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On efficient sparse spike coding schemes for learning natural scenes in the primary visual cortex

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We describe the theoretical formulation of a learning algorithm in a model of the primary visual cortex (V1) and present results of the efficiency of this algorithm by comparing it to the SparseNet algorithm [1]. As the SparseNet algorithm, it is based on a model of signal synthesis as a Linear Generative Model but differs in the efficiency criteria for the representation. This learning algorithm is in fact based on an efficiency criteria based on the Occam razor: for a similar quality, the shortest representation should be privileged. This inverse problem is NP-complete and we propose here a greedy solution which is based on the architecture and nature of neural computations [2]). It proposes that the supra-threshold neural activity progressively removes redundancies in the representation based on a correlation-based inhibition and provides a dynamical implementation close to the concept of neural assemblies from Hebb [3]). We present here results of simulation of this network with small natural images (available at http://incm.cnrs-mrs.fr/LaurentPerrinet/SparseHebbianLearning) and compare it to the Sparsenet solution. Extending it to realistic images and to the NEST simulator http://www.nest-initiative.org/, we show that this learning algorithm based on the properties of neural computations produces adaptive and efficient representations in V1.

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References

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