Contribution ID: 13

## Functional digital twins in visual neuroscience

Friday 27 September 2024 09:45 (45 minutes)

For years, neurons in visual cortex have been characterized in terms of simple feature dimensions such as orientation and spatial frequency. However, in recent years deep learning methods have set new standards in predicting the activity of neurons in visual cortex to arbitrary stimuli. Because of this property, these models are sometimes referred to as digital twins (DTs). Here we show how DTs can be used to efficiently and flexibly explore the space of tuning and invariance properties of neurons –beyond the manifold of parametric stimuli such as Gabor gratings. We find that while DTs reproduce classical experimental characterizations of neurons in primary visual cortex (V1), optimizing novel stimuli beyond the classical parametrizations and verifying them experimentally, can lead to novel and surprising results, that challenges classical interpretations of the computational role of neurons in V1. We will provide two examples for that: Center-surround contextual modulation and color tuning with behavioral context.

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Session Classification: Multiscale Models in Neuroscience (Chair: Hermann Cuntz)