On Competition and Learning in Cortical Structures

In this talk we will look at canonical computations in recurrent neural networks and how plasticity can be used to learn a notion of typical input patterns and the relationships between such inputs. The networks we study are fairly biologically plausible cortical populations. In-line with the tabula-rasa hypothesis we connect the neurons inside and between such populations randomly.

In a first step we will look at typical response patterns of such recurrent networks and how excitation and inhibition can be balanced in order to avoid degenerate network dynamics. For this talk we will favor a regime in which the inhibition is balancing the excitation without introducing synchronous spiking patterns.

In a second step we include synaptic plasticity in our networks. We will see two interesting effects:

(i) Inside populations the learning introduces a notion of "typical input patterns". Those patterns do compete with each other, showing similar dynamics as (Soft-)Winner-take-all networks.

(ii) Between interconnected populations we learn the relation between simultaneous activations. After learning this relation it can be used for tasks like inference or cue-integration.