APS106

UNIVERSITY OF TORONTO

introduction.

Week 1 | Lecture 1 (1.1)

if nothing else, write #cleancode

This Week's Content

- **Lecture 1.1**
  - **Introduction**
- **Lecture 1.2**
  - Variables, Expressions, and Operators
  - Reading: Chapters 1, 2, 3
- **Lecture 1.3**
  - The Programming Process

Teaching Team

Ben
Instructor

Seb
Instructor

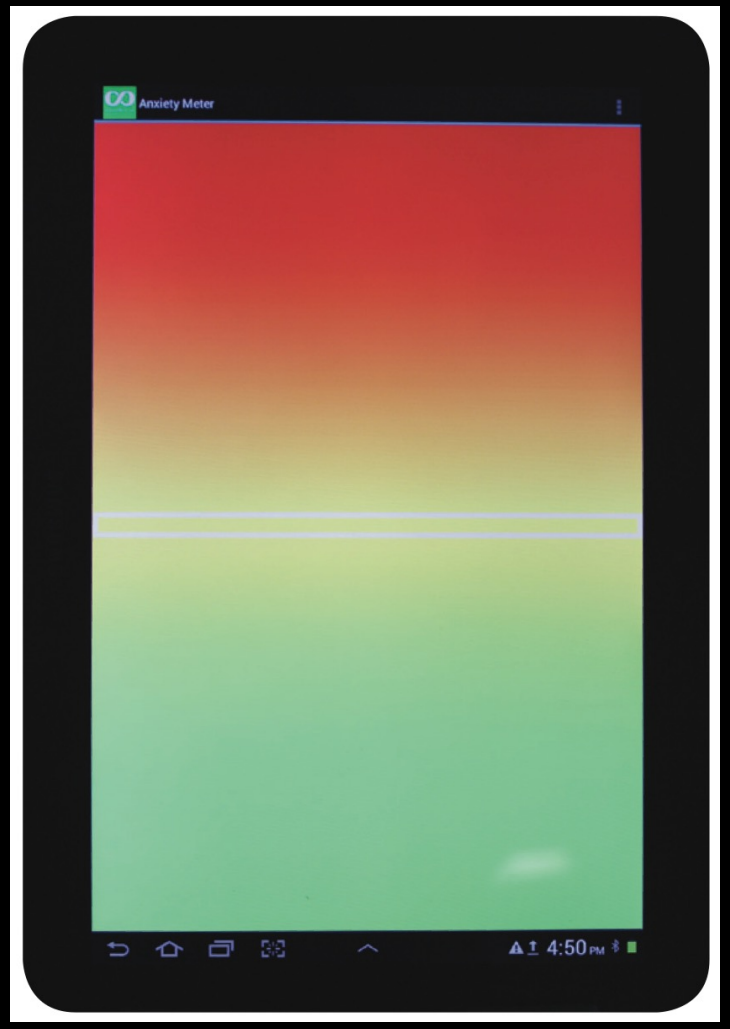
Joseph
TA

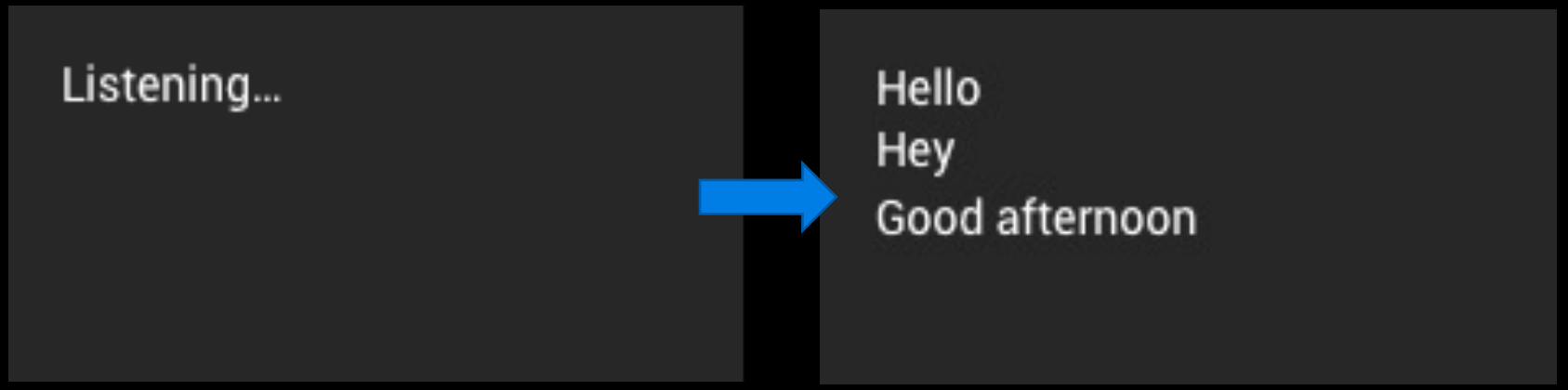
Katia
TA

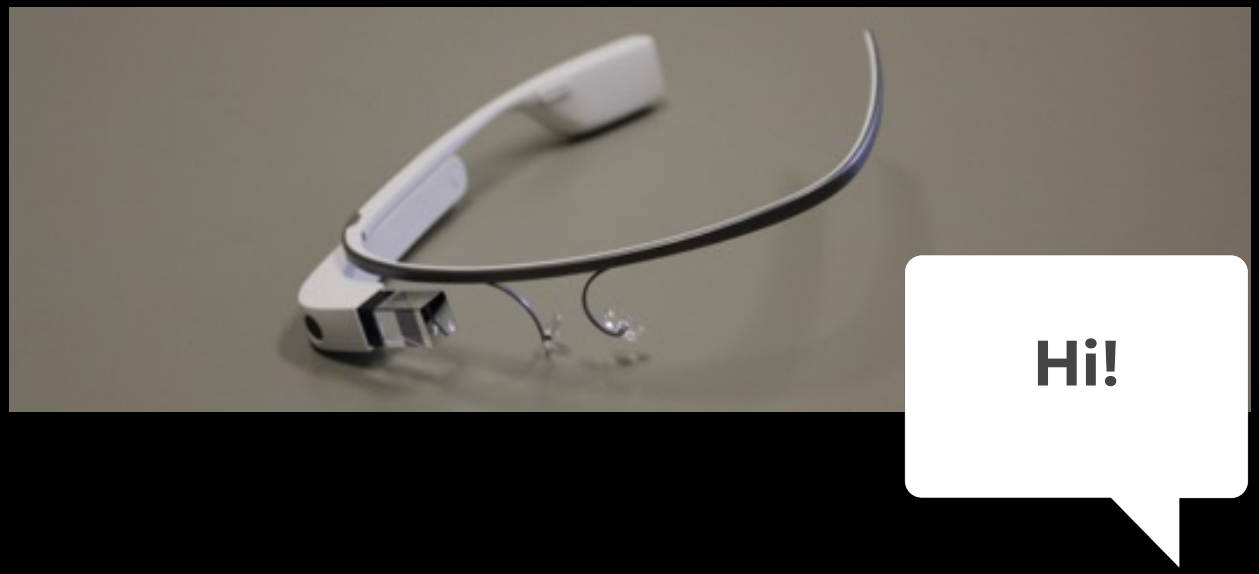
Ben

- Bachelor of Electrical & Biomedical Engineering @ McMaster University 2015
  - Realized the power of programming (and how it can be used for good, not evil)
- Master of Biomedical Engineering @ University of Toronto 2020
  - Hold up… people will pay me for ‘playing’ on my computer?
- In between obtaining degrees I spent time programming a few different projects…

