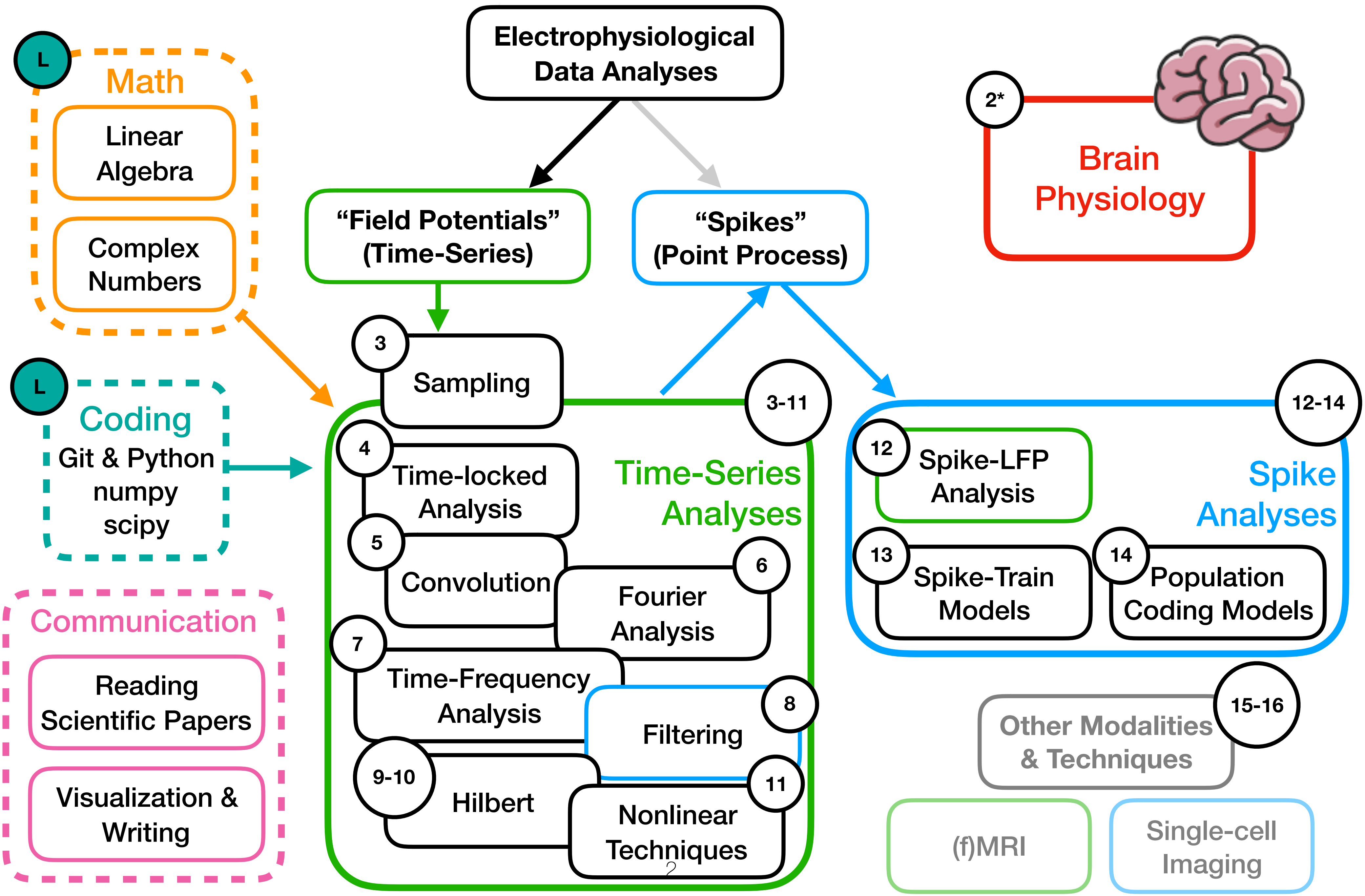
Math & Python Bootcamp

Lab 1

July 1, 2019

Course Outline: Road Map



1. Get (re)acquainted with GitHub & python
2. Vectors and dot product
