

Neuromatch Academy

tutorial review

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Aug. 21st 2020

<https://neuromatch.io/academy/>

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

<https://github.com/QiGuangyao/NeuroMatchAcademyTeachingAssitant>

What is Neuromatch Academy about?

The screenshot shows the Neuromatch Academy 2020 website. At the top, there's a navigation bar with icons for search, refresh, home, and a lock, followed by the URL 'neuromatch.io/academy/'. To the right are links for 'Volunteer', 'Syllabus', 'FAQ', and 'About'. Below the navigation is the main title 'Neuromatch Academy 2020' in large white font. Underneath it is the subtitle 'An online school for Computational Neuroscience'. A paragraph explains the academy's purpose: 'Started by the team who created CoSMo summer school, CCN SS, Simons IBRO, and neuromatch conference , we announce a worldwide academy to train neuroscientists to learn computational tools, make connections to real world neuroscience problems, and promote networking with researchers.' It also mentions a 'message to the NMA community' about Iranian residents and directs current interactive students to a 'github page' for course content and a discussion forum hosted by Neurostars.

Objectives

Introduce traditional and emerging computational neuroscience tools	Learn hands-on skills with neuro data	Understand how these tools relate to biological questions	Build networking, professional development, and how-to-model skills

<https://neuromatch.io/academy/>

Modeling

Models help answer **three types of questions** about the brain

(Dayan & Abbott, 2001)

Descriptive = What?

Compact summary of large amounts of data

Cosine tuning (CT)

Mechanistic = How?

Show **how** neural circuits perform complex function

HH model

Interpretive = Why?

Computations in the brain are performed in an optimal or nearly optimal way: optimal algorithms and their implementation, why the brain is designed the way it is

RL

Marr's 3 levels of analysis

Computation

What problems does the brain solve, and why?

Representation and Algorithm

What is the representation of input and output?

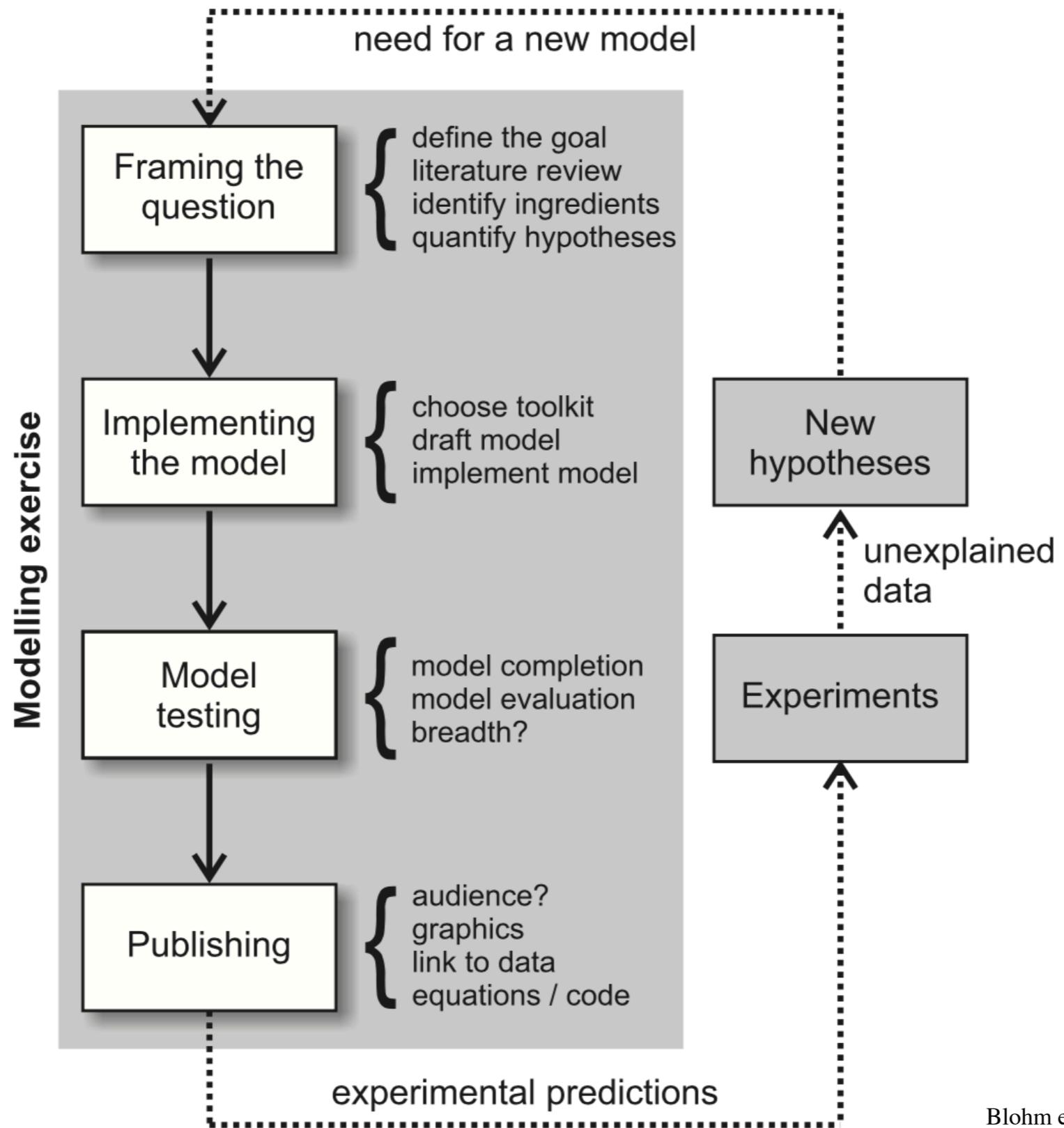
What steps transform these representations?

