Complementary approaches to Computational Neuroscience:
Objective Functions and Biophysics

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abstract:

Everyday tasks require our brain to perform computations using both the information already stored in it, and the external input we receive from the outside world. These computations have to be performed within the constraints of a biological system, namely a network of neurons connected via synapses. The study of how these connections are modified with experience, known in the field as synaptic plasticity, allows for at least two complementary formulations: a top-down approach, in which plasticity rules are derived to achieve a certain computational goal, and a bottom-up, biophysical approach, in which learning rules are formulated in terms of the dynamics of their biological building blocks, respecting their constraints and limitations.

In the present talk, a short overview of the field, together with an example for each of these two approaches are presented. A novel objective function, based on information-theoretical principles, and a biologically motivated two-trace model for plasticity, developed in our group, will be discussed.