3. Complex numbers

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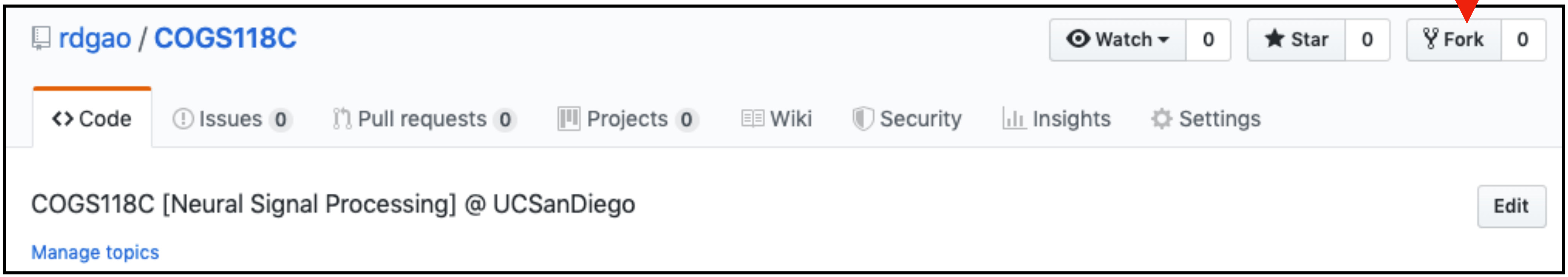
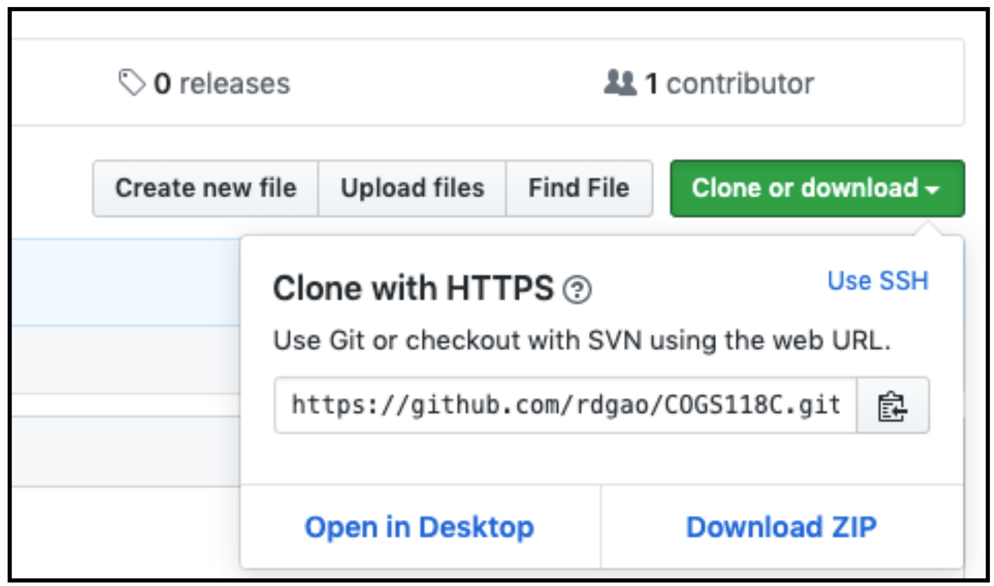
Fork & Clone Class Repo