Implementation

How does the brain achieve these computations?

Brain: hierarchy of complexities!

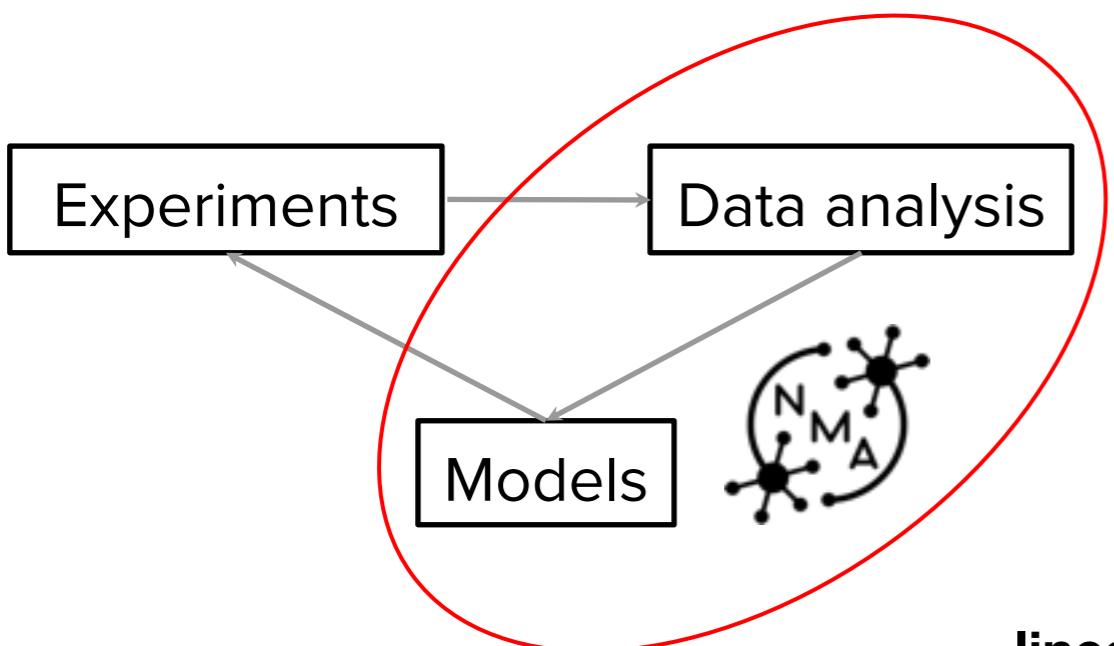
How to model?