Projects for children with autism spectrum disorder

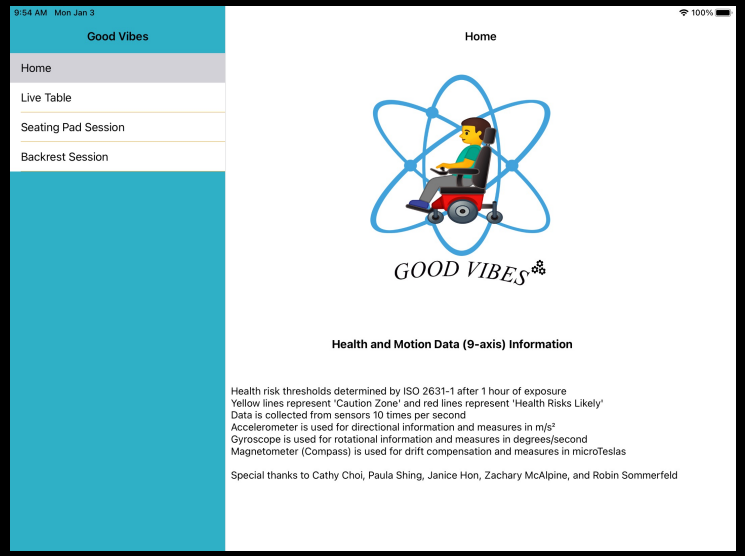


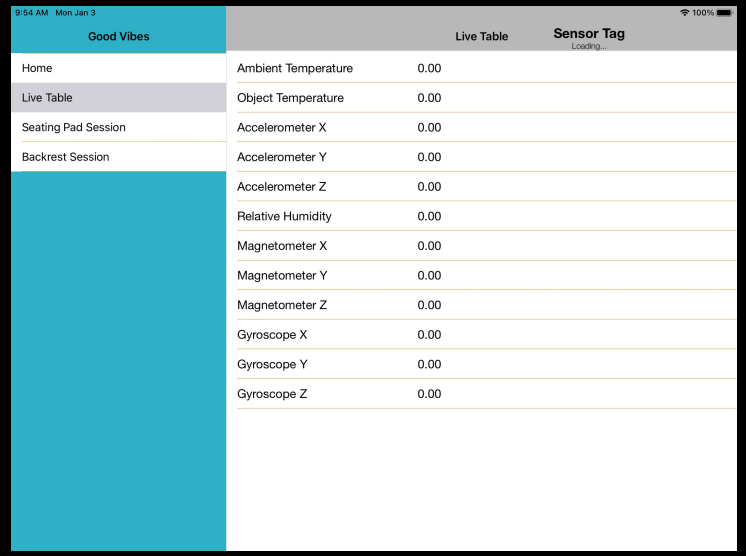


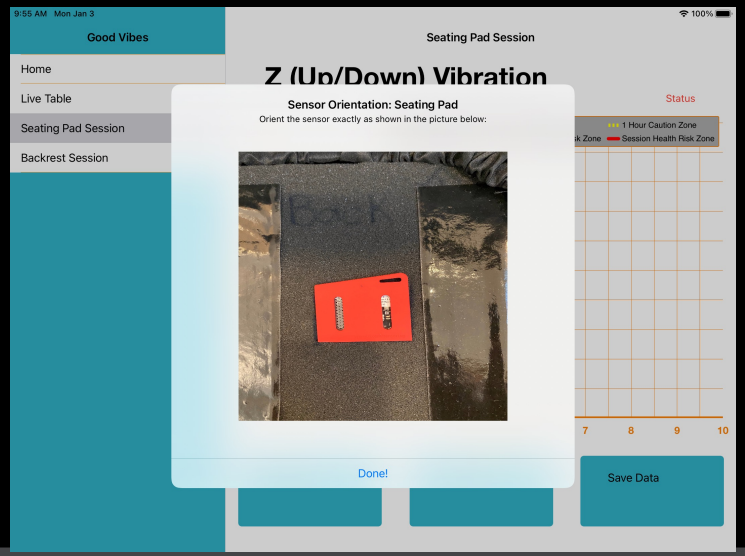


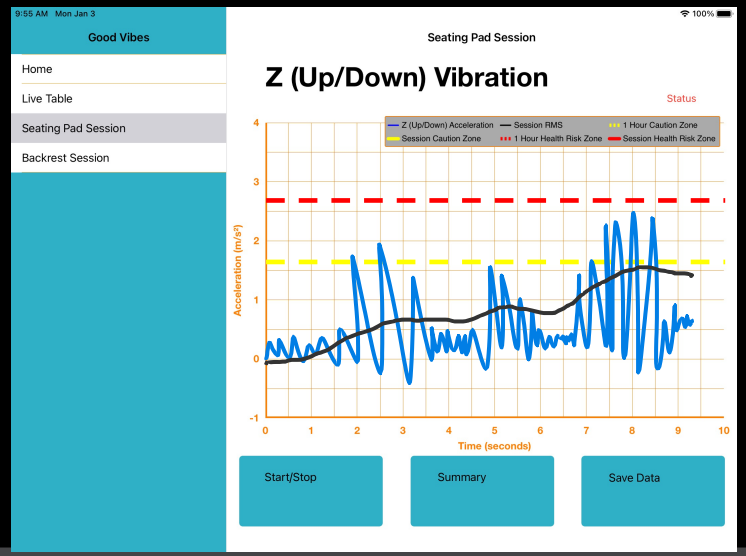
Good Vibes

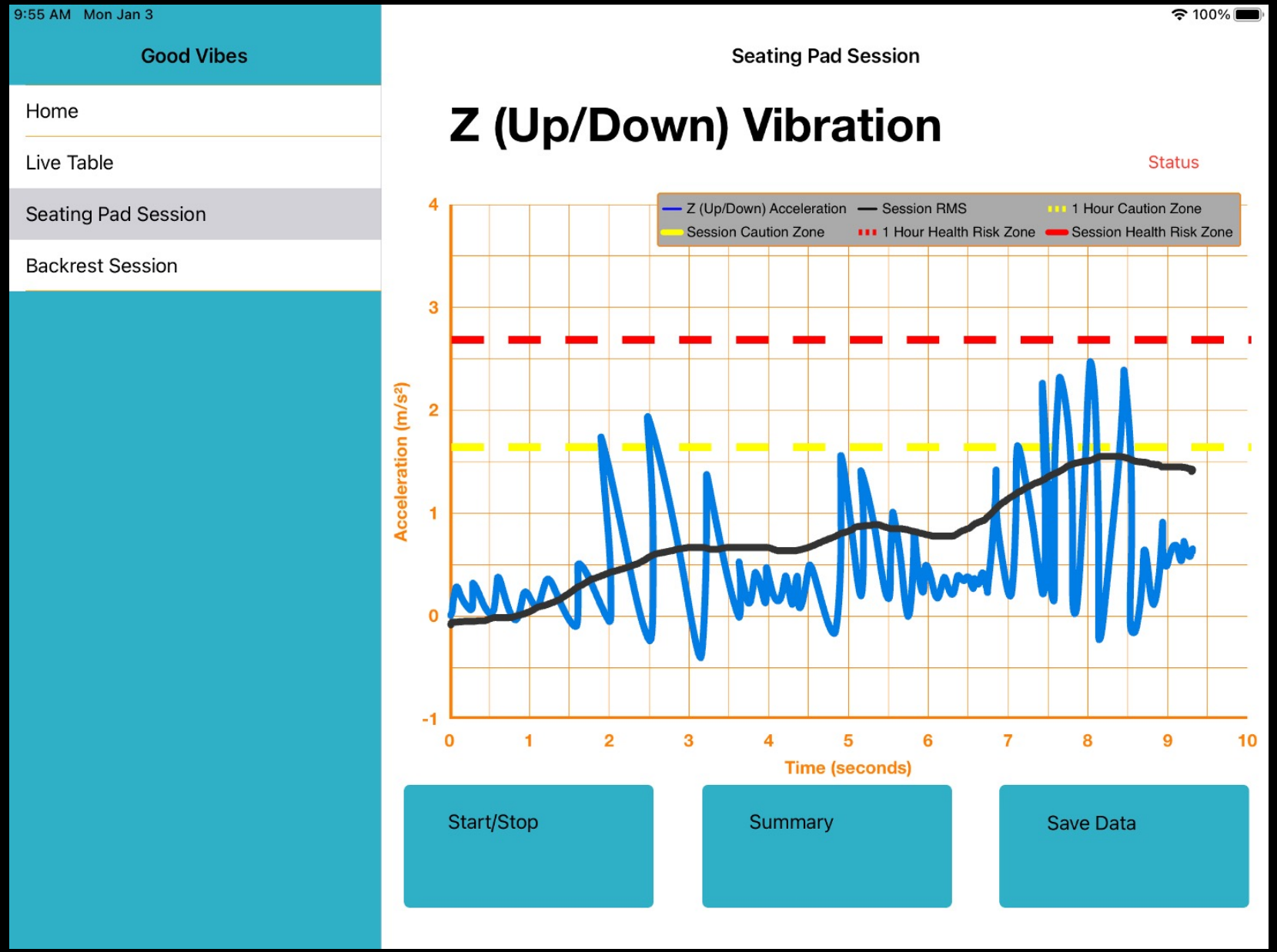
A wheelchair vibration measurement tool










9:55 AM Mon Jan 3
100%
Good Vibes
Home
Live Table
Seating Pad Session
Backrest Session
Seating Pad Session
Z (Up/Down) Vibration
Status
Z (Up/Down) Acceleration
Session RMS
1 Hour Caution Zone
Session Caution Zone
1 Hour Health Risk Zone
Session Health Risk Zone
Acceleration (m/s²)
4
3
2
1
0
-1
0
1
2
3
4
5
6
7
8
9
10
Time (seconds)
Start/Stop
Summary
Save Data

More about Ben…

Seb

- Completed CivMin PhD in 2014 where I studies rock fracture and seismology (***RFDF***).
- AI Lead at KORE Geosystems, a mining tech startup.
- Senior Research Scientist at SickKids.
- Joined UofT CivMin in January 2020.
- Research topics: rock mechanics, ultrasonics, signal processing, computer vision, applied machine learning in mining.

AI 4 Mining

At KORE,
I use code
to do this!

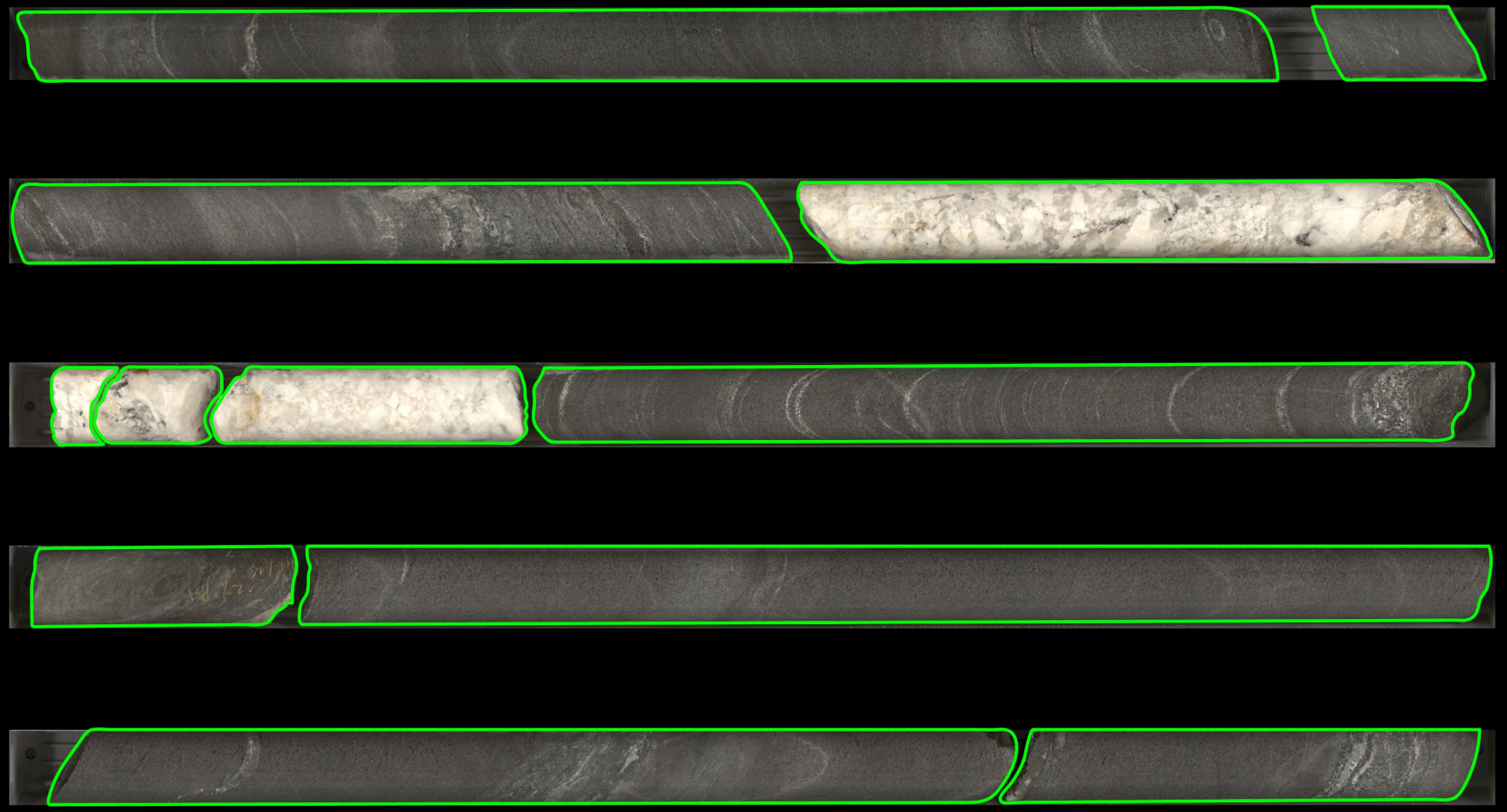
- Mining companies drill thousands of meters every year and the recovered rock (core) needs to be visually described by humans.

