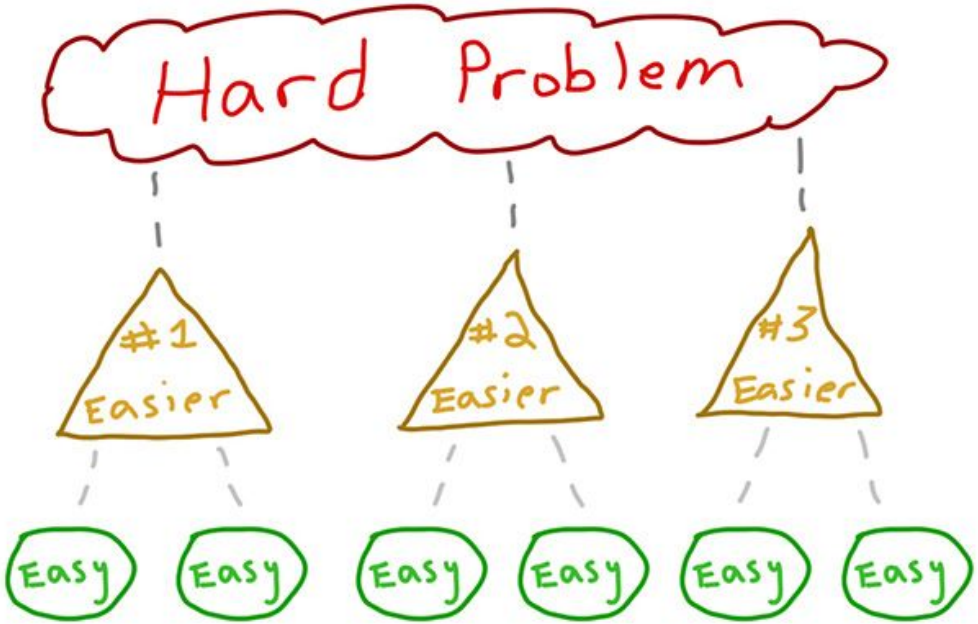
BIG O NOTATION

- Metric for determining ***algorithm efficiency***
- Difficulty of an algorithm (worst case scenario)



O(n!), O(cⁿ), O(nᶜ) *Worst*
O(nlogn) *Bad*
O(n) *Fair*
O(logn) *Good*
O(1) *Best*

THINKING LIKE A PROGRAMMER



TAKES PRACTICE!

BEST PRACTICES

- Use ***packages*** and ***libraries!***
  - Pre built code and algorithms to help you solve problems! Embrace open source!
- Annotate, annotate, annotate!
- Practice, practice, practice!
- Name your variables something ***'human readable'***
- When in doubt, ***google*** it out
- Focus on ***understand***, not copy and paste
- Knowing theory is good, but ***NOT*** essential
- Learn through projects
  - Start small build up

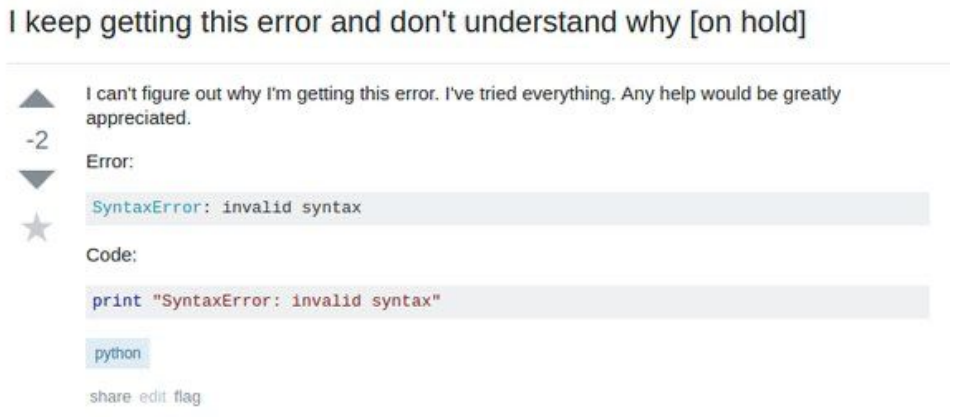
JUPYTER NOTEBOOK WALKTHROUGH

NOW THAT YOU ARE A CODING BEAST...

