SURGE

Science Unleashed

Discover R

Welcome to Discover R!

Introducing our teaching team:

Hayam Mahmoud-Ahmed

Simon Leger

Aaron Newman

Danny Godfrey

Jordan Gardiner

Murwan Bashir

Equity, Diversity, & Inclusion

SURGE is a safe space where everyone should feel welcome and included, free to pursue opportunities, and free express divergent opinions in the spirit of productive academic exchange.

Recognition of Mi’kmaq Territory

Dalhousie University is located in Mi’kma’ki, the ancestral and unceded territory of the Mi’kmaq. We are all Treaty people.

Code of Conduct

In addition to Dalhousie's Code of Student Conduct, in Discover Coding we employ the Carpentries' Code of Conduct:

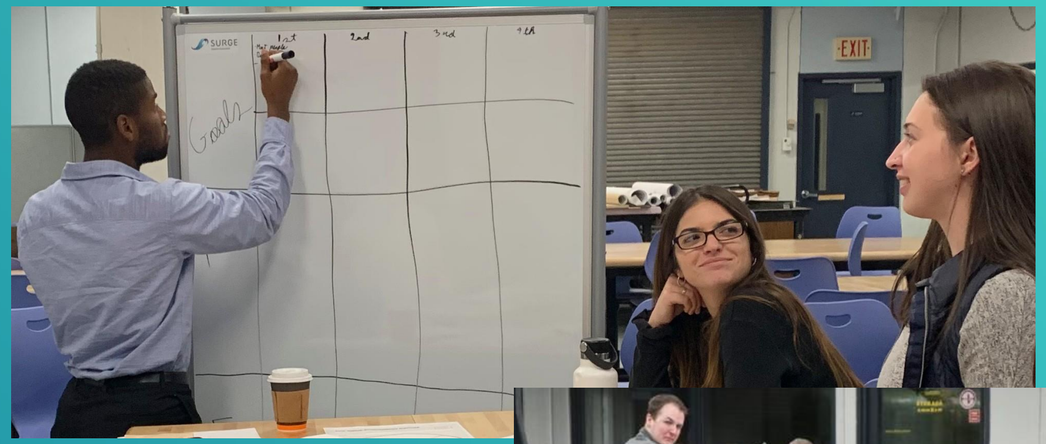
- Use welcoming and inclusive language
- Be respectful of different viewpoints and experiences
- Gracefully accept constructive criticism
- Focus on what is best for the community
- Show courtesy and respect towards other community members

https://docs.carpentries.org/topic_folders/policies/code-of-conduct.html

SURGE

What is SURGE?

- One of the NS innovation sandboxes
- Provides experiences in:
  - Applying science to real world problems
  - Creativity, innovation, design thinking
  - Entrepreneurship
  - Leadership