KORE GEOSYSTEMS

AI 4 Mining

At KORE,
I use code
to do this!

KORE GEOSYSTEMS



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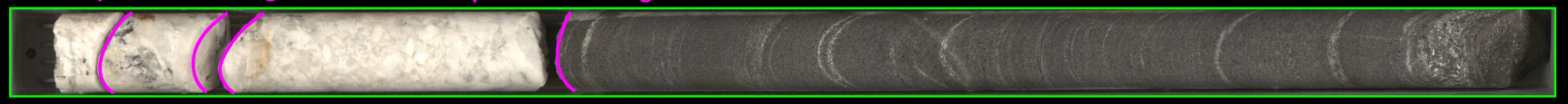
KORE GEOSYSTEMS



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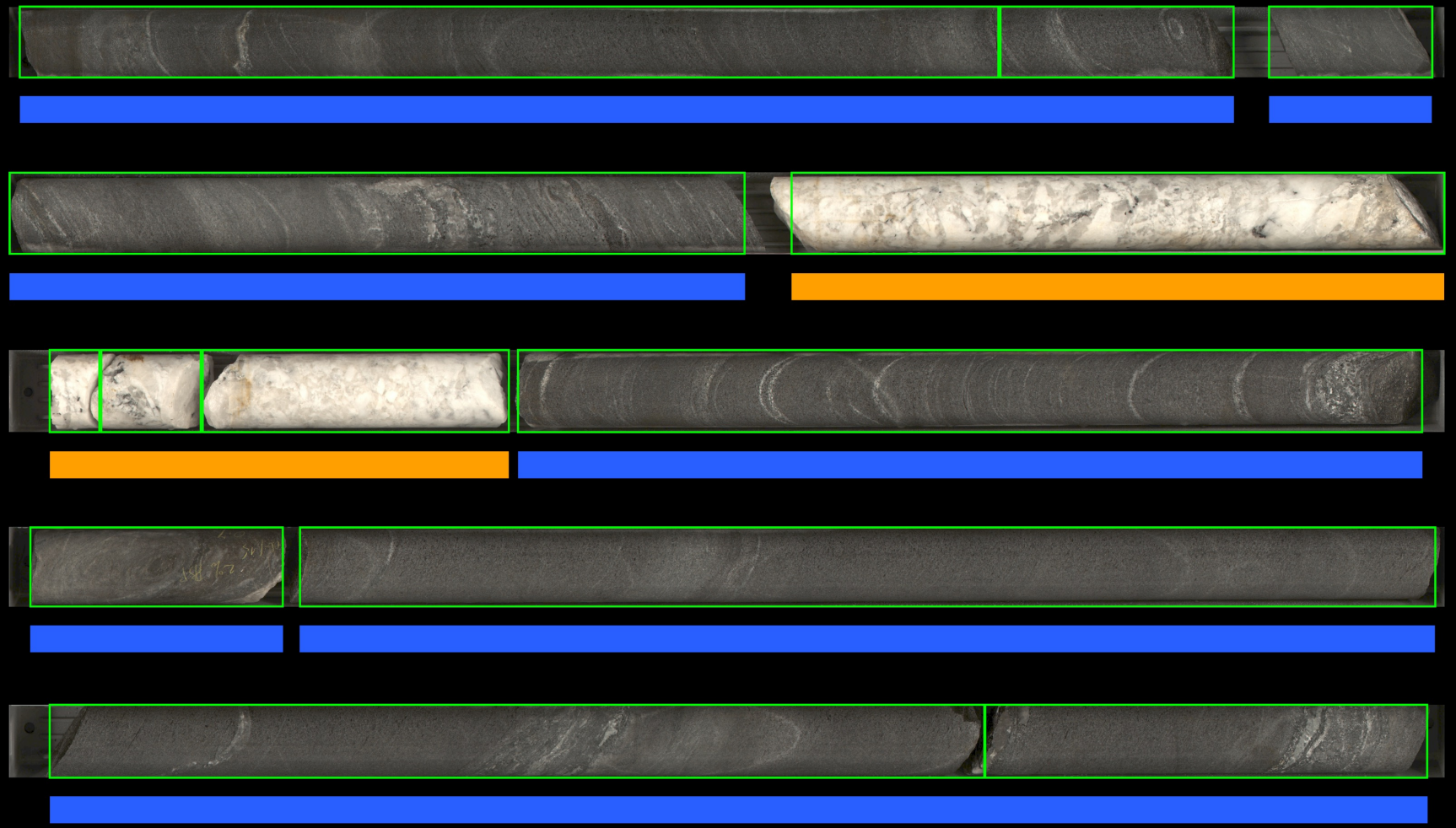
KORE GEOSYSTEMS



AI 4 Healthcare

AI Detects JET Pages Mjaye

Staff Physician

Nurse

At SickKids, I use code to do this!

SickKids®

JET Onset

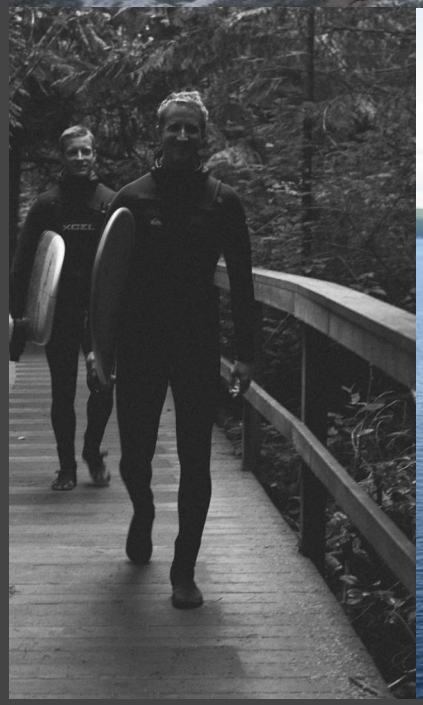
5 minutes later

Treatment begins

AI JET: 5 %

Seb

- I love travelling and have visited over 20 countries including France, Switzerland, Italy, Austria, Croatia, Costa Rica, Nicaragua, Panama, Peru, Bolivia, United States, Israel, Jordan, West Bank, Egypt, Turkey, Morocco, South Africa, and Namibia.
- I was a founding member of Ottawa's premiere Beatles cover band.
- I love camping, hiking, and surfing.
- I have a wonderful baby boy named Avery Goodfellow and baby girl name August.
- I love building things with code (Github: Seb-Good).



Katia

- Doing a Master's in Civil Engineering.
- Worked as a software application engineer-in-training (EIT) for 3.5 years.
- Working with Python to analyze and clean data!
- Using Python to work with images from digital and optical microscopes of concrete and other building materials. As well, analyzing fracture behavior from Finite Discrete Element simulation models (FDEM).
- Martial arts fanatic :) involved in both Muay Thai and karate.
- Also play piano, working towards Royal Conservatory certification.

Joseph

- Doing a PhD in biomedical engineering.
- A marathon runner and currently training for a triathlon.
- Interweaves Python and MATLAB to analyze ultrasound wave propagation in artificial hearts made from stem cells through image and signal analysis.

In Person (hopefully ☹)

- Talking
- Cell Phones
- Eating
- Being Late for Lectures

In Person (hopefully ☹)

- Talking
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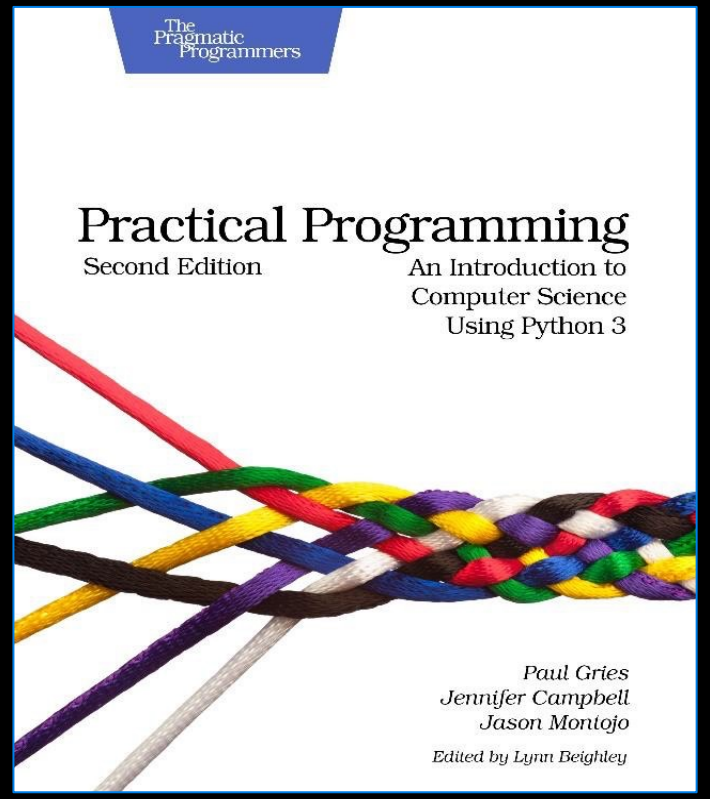
- Eating
- Being Late for Lectures

Online

- Ask questions in the chat or raise your hand if you'd like to unmute yourself to ask a question.
- Answer other students' questions if you think you know the answer
- Never forget - if you have a question, there's always other people in the room wondering the same thing. They will be happy you asked it!

Course Information

- **Quercus:**
  - APS106H1 S LEC0101 (One site contains all information).
- **Textbook:**
  - ***Practical Programming:*** *An Introduction to Computer Science Using Python 3*, 2nd edition, Paul Gries, Jennifer Campbell, Jason Montojo, Pragmatic Programmers.
- **Piazza:**
  - piazza.com/utoronto.ca/winter2019/aps106



Print $38 (e-book $25)

Grading

Labs (9 in total)	total: 10%
Midterm Test (s)	total: 40%
Final Exam	total: 50%

Petitions: First-year Office.

Lecture Schedule

Section	Monday	Tuesday	Wednesday	Thursday	Friday
LEC01 & LEC02		15:00-16:00		15:00-16:00	15:00-16:00

- Lectures will be online until Jan 31 when we will (hopefully) transition to in person in **MYHAL 150**.
- Microsoft Teams links for lectures can be found on Quercus.
- Lecture content can be found on Quercus using the Kinsella & Goodfellow link.

