An Analytically Tractable Model for the Emergence of Concept Cells in the Human MTL

Submission ID   3000078

Submission Type Poster

Topic   Neuroscience

Status   Submitted

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SUBMISSION DETAILS

Presentation Type Oral Presentation

Presentation Abstract Summary There is growing evidence that cells in the human medial temporal lobe (MTL) persistently represent real-world objects such as a familiar person; these cells have been termed concept cells. Furthermore, a recent experiment showed that a cell in the human MTL encoding a particular real-world object (such as a familiar landmark) may start to also respond to the image of another real-world object (a familiar person) following an experience associating the two (the presentation of an image of this person in that place). It is widely believed that such representations must consist of cell assemblies (a concept first proposed by Hebb in 1949): large, highly interconnected cell populations whose more-or-less synchronous activity is tantamount to a cognitive event, such as recognizing, or thinking of, a familiar person or place. However, we are not aware of theoretical models predicting the emergence and association of assemblies. Here we develop a mathematical model predicting analytically that relatively stable assemblies of cells can be created, in response to neural activity representing a sensory experience, to encode that experience; and that two such assemblies can be modified so that they intersect after a simultaneous presentation of the two sensory experiences.

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Keywords

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concept cells
cell assemblies
assembly formation
association
STDP

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