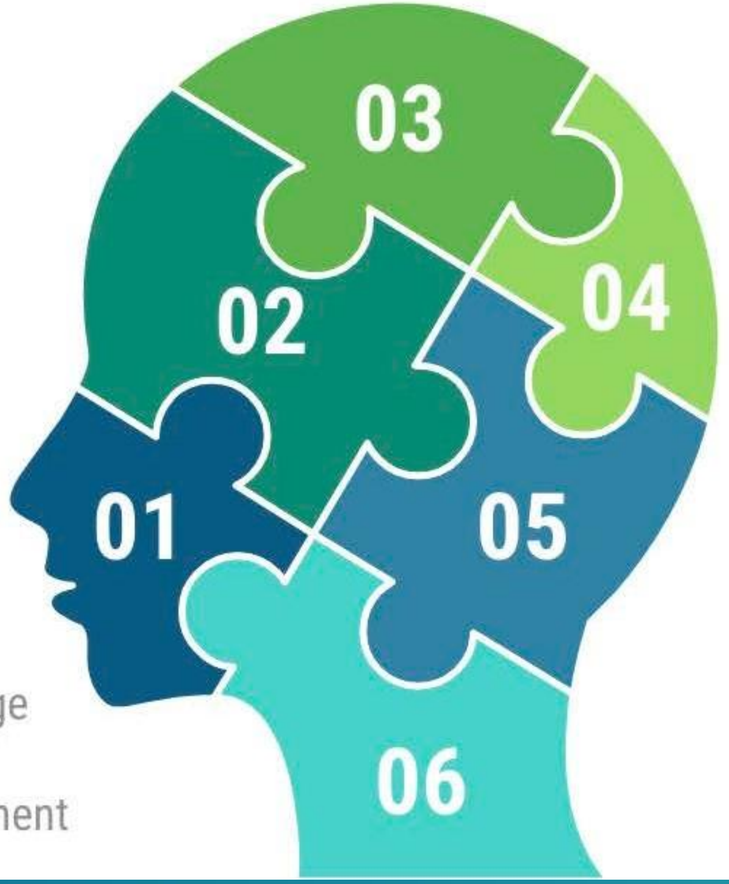


What We Teach

Problem definition
Needs finding
Customer discovery
Business models

Finding a Solution
Human-centered design
Ideation
Brainstorming

Technical understanding
Scientific & technical knowledge
Intellectual property
Technology readiness assessment



Soft Skills
Working in teams
Networking
Professionalism

Personal development
Self-driven learning
Pitching an idea

Business knowledge
Corporate ethics
Corporate structuring
Finance

About Discover R

Discover R: Our Approach

Goal: teach people working in science how to use R as a tool for working with data:

- learning the fundamentals of R
- using R for data science, including:
  - reading data
  - manipulating/processing data (e.g., extracting specific data, splitting data according to variables, applying functions, combining data)
  - exploratory data analysis
  - basic statistical analyses of data sets

What is data science?

- "…an umbrella term to describe the entire complex and multistep processes used to extract value from data." (Wing, 2019)
- The ability to "bring structure to large quantities of formless data and make analysis possible" (Davenport & Patil, 2012, p.73)
- Storage, manipulation, visualization, filtering, and preparation of data, as well as statistics to derive conclusions from existing data, and machine learning to make predictions from data that will generalize to other data
- Also the "back end": engineering, hardware, databases to support data science

Learning Objectives

Upon completing this workshop, you will be able to:

- understand and use variables
- work with common R data types
- import datasets and perform basic preprocessing
- obtain basic summary statistics from data files
- manipulate and extract data from datasets
- visualize data using R gglot2 package, and customize these plots

Origins

- **The Carpentries** (carpentries.org) teaches foundational coding, and data science skills to researchers worldwide.
  - Provide an open-source set of workshops, under Software Carpentry, Data Carpentry, and Library Carpentry
  - A diverse, global community that includes Instructors, helpers, Trainers, Maintainers, Mentors, community champions, member organisations, supporters, workshop organisers, staff and more
- **Discover R** is based on Library Carpentries' **Introduction to R** workshop
  - Adapted for our platform and based on our experience
  - Uses open-source datasets

Datasets in this workshop

- University of Houston–Clear Lake Integrated Library System in 2018
- Life expectancy data by country
- Other datasets from the UCI Machine Learning Repository
    - Open source, accessible, relatively easy to understand

Tools

- Open-source programming language and cross-platform
- Robert Gentleman and Ross Ihaka from the University of Auckland in 1995
- “a language for data analysis and graphics”
- Under continuous development by large community
- Widely used in science and data science

- Great for reproducibility
- Interdisciplinary and extensible
- Works on data of all shapes and sizes
- Large and welcoming community

TIOBE Programming Community Index

- Indicator of the popularity of programming languages.
- Ratings based on the number of skilled engineers world-wide, courses and third party vendors.
- Popular search engines such as Google, Bing, Yahoo!, Wikipedia, Amazon, YouTube and Baidu are used to calculate the ratings
- https://www.tiobe.com/tiobe-index/