Tutorial Schedule

- Tutorials will be online until Jan 31 when we will (hopefully) transition to in person.
- Zoom links for tutorials can be found on Quercus.

Week	Tut Content	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1 (Jan 10 - Jan 14)	**No Tutorial**					
Week 2 (Jan 17 - Jan 21)	**Tutorial 1**	**TUT0104** 11:00-12:00 MY 380	**TUT0106** 10:00-11:00 WB 130 **TUT0107** 11:00-12:00 GB 303 **TUT0108** 15:00-16:00 SS 1087	**TUT0102** 12:00-13:00 MY 380 **TUT0105** 16:00-17:00 MY 380		**TUT0101** 09:00-10:00 GB 304 **TUT0103** 13:00-14:00 WB 130

Click here for content.

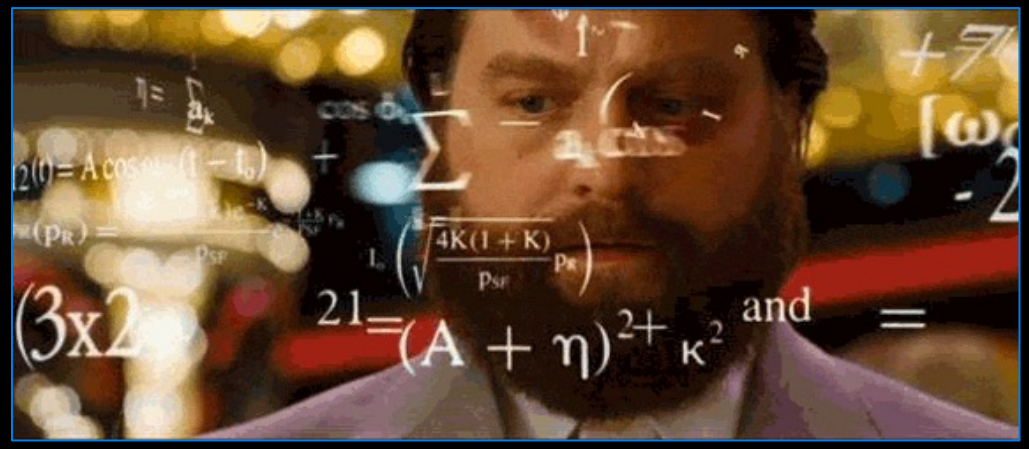
Lab Schedule

- Labs will be online until Jan 31 when we will (hopefully) transition to in person.
- Zoom links for labs can be found on Quercus.

Week	Lab Content	Monday	Tuesday	Wednesday	Thursday	Friday
Week 1 (Jan 10 - Jan 14)	**No Lab**			**Lab 1 Released 18:00**		
Week 2 (Jan 17 - Jan 21)	**Lab 1**	**PR0106** 09:00-11:00 MY 030 **PR0108** 09:00-11:00 GB 144	**PR0107** 09:00-11:00 MY 030 **PR0102** 16:00-18:00 GB 144	**PR0104** 09:00-11:00 GB 150 **PR0103** 13:00-15:00 GB 144 **PR0101** 16:00-18:00 GB 144 **Lab 2 Released 18:00**	**Lab 1 Due 23:00**	**PR0105** 11:00-13:00 WB 255

Click here for content.

Tips for Success



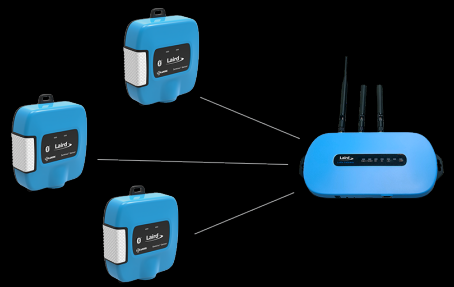
- Do not wait until the last minute.
- Work Together (except during the test/exam):
  - Synthesis
  - Application
  - Evaluation
  - Explanation
- Work Smart (effort doesn't necessarily equal progress).
- Time Management.
- Know when (and how) to ask for help.

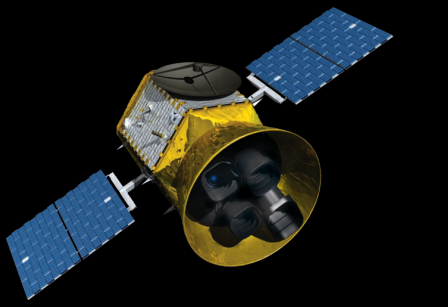
What is this course all about?

- Learn the **fundamentals** of programming.
- **Programming as a tool** used in engineering.
- **Engineering design** through programming.

Why Programming?

StartUp HERE





Why Programming?

#DISRUPTMINING
PRESENTED BY GOLDCORP — CO-HOSTED BY KPMG

KORE GEOSYSTEMS
$1,000,000 Investment.

- Computers are everywhere:
  - Learn to interact with them.
  - Simplifies our jobs.
- Entrepreneurial opportunities ($$$).
- Necessary for engineering jobs.
- Research and development.
- Because it's fun!

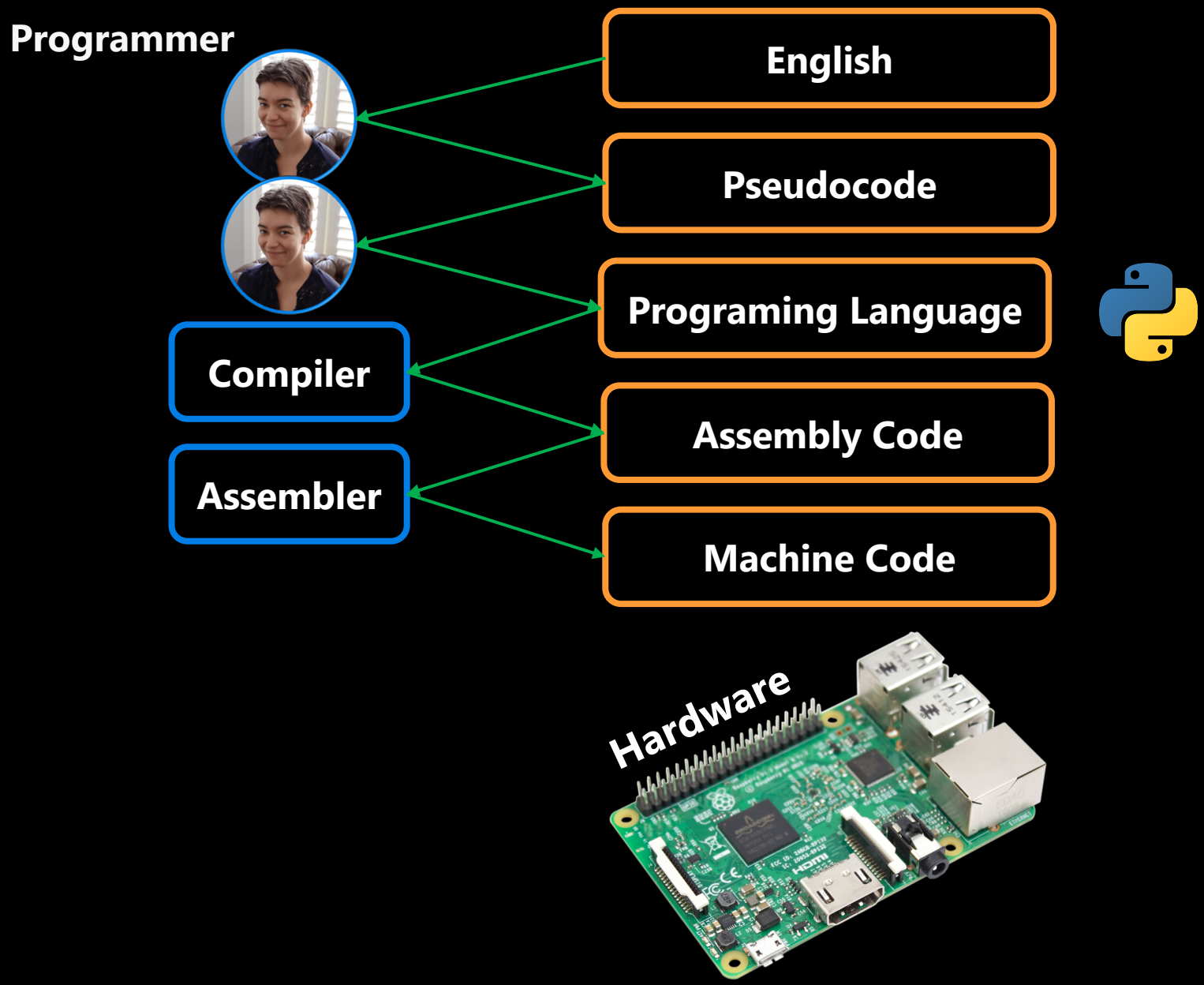
What is Programming?

- A way of telling a computer what to do.
- A computer can't infer (…yet).
  - Need to tell a computer every single step it needs to do in a language it can understand.
  - How would you request an egg for breakfast to a chef and to a computer/robot?

- **To a Chef**
  1. Sunny-side up, please!

- **To a Computer**
  1. "Turn on stove"
  2. "Take out pan"
  3. "Take one egg out of fridge"
  4. "Crack egg"
  5. "Pour egg into pan"
  6. "Wait 5 minutes"

How to Program a Computer.



Why Python?

- High-level language making it more like a readable, human language than other low-level languages.
- Simple and clear syntax.
- Large open-source community.
- Used by Google, Firefox, Dropbox, Youtube, Instagram, Yelp, NASA, CIA, etc.
- The Artificial Intelligence (AI) community overwhelmingly uses Python.