https://github.com/rdgao/COGS118C



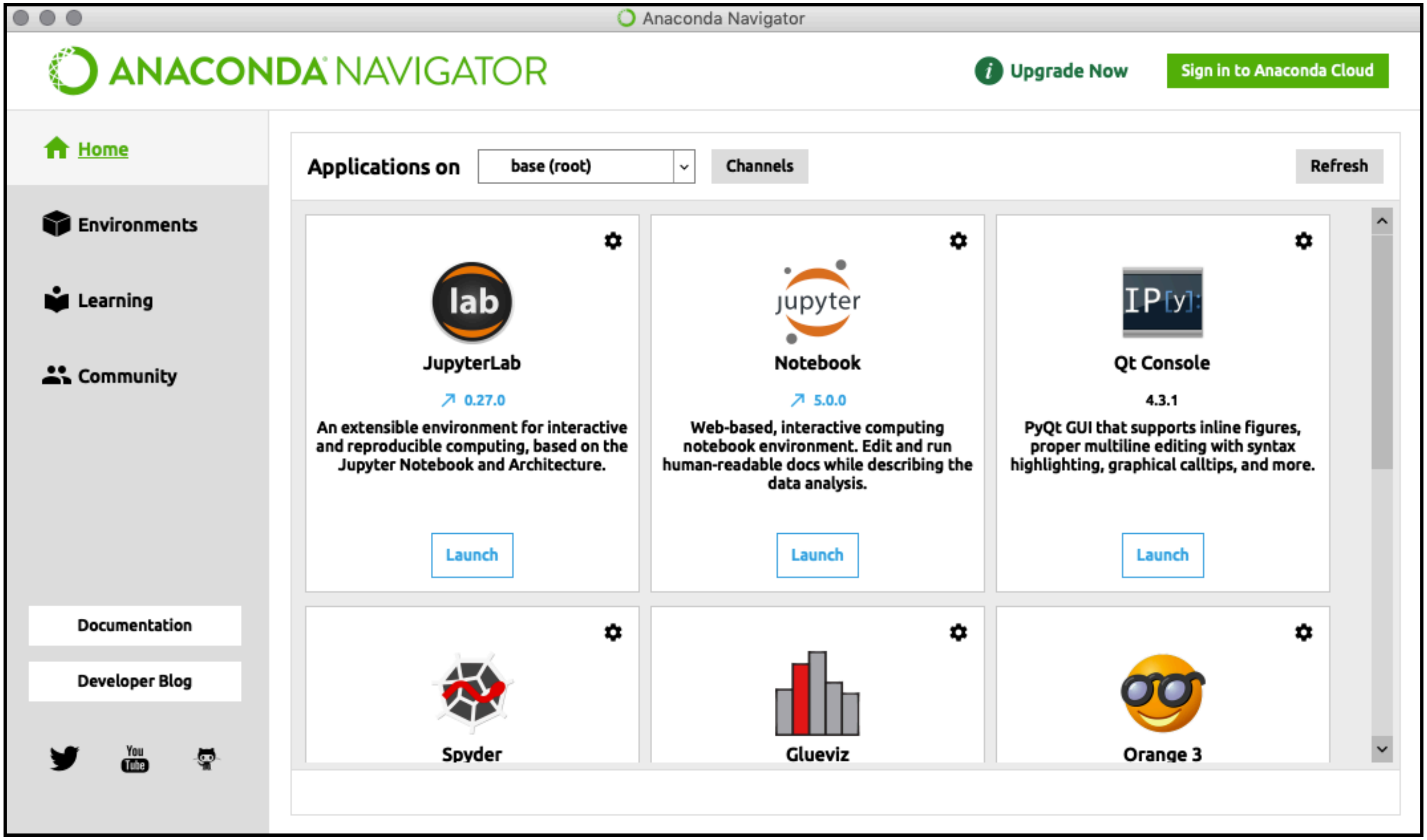
Now go to your GitHub account, where the forked repo should be, and clone a local version (on your laptop).

