Review of: "The functional unit of neural circuits and its relations to eventual sentience of artificial intelligence systems"

Christian Hansel[1]

1 University of Chicago

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This is a quite interesting article. In my comment, I want to focus on one particular aspect. I believe the paper would benefit from a discussion of the phenomenon of concept coding neurons (which include face recognition cells). Brains certainly operate using ensemble-coding, but single-neuron coding provides a very interesting special case (from what we know in higher mammals), in which conceptual representations are achieved in individual neurons that can be activated by qualitatively different features of an object, e.g. visual representation, verbal representation etc. For example, face recognition cells can be activated by the presentation of respective images as well as written names / words.

In a recent study, we have pointed out cellular requirements / consequences reminiscent of the equimeric unit idea presented here (Pham and Hansel, Journal of Physiology, 2022, doi: 10.113/JP283473): if a neuron receives synaptic input that respesents an object via qualitatively different features, these synapses are not activated at the same time. To drive that neuron to spike threshold is a problem, because of the need for diversified synaptic input (which means that less synapses are available to activate the cell from one way of representation). A computational solution to this problem is a form of non-synaptic ('intrinsic') plasticity of membrane excitability that lowers the threshold, and therefore facilitates spike activation by incomplete pattern presentation.

Beyond the cellular mechanics, this is relevant for complex biological / AI circuits: it allows representation / detection of complex patterns (features / concepts / objects) if variable or incomplete components are represented, and is also helpful for pattern categorization.

I believe that expanding the discussion to include this phenomenon would enhance the impact of the paper.