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Java

Lower-Level

```
public class HelloWorld
{
      public static void main(String[ ] args)
      {
            system.out.println("Hello World!");
      }
}
```

python

Higher-Level

```
print("Hello World!")
```

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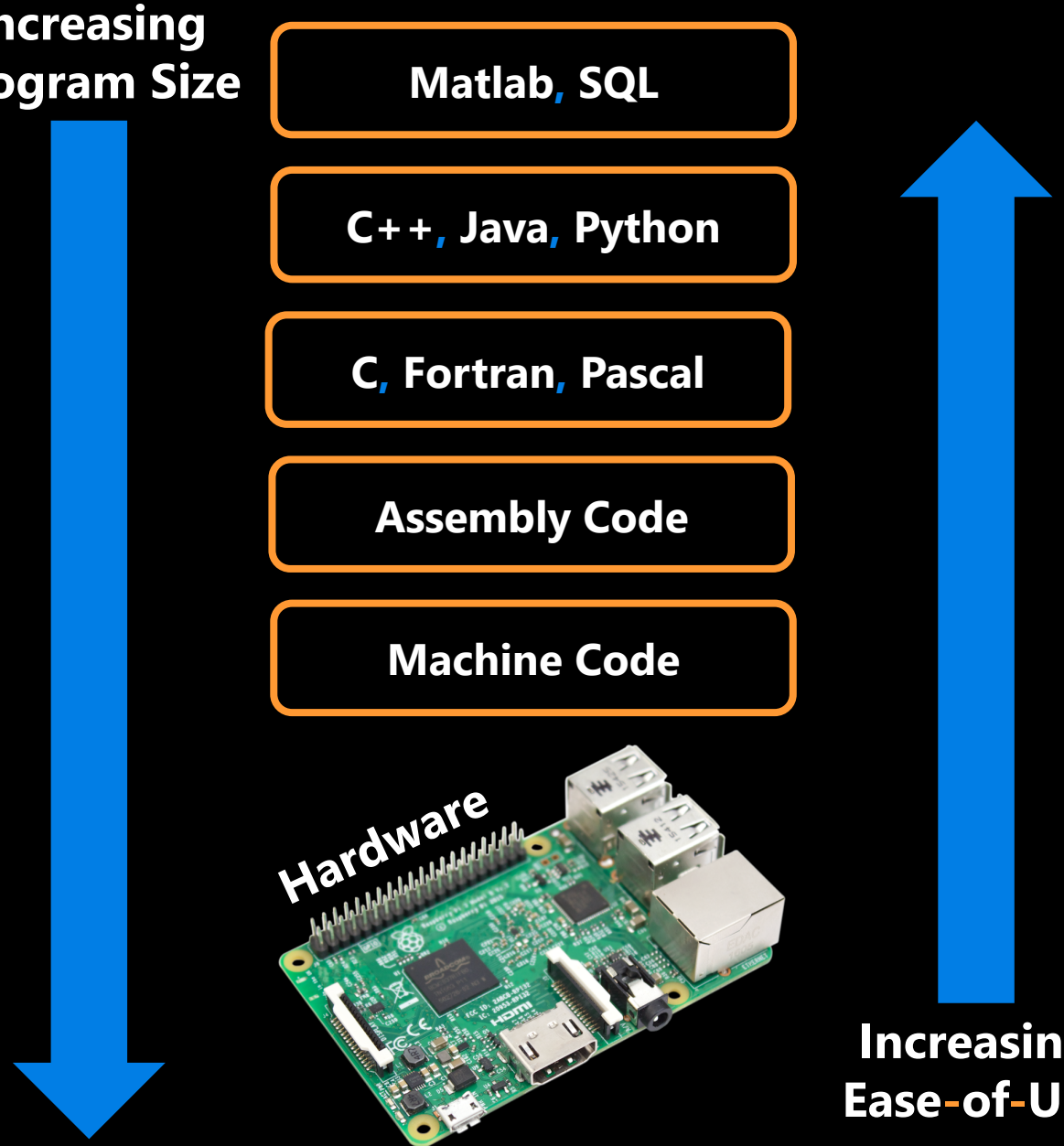

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python

```
if x > 10:
    print("x is greater than 10")
```

You don't know Python.
Can you figure out what this code does?

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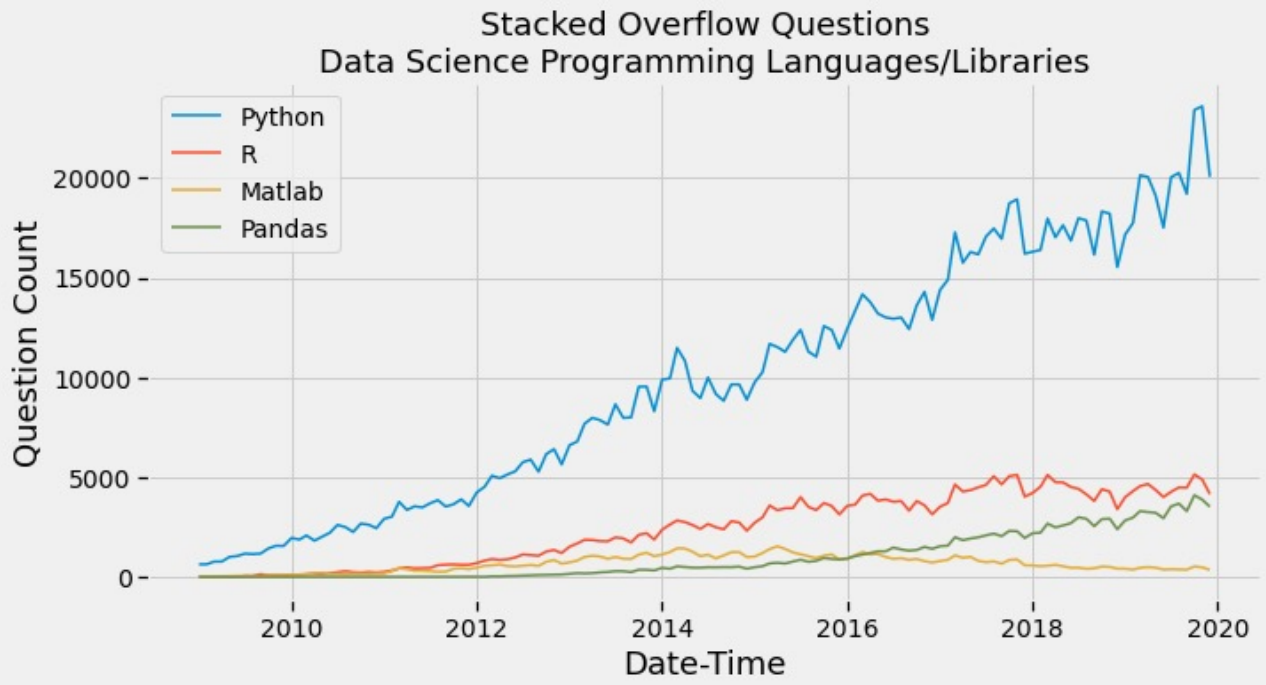

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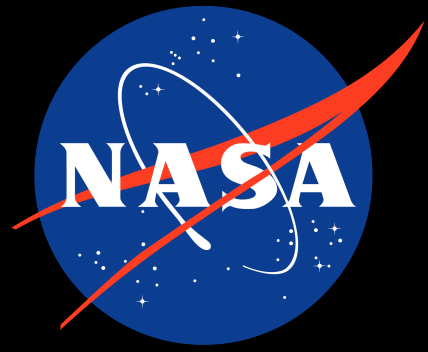

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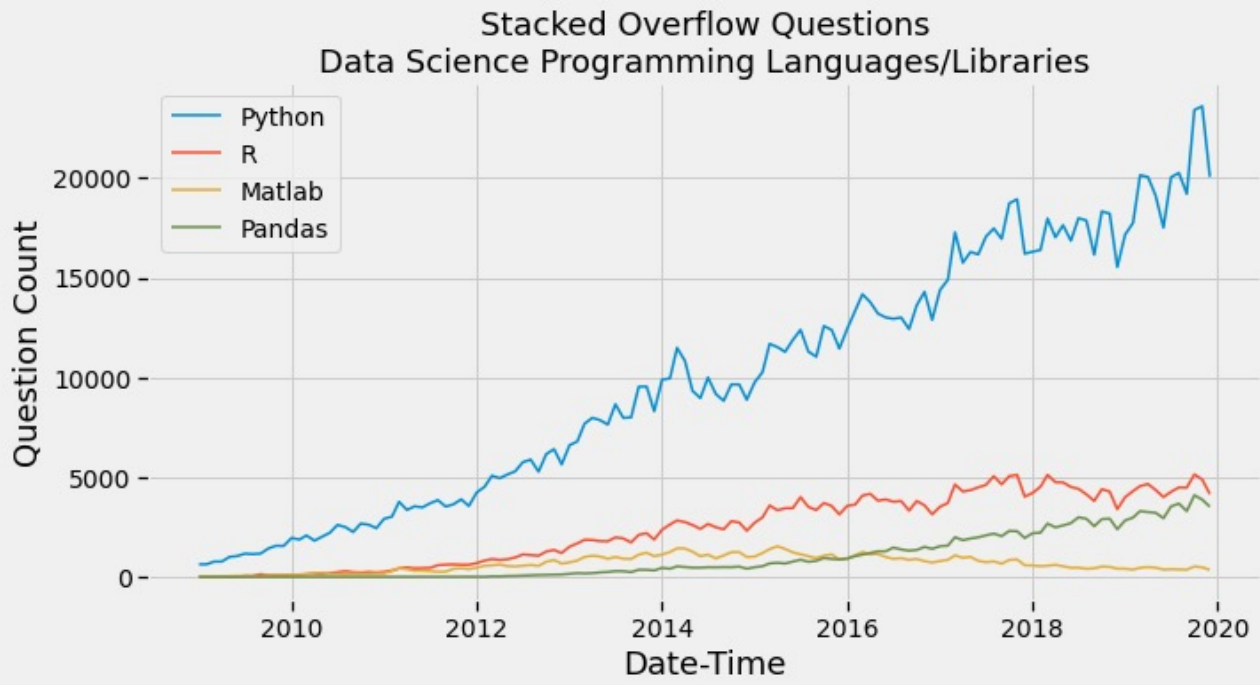


Why Engineers?

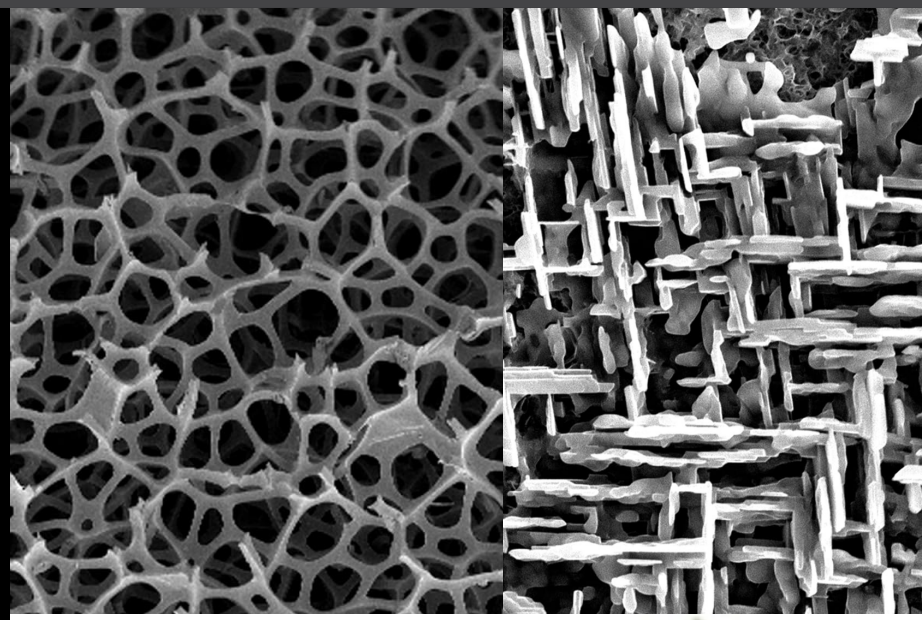
- Ok, so we've explained why coding is important and why we're learning to code in Python.
- **BUT**, you're all engineers, right?
  - Mechanical
  - Materials
  - Civil
  - Chemical
  - Mineral
- Why do these kinds of engineers need to know how to code?