Feb 2021	Feb 2020	Change	Programming Language	Ratings
1	2	↑	C	16.34%
2	1	↓	Java	11.29%
3	3		Python	10.86%
4	4		C++	6.88%
5	5		C#	4.44%
6	6		Visual Basic	4.33%
7	7		JavaScript	2.27%
8	8		PHP	1.75%
9	9		SQL	1.72%
10	12	↑	Assembly language	1.65%
11	13	↑	R	1.56%
12	26	⇈	Groovy	1.50%
13	11	↓	Go	1.28%
14	15	↑	Ruby	1.23%
15	10	⇊	Swift	1.13%
16	16		MATLAB	1.06%
17	18	↑	Delphi/Object Pascal	1.02%
18	22	⇈	Classic Visual Basic	1.01%
19	19		Perl	0.93%
20	20		Objective-C	0.89%

- A “notebook” environment for data science
- Code, output, and commentary all in one document
- Excellent for reproducible, open science

jupyter Notebook Example Last Checkpoint: a few seconds ago (autosaved)

Logout

File Edit View Insert Cell Kernel Widgets Help

Trusted Python 3

Run Code nbdiff

This is a Jupyter notebook file

This first cell is written in **markdown**, which allows *rich text formatting* including:

- bullet points
- numbered bullets

Headers

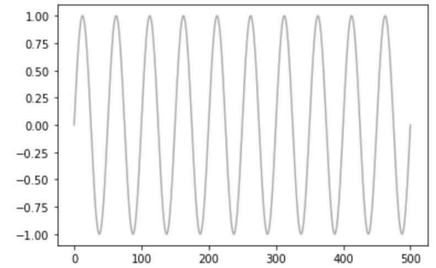
And even pictures of cats!

Below this cell is a Python code cell:

In [1]:
```
print("Hello world!")
```
```
Hello world!
```

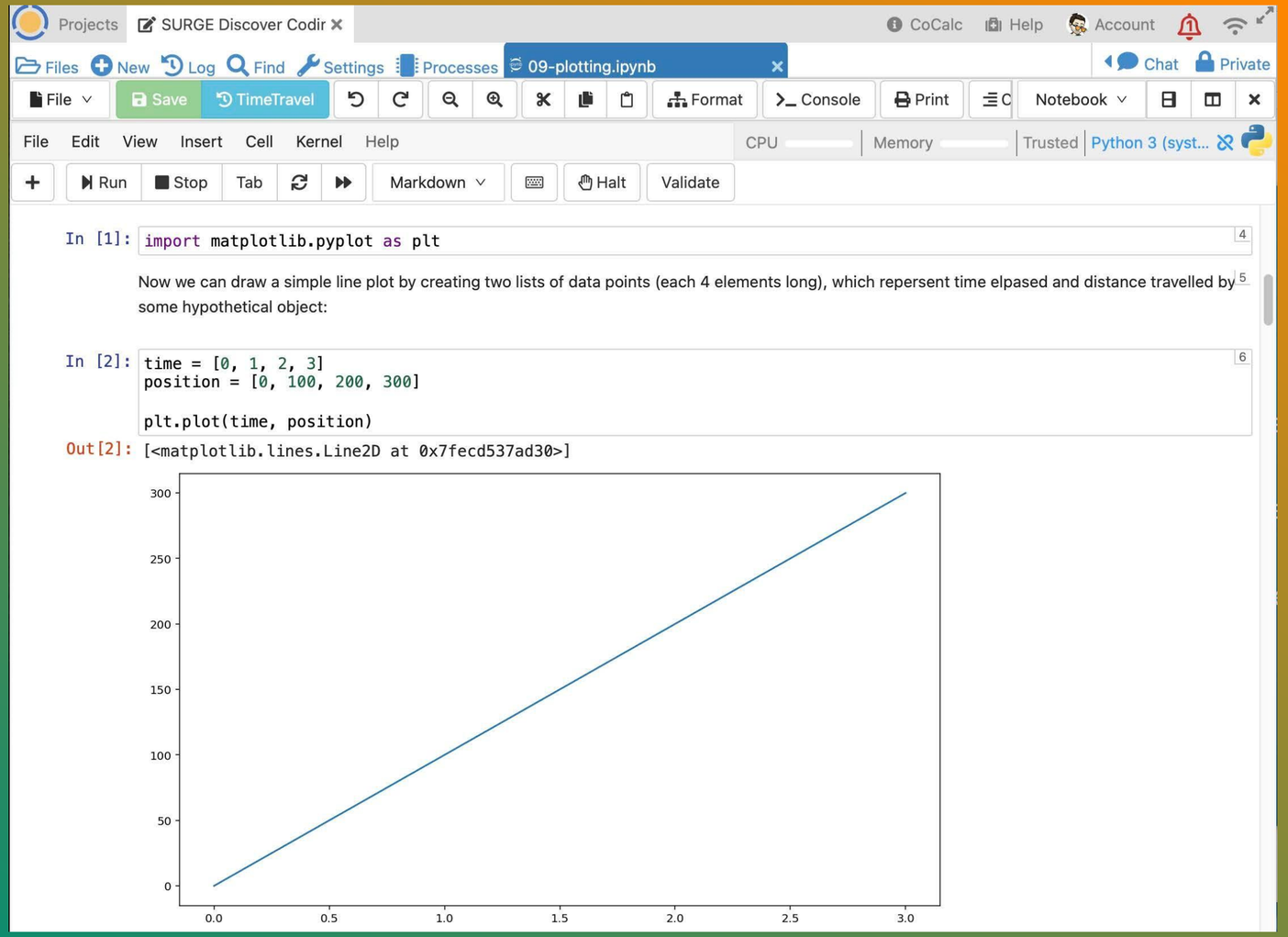
Here's some fancier code

In [8]:
```
import numpy as np
import matplotlib
import matplotlib.pyplot as plt

srate1 = 500
time_samp = 1 # sec
alpha = 10 # Hz

x1 = np.linspace(0, srate1, srate1*time_samp)

y1 = np.sin(alpha * 2*np.pi * x1 /srate1)

plt.plot(x1,y1, color='.67');
```



In [ ]:

- Cloud-based Jupyter environment
- Nothing to install
- Designed for teaching
- Teaching team and “jump in” and view your work to provide help



Workshop Mechanics

- We will be testing out things
- Thank you in advance for patience…☺
- Feedback is also greatly appreciated

- Section 1 : Before we start
- Section 2 : Introduction to R
- Section 3 : Starting with data
- Section 4 : Data transformation and preprocessing
- Section 5 : ggplot plotting
- Section 6 : Crash course in R Studio

Type code yourself

- Don’t cut and paste
- Learning is deeper if you type the code
  - Learn from your mistakes
  - Parse/analyze the code better

Getting Help

- **Helpers** are here to… help!
  - Type “HELP” into the chat
    - A helper will send you a direct message in the Zoom chat

- We will do regular **check-ins**
- **Ask the instructor**
  - Use the helpers for help with your code
  - Ask the instructor content/theory/conceptual questions
    - Raise hand (Zoom reaction) or post question in the chat
    - Ask during check-ins

