Trends in computational neuroscience

Organizer(s)  Alexandre Pouget, Luigi Acerbi, Michael Schartner

1 ECTS

Summary  This course will introduce students to modeling and data analysis techniques in computational neuroscience. There are three blocks, taught by three different people, each consisting of two 2 h sessions. The course is passed by handing in two mini-project reports.

The first block will illustrate deep-learning in neuroscience, once as a model for brain function and once as a tool for neural and behavioral data analysis. The block will require the completion of a mini-project about the analysis of video-tracking data and dimensionality reduction of neural recordings.

The second block will be about models of Bayesian decision making and reinforcement learning and consists of lectures only.

The third block will introduce students to modeling and statistical model fitting in neuroscience, with a focus on maximum-likelihood estimation and an overview of modern optimization algorithms from machine learning. The block will be evaluated by a mini-project about fitting an example model to data with the acquired techniques.

Course level  Intermediate

Pre-requirements  
- Basic coding skills in python or matlab
- A laptop with either python or matlab installed

Content of course sessions  

Session 1, 04.03.20, 10 am-12 am, Michael, 2h lecture:  
Architectures from machine-learning as models of brain function

Session 2, 11.03.20, 10 am-12 am, Michael, 2h lecture:  
Dimensionality reduction of video and neural data

Session 3, 18.03.20, 10 am-12 am, Alex, 2h lecture:  
Bayesian decision making

Session 4, 25.03.20, 10 am-12 am, Alex, 2h lecture:  
Reinforcement learning

Session 5, 01.04.20, 10 am-12 am, Luigi, 2 h lecture:  
Introduction to modeling and statistical model fitting for neuroscience

Session 6, 08.04.20, 10 am-12 am, Luigi, 2 h lecture:  
Advanced topics in optimization and other approaches to model fitting
<table>
<thead>
<tr>
<th><strong>Location</strong></th>
<th>CMU Geneva; room A04.2706</th>
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<tbody>
<tr>
<td><strong>Course dates</strong></td>
<td>6 consecutive Wednesdays, starting March 4</td>
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<tr>
<td><strong>Evaluation</strong></td>
<td>Reports for two mini-projects</td>
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<td><strong>Registration</strong></td>
<td>Register before February 5, 2020 by writing an e-mail to <a href="mailto:indscourses@gmail.com">indscourses@gmail.com</a> (with your supervisor in copy) and stating the course title as the subject.</td>
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