Mechanical Engineers

- Design Airplanes
- Micro Fluid Systems
- Automotive Engines
- Hydraulic Dams

Materials Engineers

- Biomaterials
- Design of Materials
- Manufacturing with Materials
- Sustainable Materials Processing

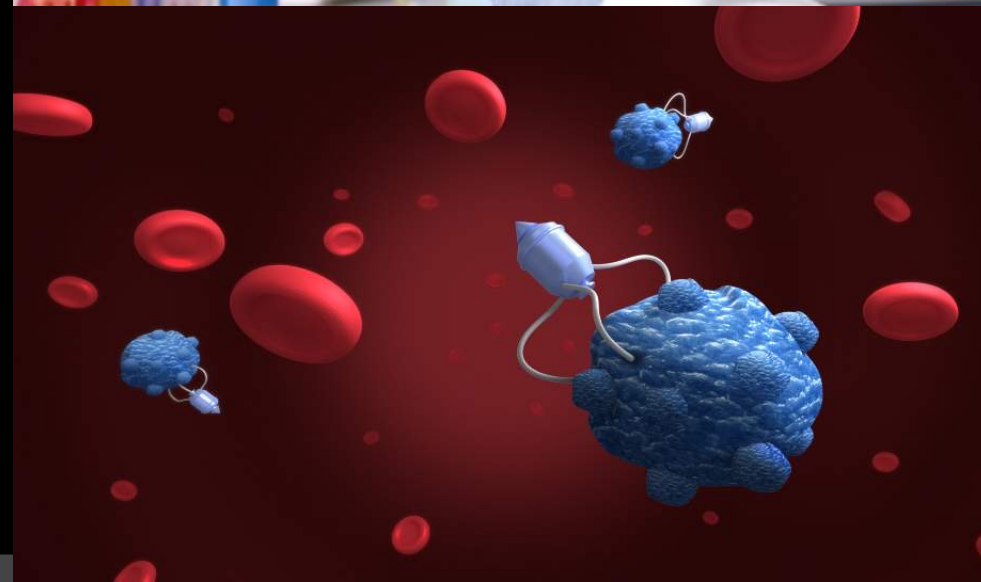


Civil Engineers

- Design Buildings
- Test Concrete
- Manage Water Supply System
- Design Bridges

Chemical Engineers

- Chemical Manufacturing Processes
- Petroleum Extraction
- Nanotechnology
- Manufacturing Computer Components

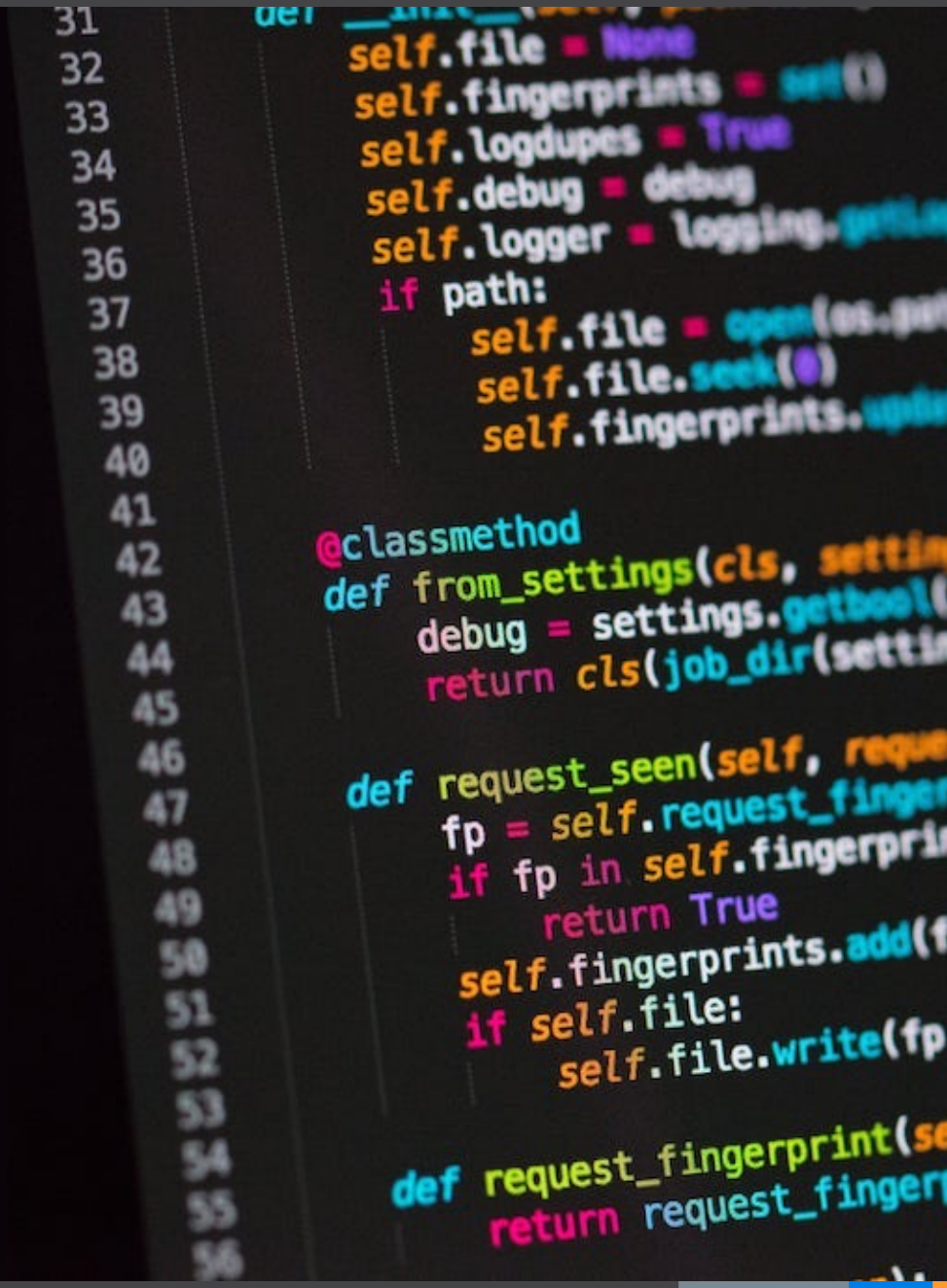


Mineral Engineers

- Mine Design
- Mineral Processing
- Mineral Exploration
- Mining Finance
- Mineral Extraction

Why Engineers?

- Again, why do engineers need to know how to code?
- In the 20th century, engineers didn't need to know how to code.
- In the 21th century, coding is an **essential skill** and any engineer without solid coding abilities will be at a major disadvantage.

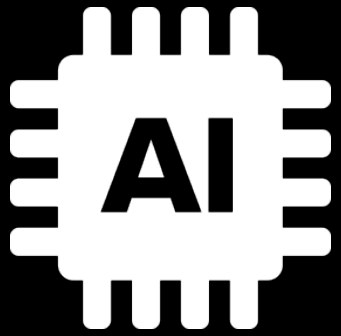


Why Engineers?

- Five technology trends have changed the game for engineers.