You can use git or GitHub Desktop

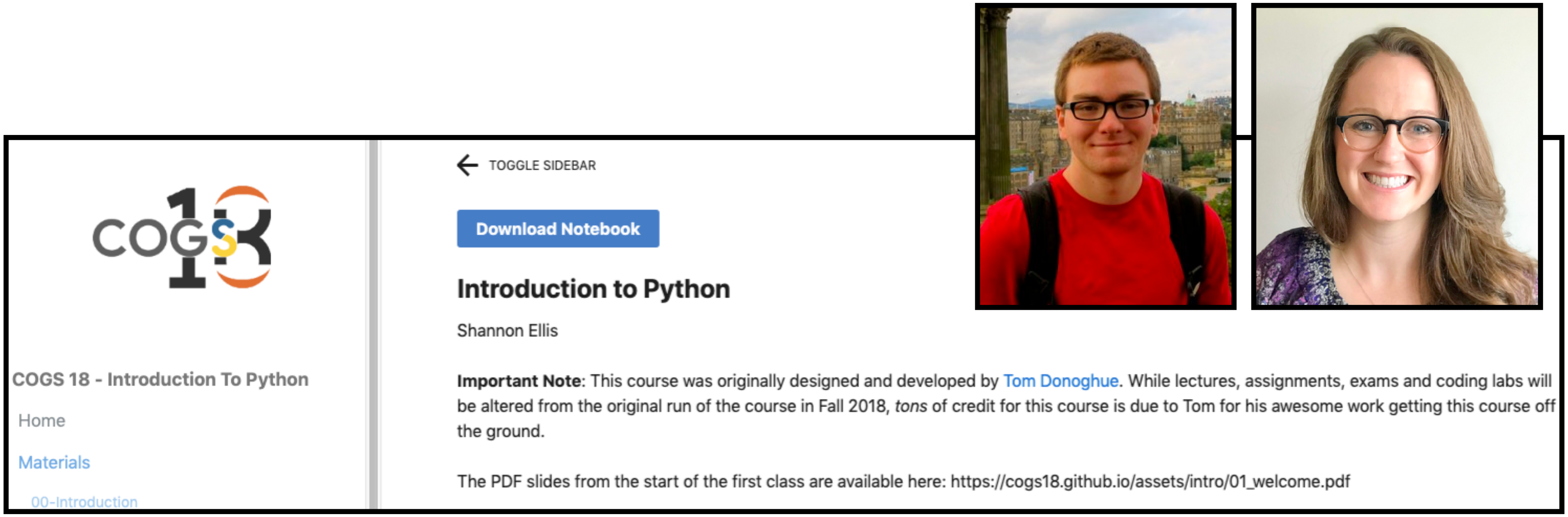


Open Jupyter Notebook

From **Anaconda Navigator**, or directly from Terminal (> jupyter notebook)



Some Basic Python Stuff



If you have not done any MATLAB or Python (or any) programming, or is feeling rusty with Python, please go to this course and complete up to (including) Lecture 11.

https://cogs18.github.io/materials/00-Introduction/

Download the notebooks, and try to answer the clicker questions before running the code to confirm your answers, and **experiment**!

