# Mini-project 2, Trends in Computational Neuroscience

luigi.acerbi@unige.ch

08.04.20

In this mini-project, you will be asked to fit computational models to behavioral data publicly released from the International Brain Laboratory, as we explored during the online lectures, and describe and interpret the results. You should use as reference the Python tutorial: https://github.com/lacerbi/tics-2020-tutorial

Note that while the class lectures and the provided tutorial code is in Python, any programming language can be used to produce results for this assignment (e.g., Matlab, R). Writing your own code, possibly in another language, is in itself a good exercise.

Your report for mini-project 2, i.e. all tasks in this document, should contain the figures and information as outlined in "goals" below, be a pdf document and should not exceed 2 DIN A4 pages. The **deadline to submit both reports via moodle is 29.04.20**. Mini-project 1 is a separate assignment that you already received from Michael Schartner.

## Goals:

**Minimal requirements:**

1a) Fit the *basic* psychometric model (with four parameters) separately to each of the 15 training sessions of mouse **KS014** using maximum-likelihood estimation. You will end up then with 15 maximum-likelihood parameter vectors, one per session. In your report, include a plot (possibly on multiple panels) of the four parameters - bias, threshold, lapse, lapse bias - as a function of session 1-15, and briefly explain and discuss the results.

1b) Fit the *repeatlast* psychometric model (with five parameters) separately to each of the 15 training sessions of mouse **KS014**. For each session, compute several model comparison metrics for both the *basic* psychometric model and the *repeatlast* model (negative log-likelihood, AIC, BIC). Choose one metric (e.g., BIC) and plot a graph of the *difference* in the metric (e.g., ΔBIC) between the *repeatlast* model and the *basic* model fitted in 1a. Briefly explain and discuss the results.

**Notes:**

- The absolute magnitude of a model comparison metric is usually meaningless; what matters is the difference between distinct models.
- Make your plots clear! (e.g., specify well the axes)

**Advanced:**

2) Come up and code a *new* model - possibly a modification of the psychometric function model(s) that we saw in class, but everything is allowed; fit your model to the data.

Perform a model comparison using BIC, comparing your model to both the *repeatlast* and the *basic* model (plot the difference of the other models *relative* to the *basic* model).
Does your model fit the data better or worse? Discuss your results. Include a description of the model (and the rationale behind it!), with code.

**Note:**

- Your model (the log-likelihood function) shouldn't be longer than 10-15 lines of code max.

## Help:

Given the online lectures, you should already be able to run the tutorial with iPython and Jupyter notebook. You can write your code starting off with the code used in the tutorial.
Point 1a and 1b use functions that are already in the tutorial, with minimal changes.