Blohm et al., 2019

<https://doi.org/10.1523/ENEURO.0352-19.2019>

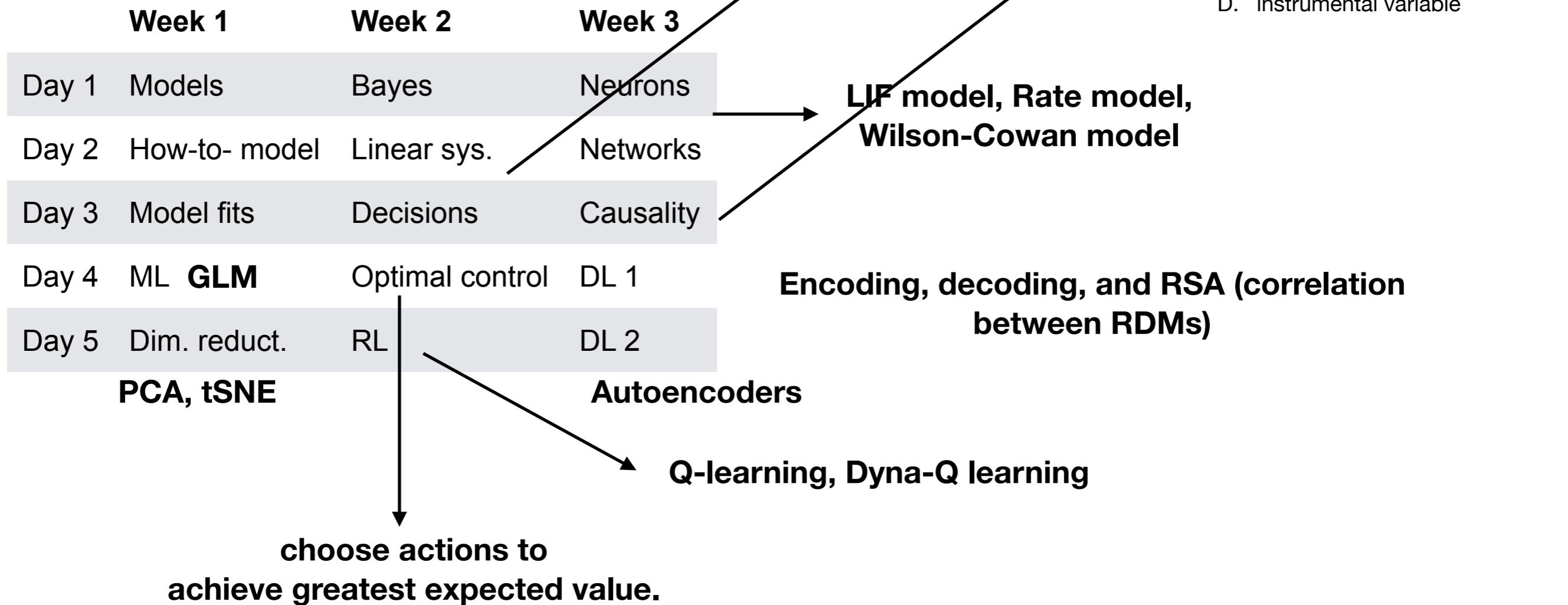
Modeling and Data analysis



Association: What is $P(y|x)$?
Causality: What is $P(y|do(x))$?

- Reichenbach's common cause principle:

If x and y are correlated,
 x **causes** y OR
 y **causes** x OR
they share a **common cause**.



