

About this course

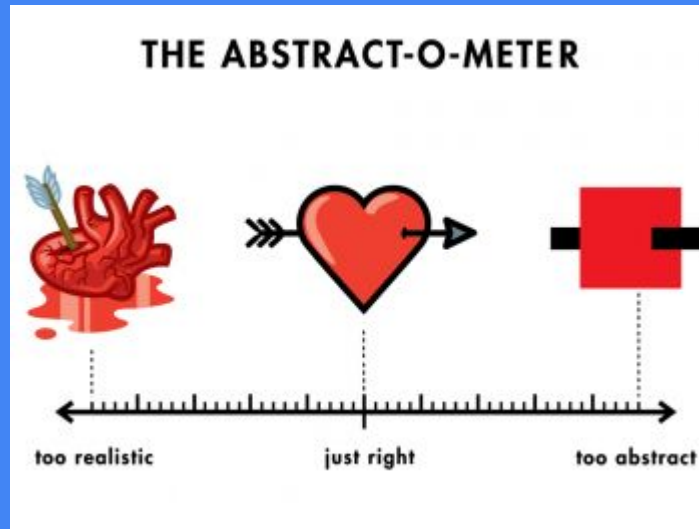
Course materials available at

<https://github.com/mariakesa/IntroductionToComputationalNeuroscienceUdemy>

Maria Kesa



This course is FOR EVERYONE! Everyone should have access to scientific insights into brain function in the 21st century!



Course outline

There will be 13 lectures:

1. Neuronal Biophysics
2. Fourier Decomposition
3. Measuring Neuronal Variability
4. Bayes Theorem
5. Measuring Correlation and Covariance
6. Regression
7. Communication subspaces
8. Clustering
9. Neural Networks and
and Reinforcement Learning
10. fMRI data processing
11. Connectomics

Lectures will be followed by a coding session.

What are the aims of this course?

I want to give you the basics of the most important computational methods that are used for modeling neural function, analyzing neural data and using machine learning to understand large multivariate neural datasets.

During the coding sessions we will be working with real data, including calcium imaging datasets from V1 (more than 10,000 neurons) and amygdala, NeuroPixel probes massive electrophysiological dataset with recorded neurons all over the mouse brain, drosophila connectomics data, neural activations while a network is playing ATARI games and more!

Course Philosophy

Neuroscience is really exciting! We want to learn some math, but always be hands-on and work with real data, so that you can get a concrete understanding of how computational methods are used **in practice and as tools of discovery**.

The course has open-ended coding exercises that will help you grow more proficient in **neural data science**. We will be mining **real challenging research datasets**-- it is possible that if you find something interesting, you can publish it. Nothing like this exists in any course on Computational Neuroscience out there on the web! I got a job at the Howard Hughes Medical Institute by applying a novel algorithm to an open dataset and writing to the authors.

Python skills

You need some Python skills for the coding tutorials and doing the homework. If you don't know Python take a course on Udemy to learn the basics and come back.

You need to be comfortable with working with these libraries:

- Numpy, Scipy
- Matplotlib
- sklearn
- Keras, PyTorch

You'll also need to be able to work with github and pip install.

This course exists to excite people about neuroscience and encourage them to delve further!

Some free resources to let you continue the journey:

Gerstner et al, “Neuronal Dynamics”, free book and Python exercises

<https://neurondynamics.epfl.ch/>

Fee, MIT OCW free lectures, “Introduction to Neural Computation”,

<https://ocw.mit.edu/courses/brain-and-cognitive-sciences/9-40-introduction-to-neural-computation-spring-2018/>

White, Coursera free lectures (relatively small fee for certificate),
“Medical Neuroscience”

<https://www.coursera.org/learn/medical-neuroscience>

NeuroMatch Academy

<https://github.com/NeuromatchAcademy/course-content>



Enjoy!

It's an epic
adventure!