

POSTER PRESENTATION

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Beyond the frontiers of neuronal types: fuzzy classification of interneurons

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From Twenty Second Annual Computational Neuroscience Meeting: CNS*2013
Paris, France. 13-18 July 2013

Cortical neurons and, particularly, inhibitory interneurons display a large diversity of morphological, synaptic, electrophysiological, and molecular properties, as well as diverse embryonic origins. Various authors have proposed alternative classification schemes that rely on the concomitant observation of several multimodal features. However, a broad variability is generally observed even among cells that are grouped into a same class. Furthermore, the attribution of specific neurons to a single defined class is often difficult, because individual properties vary in a highly graded fashion, suggestive of continua of features between types. Going beyond the description of representative traits of distinct classes, we focus here on the analysis of atypical cells[1]. We introduce a novel paradigm for neuronal type classification, assuming explicitly the existence of a structured continuum of diversity. Our approach, grounded on the theory of fuzzy sets[2], identifies a small optimal number of model archetypes[3]. At the same time, it quantifies the degree of similarity between these archetypes and each considered neuron. This allows highlighting archetypal cells, which bear a clear similarity to a single model archetype, and edge cells, which manifest a convergence of traits from multiple archetypes.

A ready-to-use software package allowing classification of neuronal data with standard tools (MATLAB, Python, ...) via this fuzzy clustering approach without the need for a reimplementations of the algorithmic aspects is in preparation.

Acknowledgements

We acknowledge financial support by the German Federal Ministry of Education and Research (BMBF) via the Bernstein Center for Computational Neuroscience Göttingen (01GQ1005B), by the Human Frontier Science Program (RGY0070/2007) and by the Agence Nationale pour la Recherche

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(ANR 2011 MALZ 003 01). Anastassios Karagiannis was supported by a Fondation pour la Recherche Médicale fellowship (FDT20100920106).

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Published: 8 July 2013

References

1. Karagiannis A, Gallopin T, Dávid C, Battaglia D, Geoffroy H, Rossier J, Hillman EM, Staiger JF, Cauli B: **Classification of NPY-expressing neocortical interneurons**. *J Neurosci* 2009, **29**(11):3642-3659, DOI: 10.1523/jneurosci.0058-09.2009.
2. Zadeh LA: **Fuzzy sets**. *Inform Control* 1965, **8**:338-353.
3. Battaglia D, Karagiannis A, Gallopin T, Gutch HW, Cauli B: **Beyond the frontiers of neuronal types**. *Front Neural Circuits* 2013, **7**:13, DOI: 10.3389/fncir.2013.00013.

doi:10.1186/1471-2202-14-S1-P56

Cite this article as: Gutch et al.: Beyond the frontiers of neuronal types: fuzzy classification of interneurons. *BMC Neuroscience* 2013 **14**(Suppl 1):P56.

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