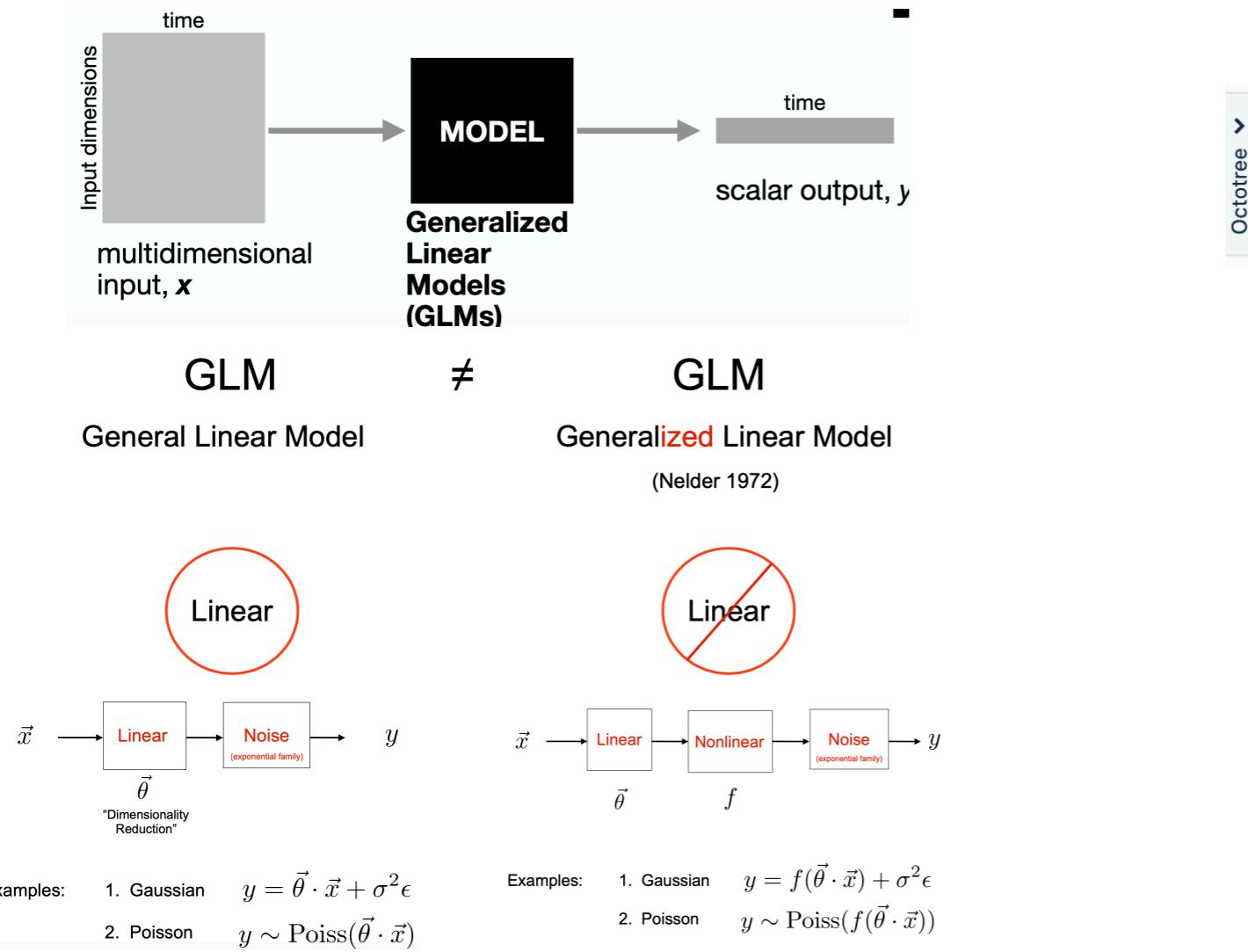
- A. perturbations
- B. correlations
- C. simultaneous fitting/regression
- D. instrumental variable

Example: W1 D3 ML

Some common problems in neuroscience

- What features of the sensory inputs does a neuron care about?
- How is the activity of a neuron influenced by the rest of the circuit?
- Which features of the neural responses driven behavior?

Generalized Linear Models



← → ⌂ ⌂ github.com/NeuromatchAcademy/course-content/tree

W1D4 - Machine Learning

[YouTube Playlist](#)

Slides: [Intro](#) | [Tutorials](#) | [Outro](#) | [Reading](#)

	Run	View
Tutorial 1	Open in Colab	
Tutorial 2	Open in Colab	

W1D5 - Dimensionality Reduction

[YouTube Playlist](#)