- Research
  - Statistics
  - Database studies
  - *Everything you can do in things like GraphPad Prism, STATA, and SPSS, you can do in Python!*
- Clinical tools
  - Screen for tumors in brain MRIs
- Academic tools
  - Scheduler for volunteering shifts
- Personal use
  - Create a interface to keep track of workouts

WHAT HAPPENS IF YOU GET STUCK?

- Copy and paste your error into **Google** and go from there
  - Important to learn the terminology so you can Google effectively
- **Stackoverflow.com**



I keep getting this error and don't understand why [on hold]

-2

I can't figure out why I'm getting this error. I've tried everything. Any help would be greatly appreciated.

Error:

```
SyntaxError: invalid syntax
```

Code:

```
print "SyntaxError: invalid syntax"
```

python

share edit flag

CONTINUED LEARNING

What we covered today is just the tip of the tip of the iceberg!

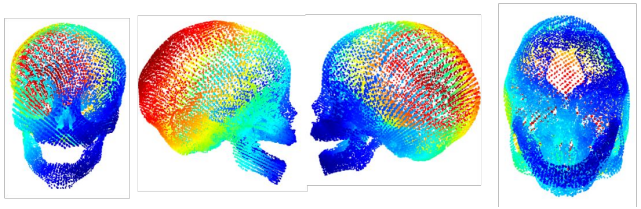
- Just like in medicine, **learning in programming never ends**
  - learnpython.org
  - codecademy.com
  - Google Python Style Guide
- Learn **bash scripting** to get around your terminal and file system
- Other tools worth downloading:
  - Visual Studio Code or PyCharm
  - Git is a system that allows you to share code and collaborate with other people

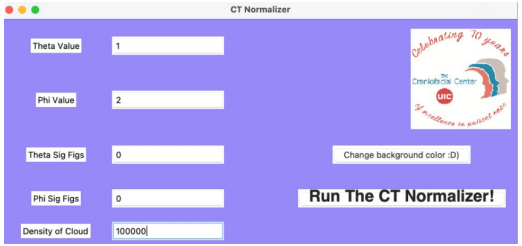
SOME USEFUL LIBRARIES

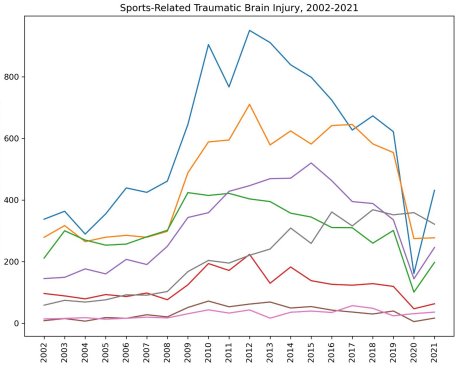
- **Data Science and Statistics**
  - Pandas
  - SciPy
  - Numpy
  - Statsmodels
  - Matplotlib/Plotly/Seaborn
- **Software Development**
  - Tkinter/PyQT (user interfaces)
  - Django/Flask (application backends)
- **Biological Computation**
  - BioPython
- **Machine Learning**
  - OpenCV (also computer vision)
  - Scikit-learn
  - Tensorflow
  - Keras
  - PyTorch
- **Miscellaneous**
  - os
  - sys
  - re
  - datetime

Whatever you want to do, there's probably a library to help you do it!