Zoom Meeting

You are viewing Jordan Gardiner (she/her)'s screen

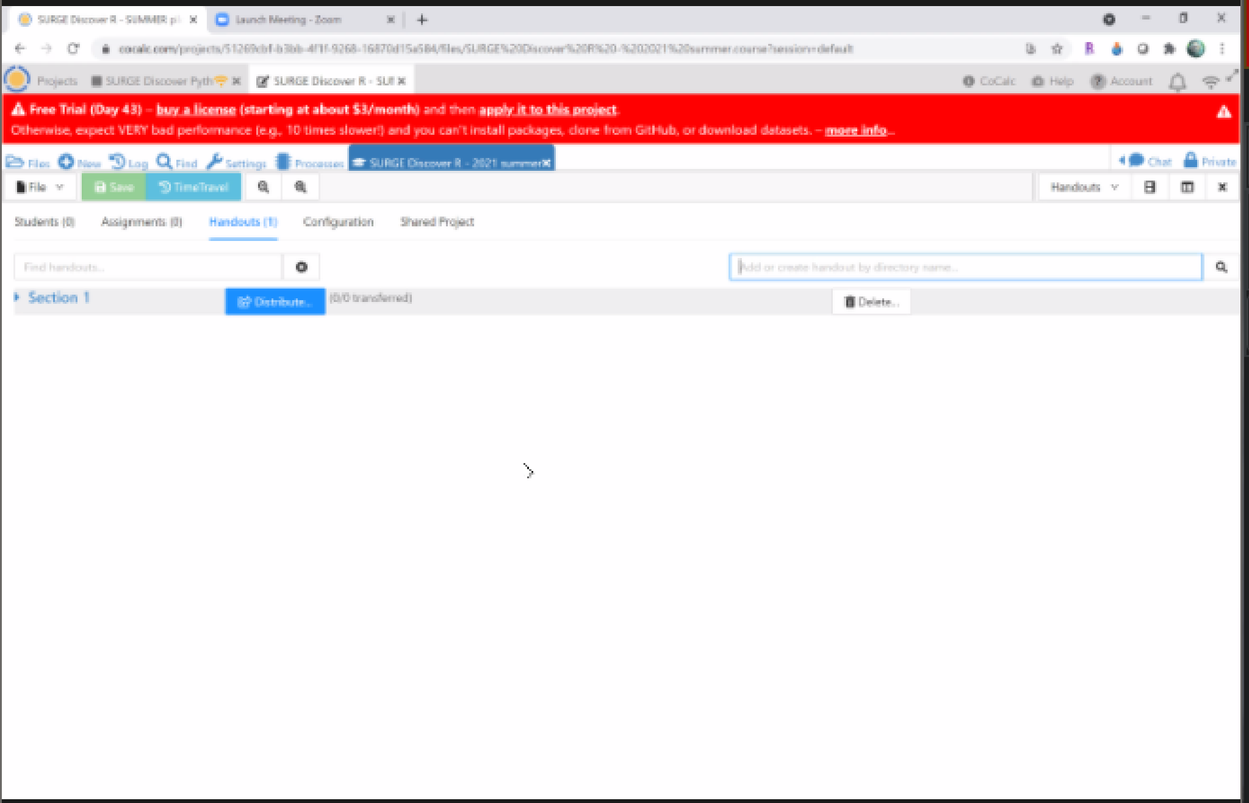
View Options

View

Hayam Mahmou...

Jordan Gardiner...

00:02:23



Mute | Stop Video | 2 Participants | Share Screen | More | Leave

cocalc.com/projects/51269cbf-b3bb-4f1...

Apps | Google | Ecosia | Google Scholar | Sci-Hub | Sign In | Other bookmarks

Projects | SURGE Discover R - SUI | CoCalc | Help | Account

Free Trial (Day 43) – **buy a license (starting at about $3/month)** and then **apply it to this project**.
Otherwise, expect VERY bad performance (e.g., 10 times slower!) and you can't install packages, clone from GitHub, or download datasets. – **more info**...

Files | New | Log | Find | Settings | Processes | Chat | Private

File | Notebook

CPU | Memory | Trusted | R (system-wide)

File Edit View Insert Cell Kernel Help

Run | Stop | Tab | Markdown | Validate

Introduction

Welcome to the SURGE Discover Coding R workshop! This workshop is aimed at people from science disciplines who have no previous experience with a programming language. We teach the basic of coding using Python, a very popular language used in science and data science. If you have programmed before, but are new to Python, you will also find this workshop useful, if perhaps a bit slow at times.

Our Approach

R This is not an introduction to computer science. The SURGE Discover Coding series aims to teach people working in science how to use Python as a tool for working with data. As such, our focus is on:

- learning the fundamentals of R
- learning the fundamentals of programming logic

Type here to search

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