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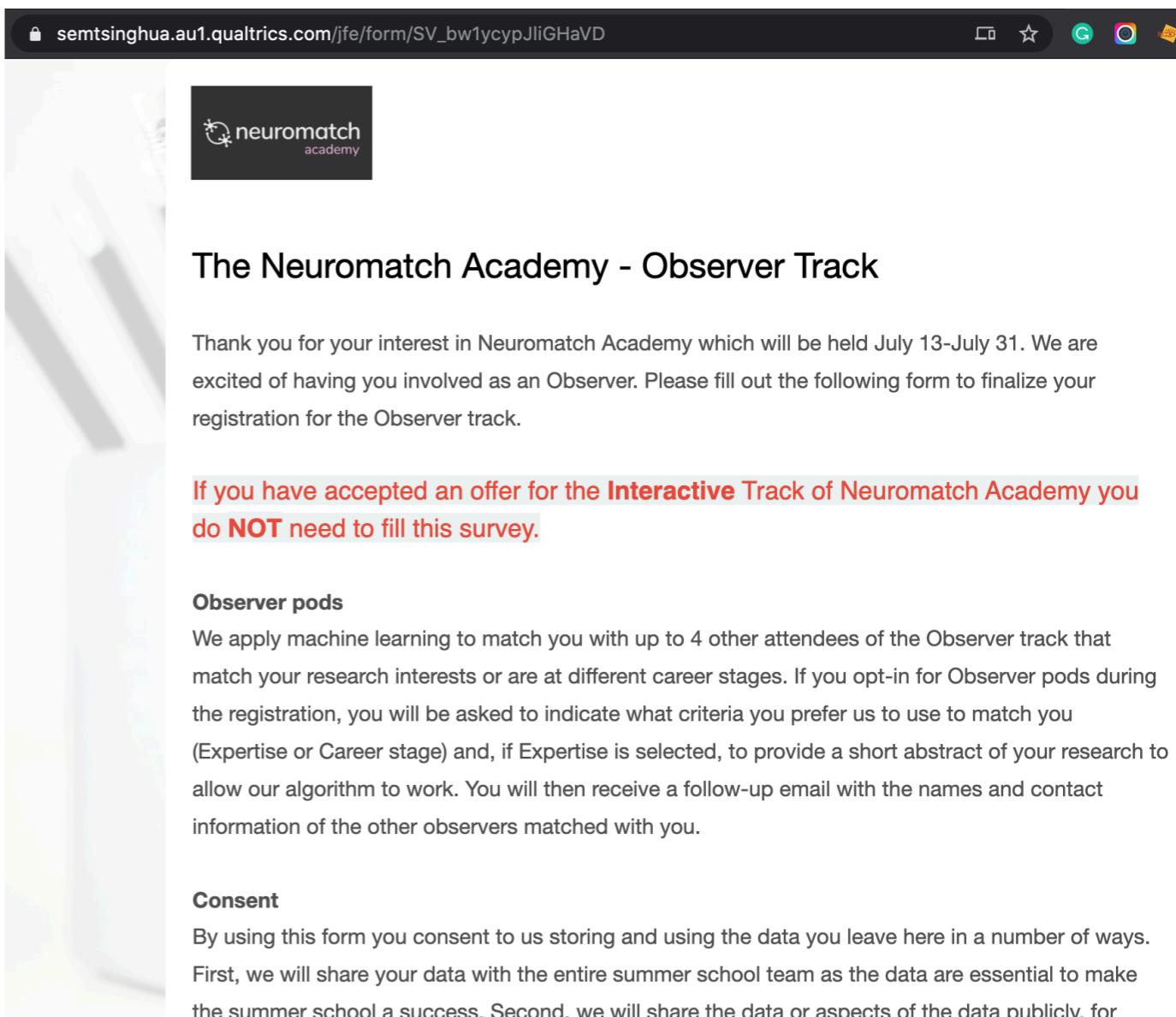
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Tutorial 3	Open in Colab	
Tutorial 4	Open in Colab	

<https://github.com/NeuromatchAcademy/course-content/tree/master/tutorials#w1d4---machine-learning>

How to learn?

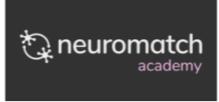
- Problem-based learning
- Learn something by teaching

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The screenshot shows a Qualtrics survey page with the URL https://semtsinghua.au1.qualtrics.com/jfe/form/SV_bw1ycypJliGHaVD in the address bar. The page has a dark header with the Neuromatch Academy logo. The main content area is titled "The Neuromatch Academy - Observer Track". It includes a message about the registration period (July 13-July 31) and the purpose of the survey. A red note says: "If you have accepted an offer for the Interactive Track of Neuromatch Academy you do NOT need to fill this survey." Below this, there are sections for "Observer pods" and "Consent", each with detailed explanatory text.

semtsinghua.au1.qualtrics.com/jfe/form/SV_bw1ycypJliGHaVD



The Neuromatch Academy - Observer Track

Thank you for your interest in Neuromatch Academy which will be held July 13-July 31. We are excited of having you involved as an Observer. Please fill out the following form to finalize your registration for the Observer track.

If you have accepted an offer for the **Interactive Track** of Neuromatch Academy you do **NOT** need to fill this survey.

Observer pods

We apply machine learning to match you with up to 4 other attendees of the Observer track that match your research interests or are at different career stages. If you opt-in for Observer pods during the registration, you will be asked to indicate what criteria you prefer us to use to match you (Expertise or Career stage) and, if Expertise is selected, to provide a short abstract of your research to allow our algorithm to work. You will then receive a follow-up email with the names and contact information of the other observers matched with you.

Consent

By using this form you consent to us storing and using the data you leave here in a number of ways. First, we will share your data with the entire summer school team as the data are essential to make the summer school a success. Second, we will share the data or aspects of the data publicly, for

https://semtsinghua.au1.qualtrics.com/jfe/form/SV_bw1ycypJliGHaVD