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Analysis of one photon calcium imaging data to investigate the properties of CA1 place cells

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The hippocampus is considered to be involved in spatial navigation and memory formation; it hosts cells with high firing rates at a given location –place cells (PCs), which allow the construction of the hippocampal cognitive map of space. However, it is not understood how memories are related to the hippocampal place fields. On the one hand, the stability of its neural code may support long-term storage and retrieval of memories; on the other hand, the turnover of its neural representations may facilitate learning and adaptation.

Here, we focus on the analysis of one-photon (1P) calcium imaging data from dorsal CA1 of a mouse, recorded with a miniature microscope during free foraging in a previously familiarized two-dimensional arena, while most of the calcium imaging data from the hippocampus obtained from one-dimensional tracks. The CaImAn software tool is applied to the raw recordings to extract the spatial footprints of cells, as well as the corresponding time-varying calcium transients, which are used to estimate the cells'place fields and spatial information (SI) values. With the CellReg toolbox, neurons were tracked across multiple sessions, allowing to investigation of the temporal dynamics of CA1 neural code over time on a scale of up to two weeks.

After doing that three methods of determining statistically significant PCs are benchmarked on the aforementioned set of data comprising 5-6 sessions for 2 subjects.

Author: IVANTAEV, Vladislav

Co-authors: ATTARDO, Alessio (Leibniz Institute for Neurobiology); LEIBOLD, Christian (Albert-Ludwigs-Universität Freiburg, Fakultät für Biologe & Bernstein Center Freiburg)

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