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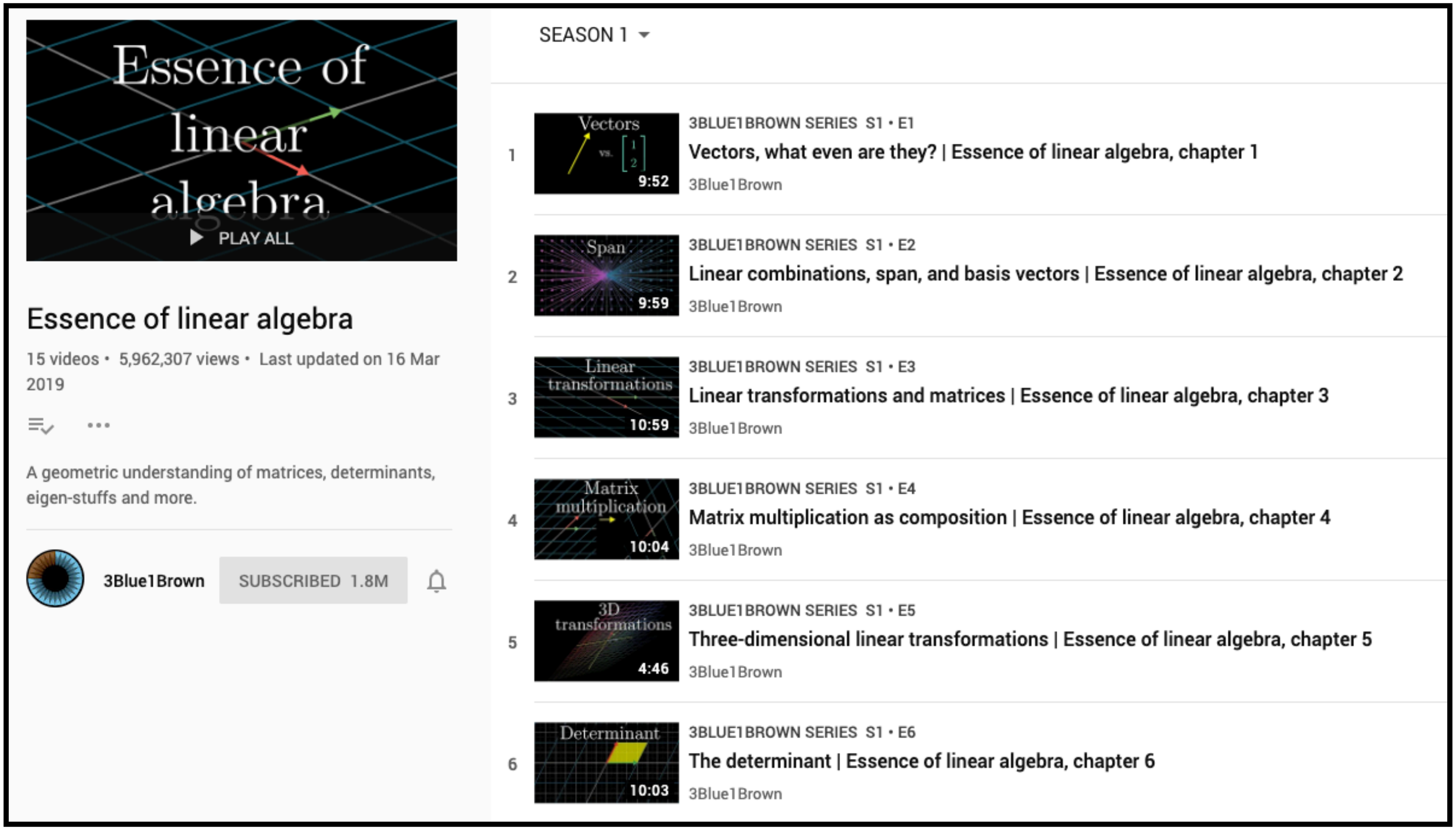
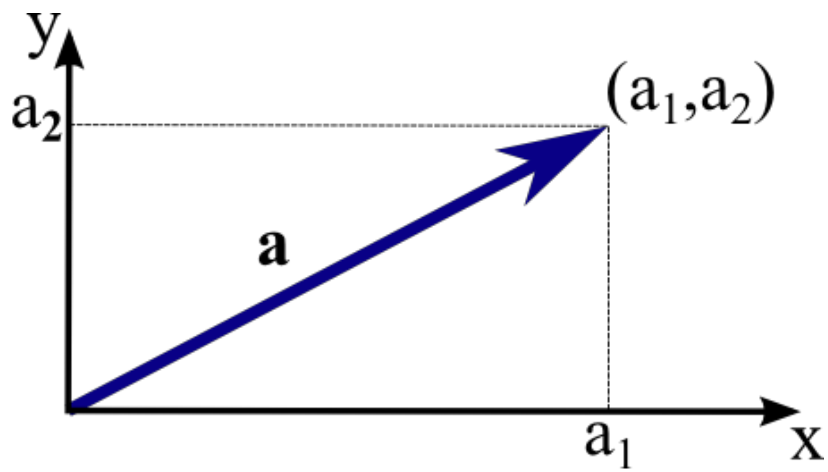
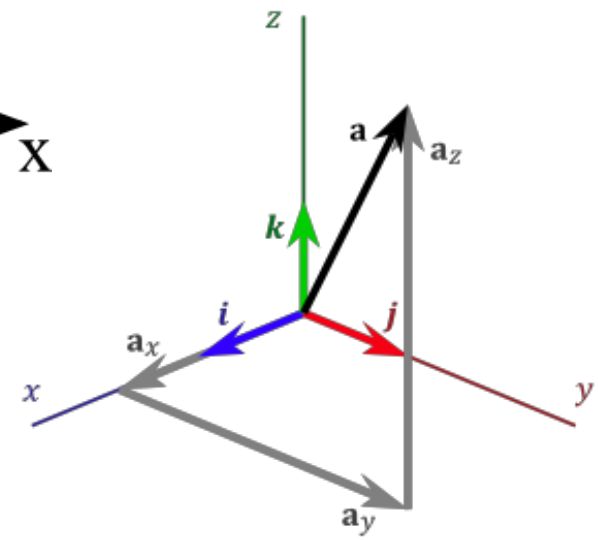
Vectors & Arrays



A vector is most intuitively thought about graphically.
It has a **direction** and a **magnitude**.

