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Simulation of optogenetic based visual prosthetic stimulation in V1

Thursday 23 June 2022 09:35 (45 minutes)

The neural encoding of visual features in primary visual cortex (V1) is well understood, with strong correlates to low-level perception, making V1 a suitable target for vision restoration through neuroprosthetics. However, the functional relevance of neural dynamics evoked through external stimulation directly imposed at the cortical level remains poorly understood. In the talk I will present results from our recent simulation study (Antolik et al. 2021) that combined (1) a large-scale spiking neural network model of cat V1 and (2) a virtual prosthetic system that drives in situ optogenetically modified cortical tissue with a matrix light stimulator. We designed a protocol for translating simple Fourier contrasted visual stimuli (gratings) into activation patterns of the optogenetic matrix stimulator. We characterised the relationship between the spatial configuration of the imposed light pattern and the induced cortical activity. Our simulations show that in the absence of visual drive (simulated blindness) optogenetic stimulation with a spatial resolution as low as 100 µm is sufficient to evoke activity patterns in V1 close to those evoked by normal vision. I will also discuss our recent unpublished effort to expand the simulations with neuron morphology dependent aspects of optogenetic light stimulation of neural tissue.

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Preferred form of presentation

Talk & (optional) poster

Topic area

models and applications

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References

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