EXAMPLES OF RESEARCH PROJECTS

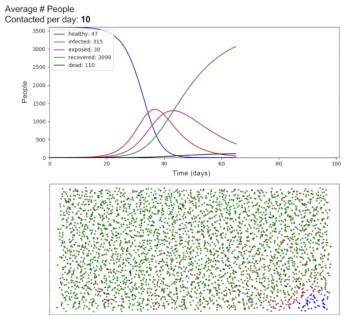


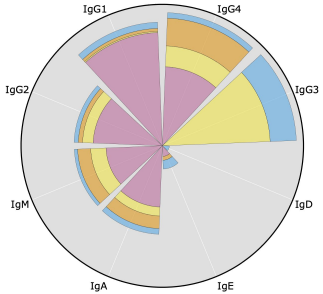


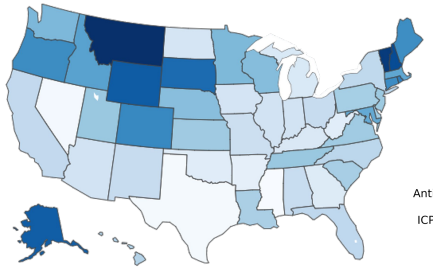


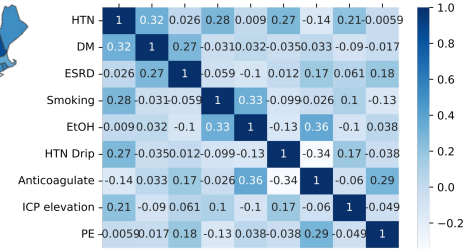
	AC (n=7075)	Non-AC (n=7075)	P-Value
Demographics			
Age (years)	72.80 ± 11.21	72.82 ± 11.20	<0.001*
Sex (female)	2388 (33.75%)	2393 (33.82%)	0.929
White	5912 (83.56%)	6024 (85.14%)	0.010*
Black	541 (7.65%)	528 (7.46%)	0.679
Asian	203 (2.87%)	181 (2.56%)	0.255
Native American	26 (0.37%)	20 (0.28%)	0.376
Pacific Islander	24 (0.34%)	7 (0.10%)	0.002*
Hispanic	367 (5.19%)	318 (4.49%)	0.055
In-Hospital Complications			
CLABSI	12 (0.17%)	7 (0.10%)	0.251
Deep Vein Thrombosis	231 (3.27%)	158 (2.23%)	<0.001*
Alcohol Withdrawal	57 (0.81%)	76 (1.07%)	0.098
Cardiac Arrest	130 (1.84%)	117 (1.65%)	0.404
CAUTI	101 (1.43%)	62 (0.88%)	0.002*
Pulmonary Embolism	46 (0.65%)	40 (0.57%)	0.516
Extremity CS	2 (0.03%)	3 (0.04%)	0.655
Intubation	551 (7.79%)	395 (5.58%)	<0.001*
Kidney Failure	98 (1.39%)	87 (1.23%)	0.416
Myocardial Infarction	76 (1.07%)	32 (0.45%)	<0.001*
Respiratory Failure	54 (0.76%)	61 (0.86%)	0.512
Unplanned Reoperation	295 (4.17%)	239 (3.38%)	0.013*
Sepsis	84 (1.19%)	48 (0.68%)	0.002*
Stroke	192 (2.71%)	145 (2.05%)	0.010*
Pressure Ulcer	120 (1.70%)	105 (1.48%)	0.313
Unplanned ICU Admission	538 (7.60%)	387 (5.47%)	<0.001*
VAP	161 (2.28%)	154 (2.18%)	0.690
Miscellaneous			
VTE Prophylaxis	3675 (51.63%)	3528 (49.87%)	0.036*
Ventilator Duration (days)	8.32 ± 5.65	8.69 ± 5.50	<0.001*
Length of Stay (days)	15.40 ± 8.25	15.40 ± 7.70	0.984
In-Hospital Death	1682 (23.77%)	1145 (16.18%)	<0.001*

* = significant
AC = anti-coagulant, CAUTI = catheter-associated urinary tract infection, CLABSI = central-line associated bloodstream infection, CS = compartment syndrome, VAP = ventilator-associated pneumonia, VTE = venous thromboembolism









POTENTIAL FUTURE SESSIONS

- **We want to keep the party going!**
- Potential sessions include:
  - Data analysis for research workshop
  - Leetcode/algorithms workshop
  - Intro to scripting
  - Intro to machine learning and computer vision
  - Whatever you guys want to learn! (i.e., fill out the feedback form)

THANK YOU!

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