Can be in arbitrary number of dimensions.





Conveniently, in Python (and most other languages), an **N-dimensional vector** can be represented as a **length-N array.**

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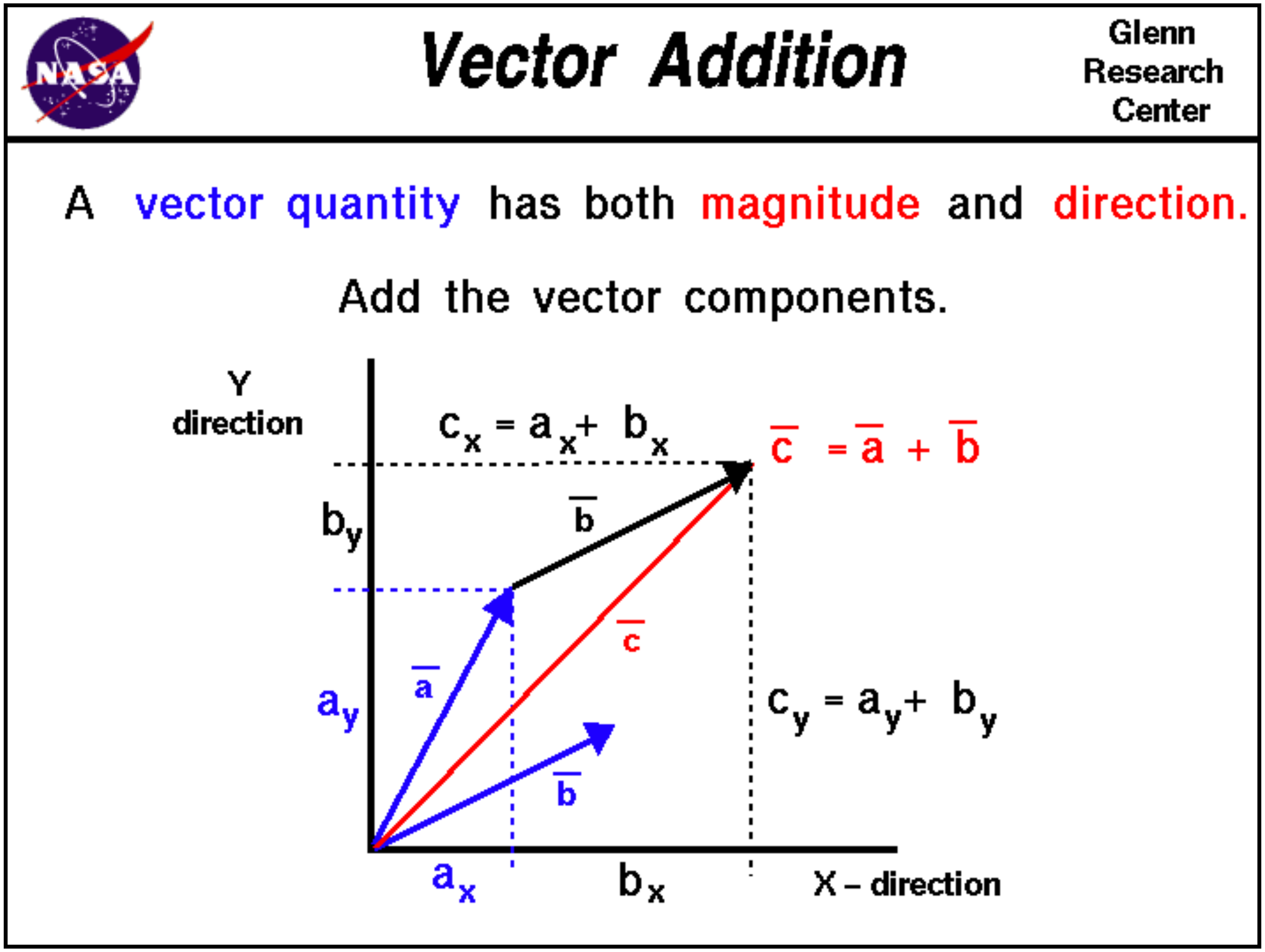
Operations between vectors (adding, multiplying, etc) are done element-wise.



