Cortically-inspired Computational Models for Multimodality
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We focus in this poster on the distributed, continuous and unsupervised learning of multi-sensory representations and sensorimotor behaviors. For localized bumps of activity to emerge on cortical maps when coherent stimuli are presented, adequate competition mechanisms such as the CNFT (Continuous Neural Field Theory) are required. Nearby units can thus become selective to similar stimuli and self-organize.

**Dynamic Neural Fields**

In the field of computational neuroscience, we develop distributed models of the cortex to account for perceptual and sensorimotor capabilities. Adopting a mesoscopic level of modeling with dynamic neural fields representing topologically organized populations of cortical columns, we propose various learning rules, competition mechanisms and interconnection schemes. Under the right conditions, these allow the emergence of spatially coherent bumps of activity yielding attentional properties and high robustness to noise.

**Competition & Self-organization**

The BCM theory uses a bio-plausible learning rule for assemblies of neurons to become selective to specific stimuli. With the standard formulation of the rule, the lower the probability of a stimulus, the harder it is to become selective to it. This is problematic in a multimodal context, as it often leads to the dominance of one modality. Adaptive parameters are introduced to improve stability and speed up convergence.

**Interconnection Schemes**

The nature of multimodal representations depends on the number of maps used and their interconnections. Different modalities can either be directly merged as a single sensory flow or directed to a set of unimodal maps later combined in associative maps. Interactions may directly modulate the activity, dynamics or learning rules, on which the emergence of distributed coherent representations depends.

**Computational Abstraction**

In order to speed up the computations and alleviate the 2D constraints of cortical sheets, the regular mesh generally considered can be replaced by discrete interacting points. The resulting topology lacks the flexibility of self-organizing maps but allows the manipulation of an arbitrary and variable number of dimensions.

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