The Cloud

Cheap Sensors



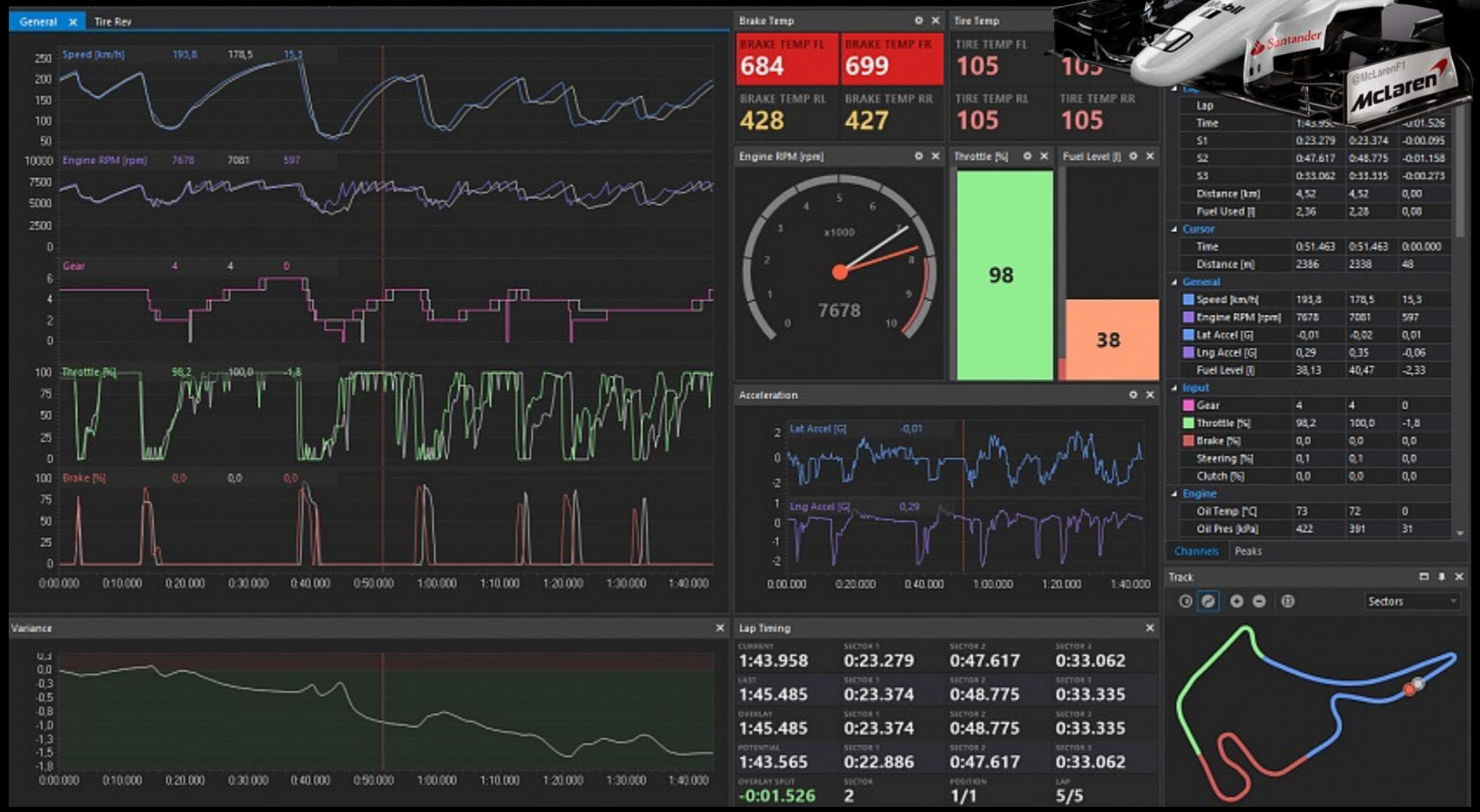
Artificial Intelligence

Big Data

The Internet Of Things

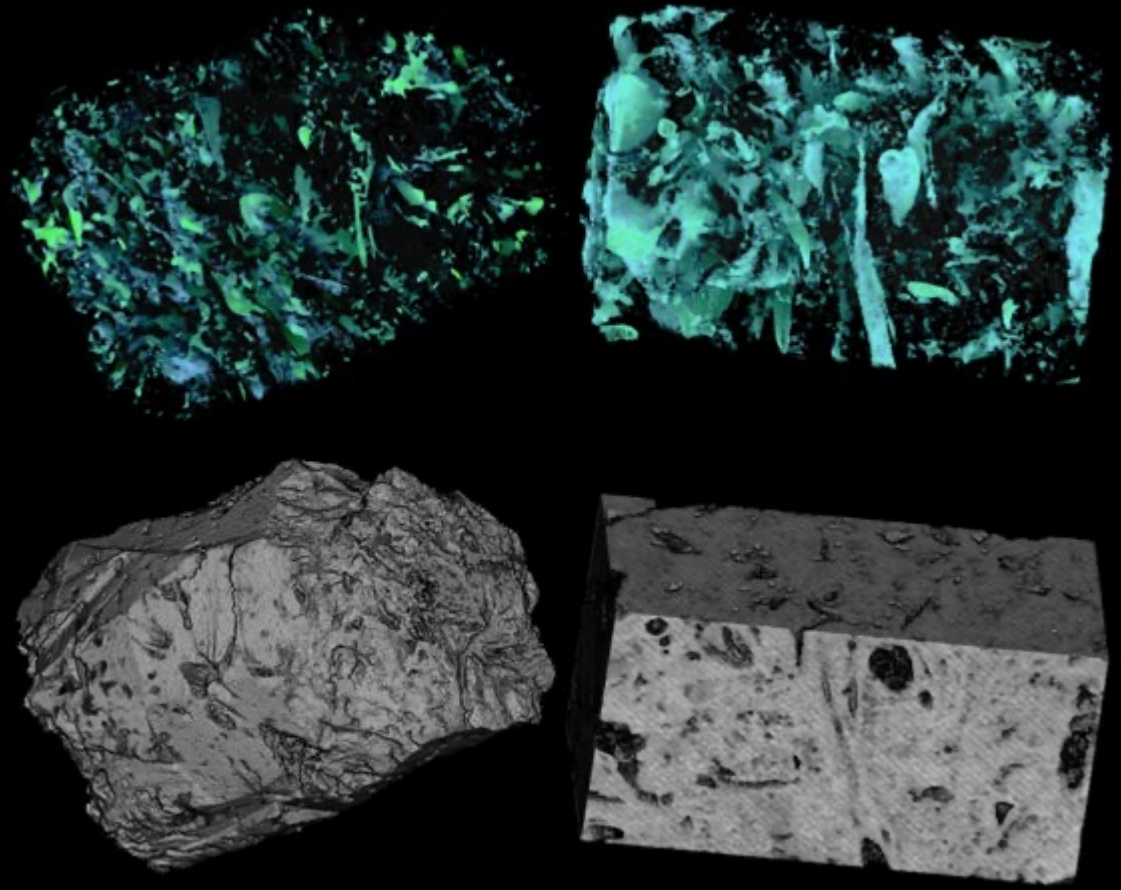
Mechanical Engineers

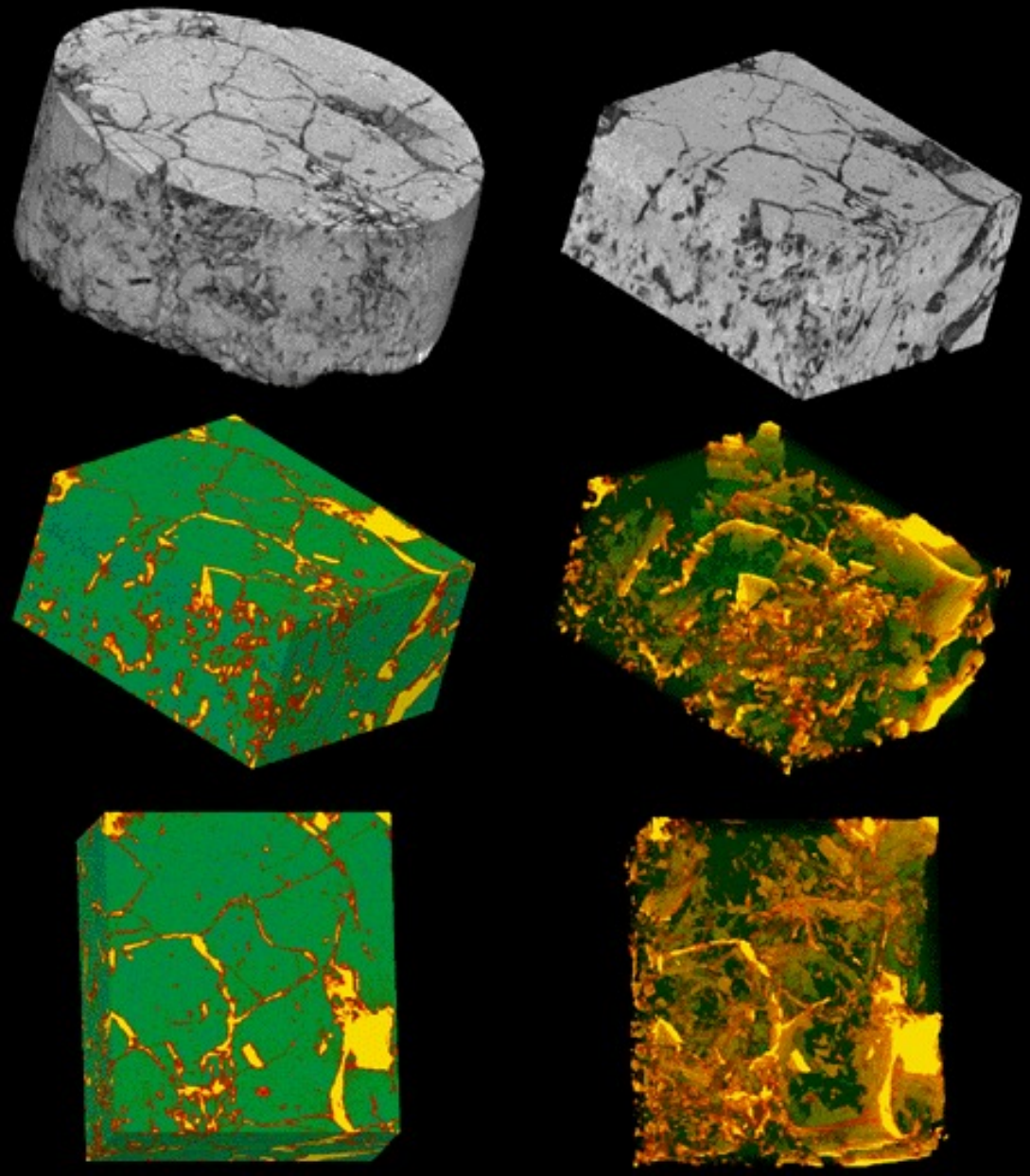
Realtime Diagnostics & Tuning



Materials Engineers

Digital Image Analysis of Material Microstructure



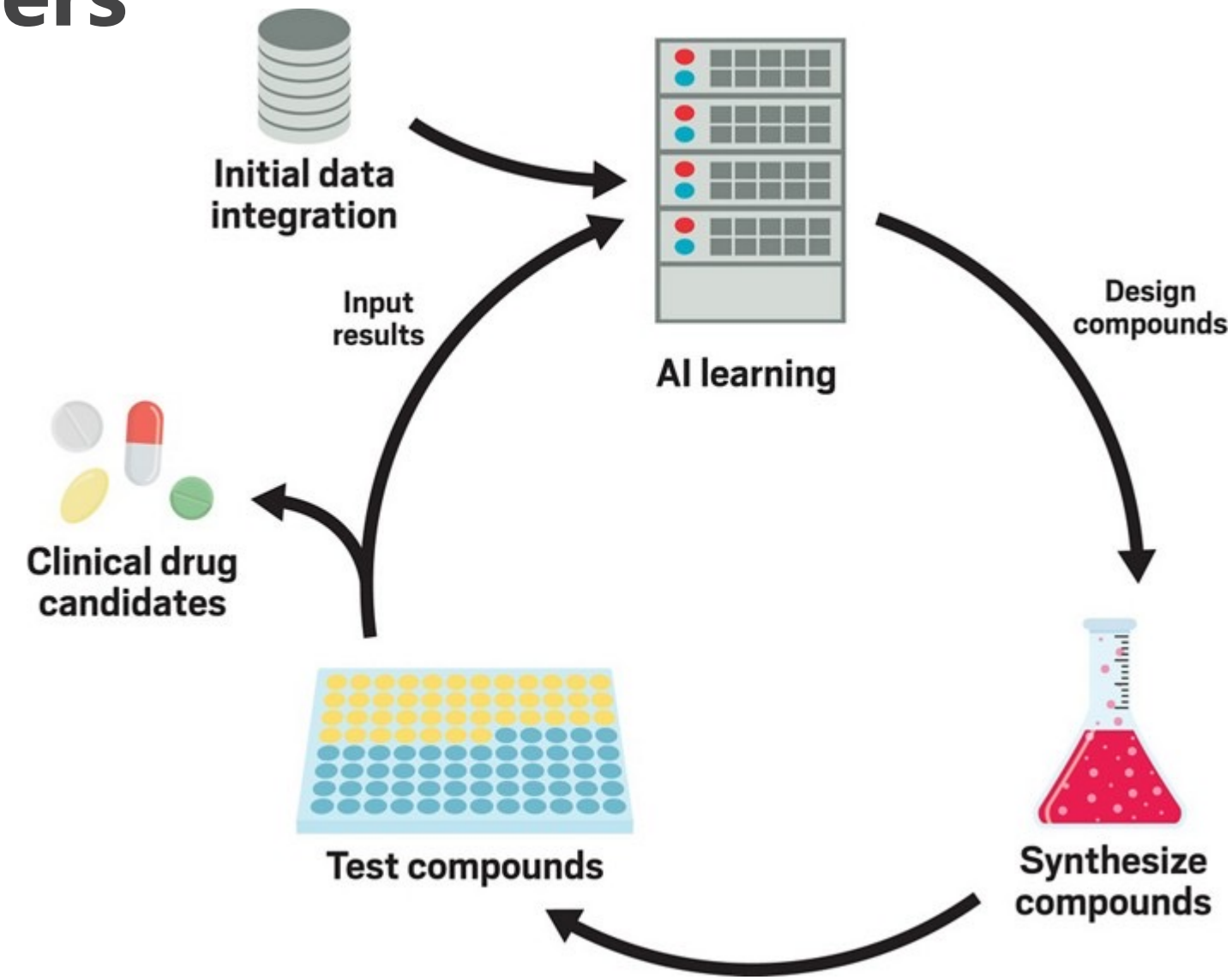


Civil Engineers

Urban Transportation Disrupted

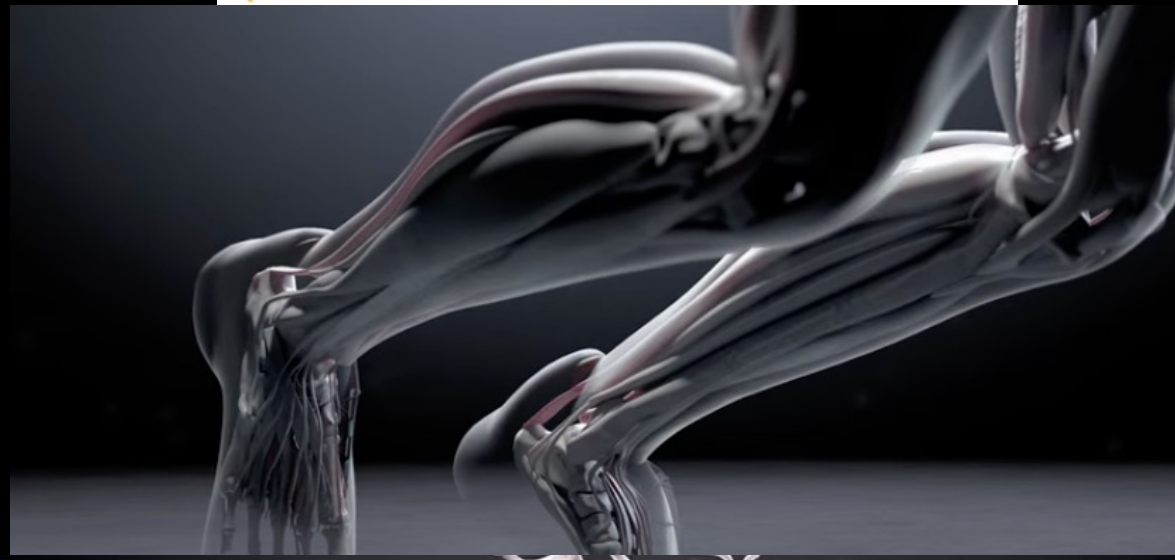
Chemical Engineers

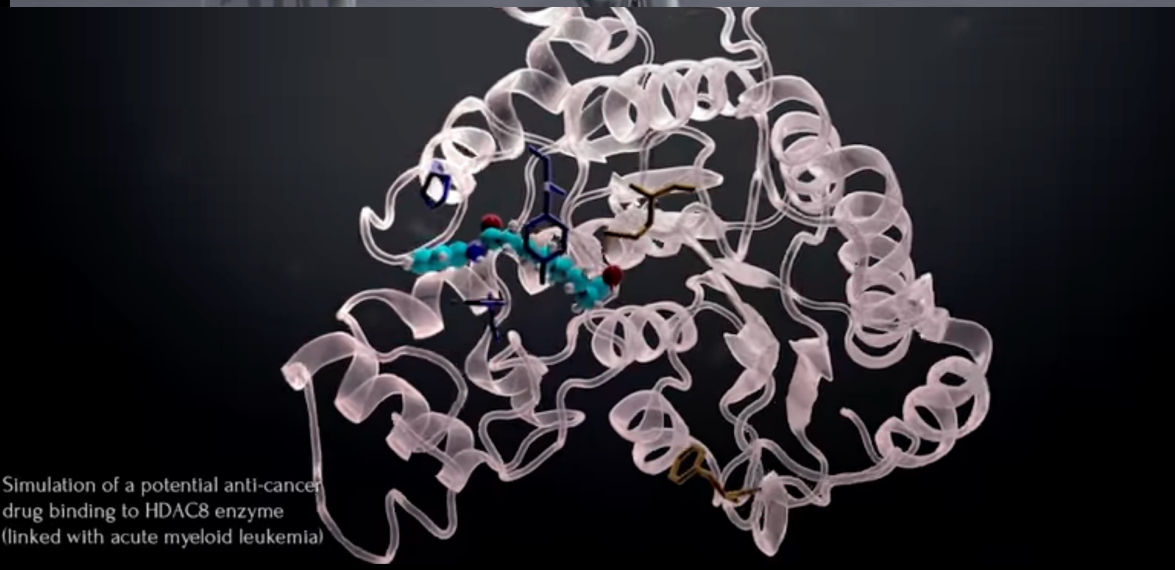
Synthesizing new compounds



Sci-fi Inspiration

CompBioMed





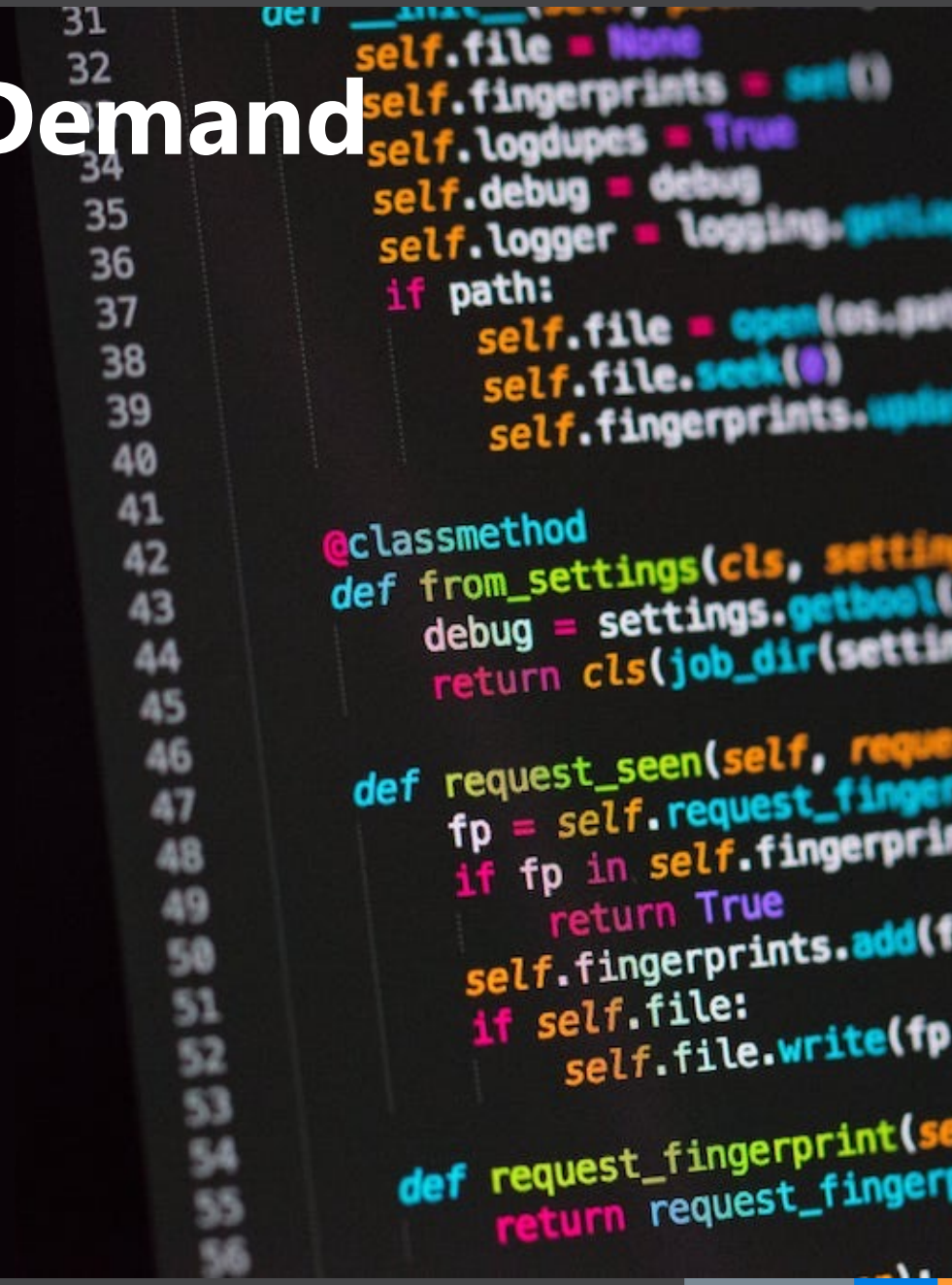
Simulation of a potential anti-cancer drug binding to HDAC8 enzyme (linked with acute myeloid leukemia)

Mineral Engineers

Semi-Autonomous Mines

Programming Skills Are In Demand

- According to the *Developer Survey by StackOverflow*, Python was one of the most in-demand technologies of 2018, 2019, 2020, and 2021.
- As of 2021, it is ranked as the world's 2nd most popular programming language among professional software developers as well as the first most wanted programming language.



One of the reasons for choosing Engineering!

- Finally! A course that isn't Chem, Bio, Physics, or Math
- This (as well as your engineering design course) is what separates you from many other sciences
  - And makes you **MUCH** more valuable….

Programmer


What my friends think I do


What my mom thinks I do


What society thinks I do


What my boss thinks I do


What I think I do


What I actually do

APS106

UNIVERSITY OF TORONTO

introduction.

Week 1 | Lecture 1 (1.1)

if nothing else, write #cleancode