Dot Product

Algebraic definition [edit]

The dot product of two vectors **a** = [a_1, a_2, …, a_n] and **b** = [b_1, b_2, …, b_n] is defined as:[1]

$$\mathbf{a} \cdot \mathbf{b} = \sum_{i=1}^{n} a_i b_i = a_1 b_1 + a_2 b_2 + \cdots + a_n b_n$$

where Σ denotes summation and n is the dimension of the vector space. For instance, in three-dimensional space, the dot product of vectors [1, 3, −5] and [4, −2, −1] is:

$$\begin{aligned}[1, 3, -5] \cdot [4, -2, -1] &= (1 \times 4) + (3 \times -2) + (-5 \times -1) \\ &= 4 - 6 + 5 \\ &= 3\end{aligned}$$

We’ll be using various forms of this. **A LOT**.

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Goals for Today

1. Get (re)acquainted with GitHub & python

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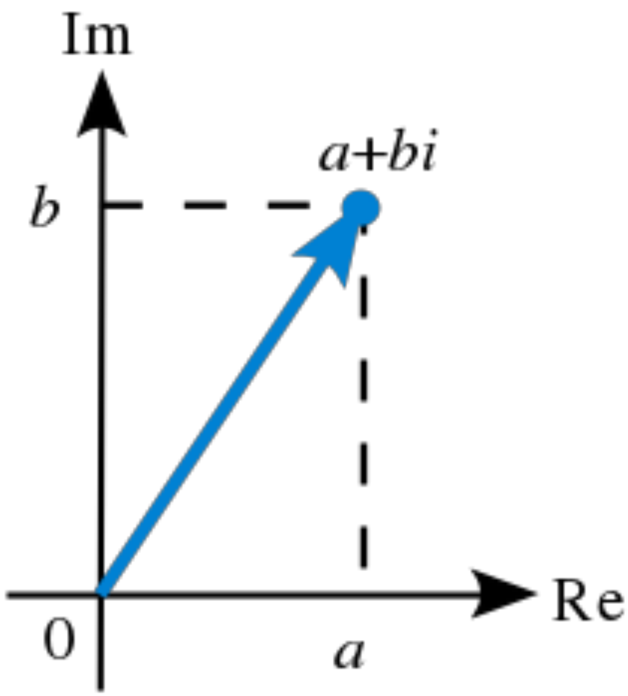
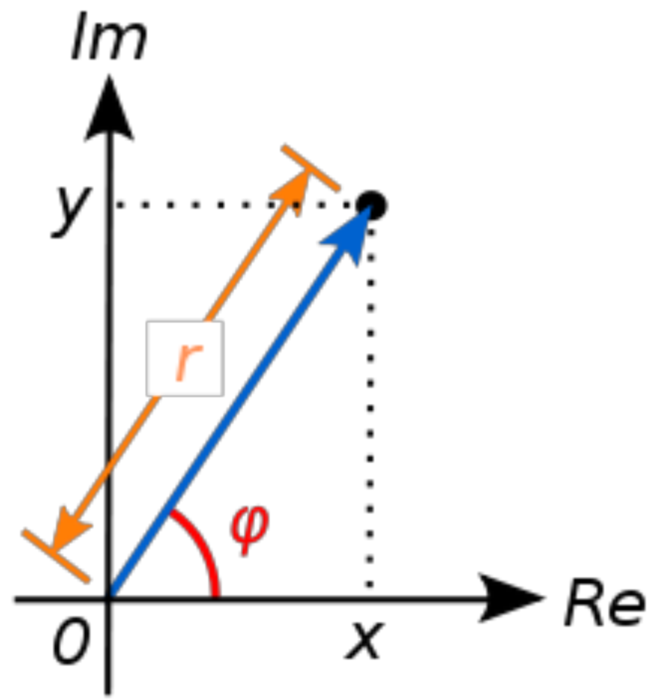


Rectangular Form



Polar Form