

Efficient coding of visual information in neural computations

Laurent Perrinet

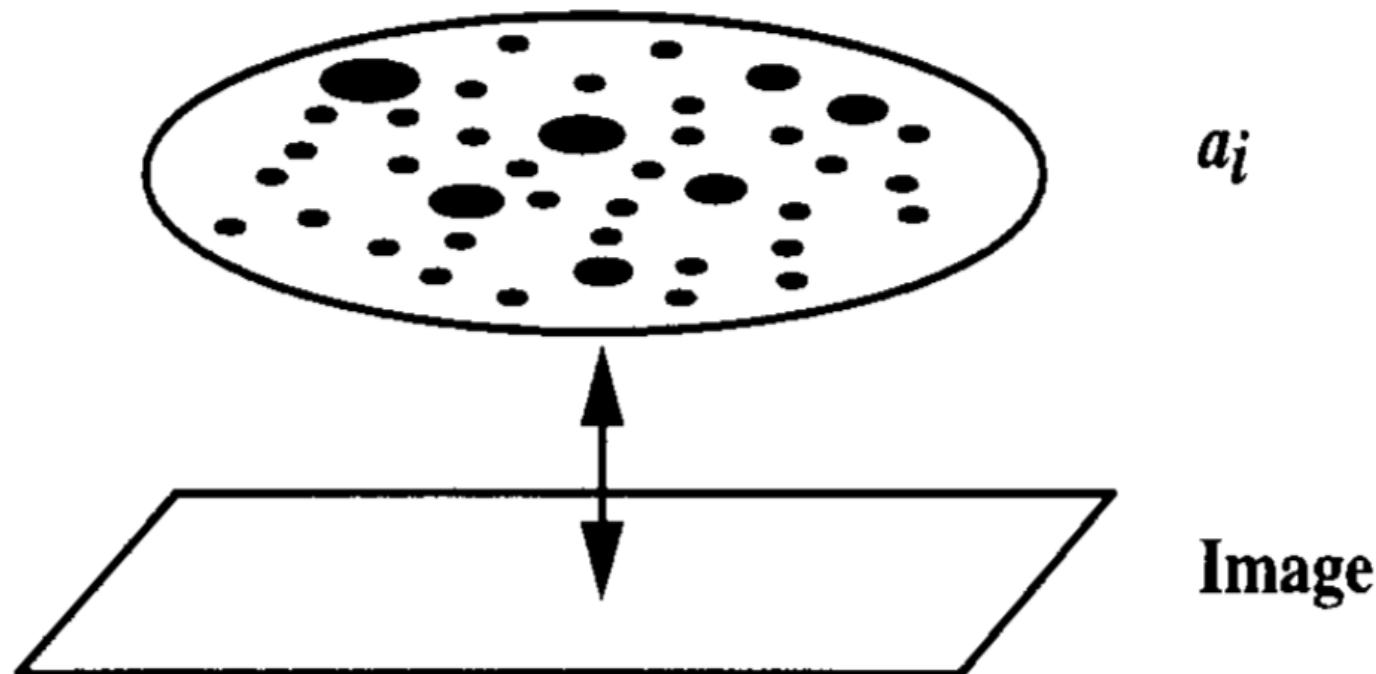


LACONEU 2019: 5th Latin-American Summer School in Computational Neuroscience, 16/1/2019



a.

Sparse representation



b.

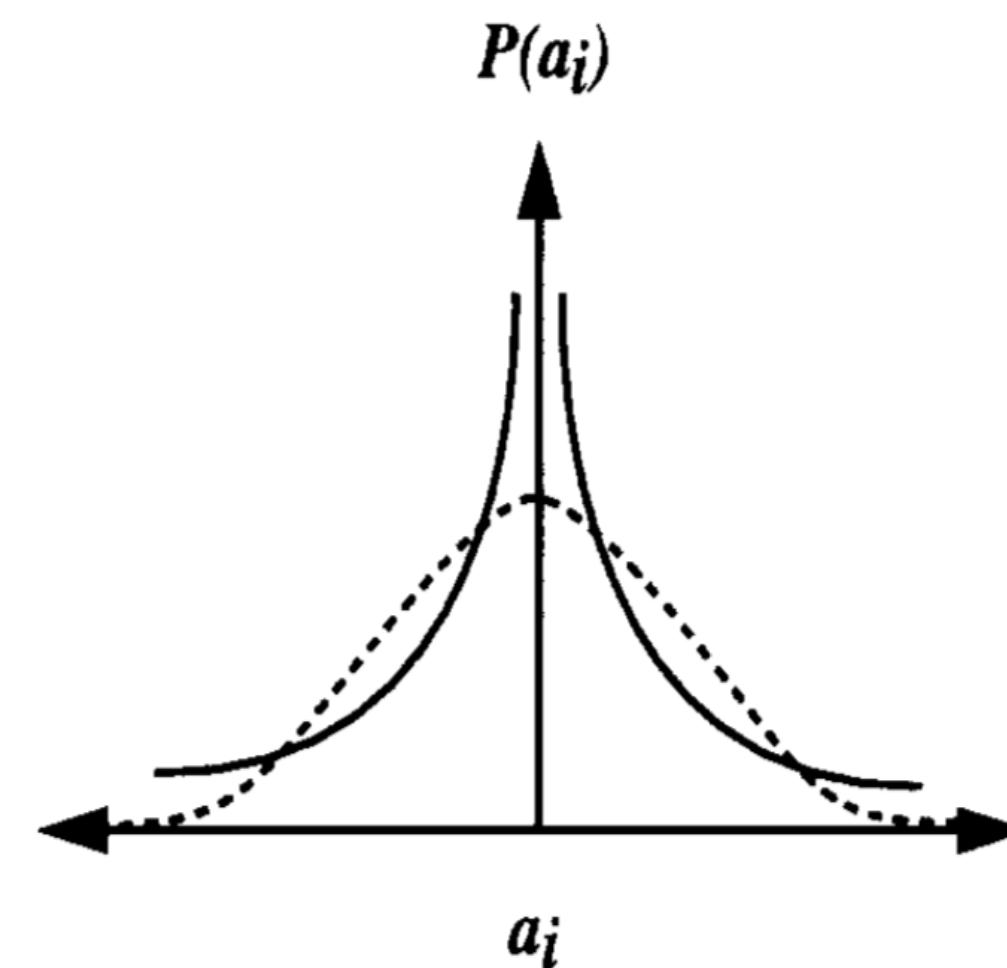
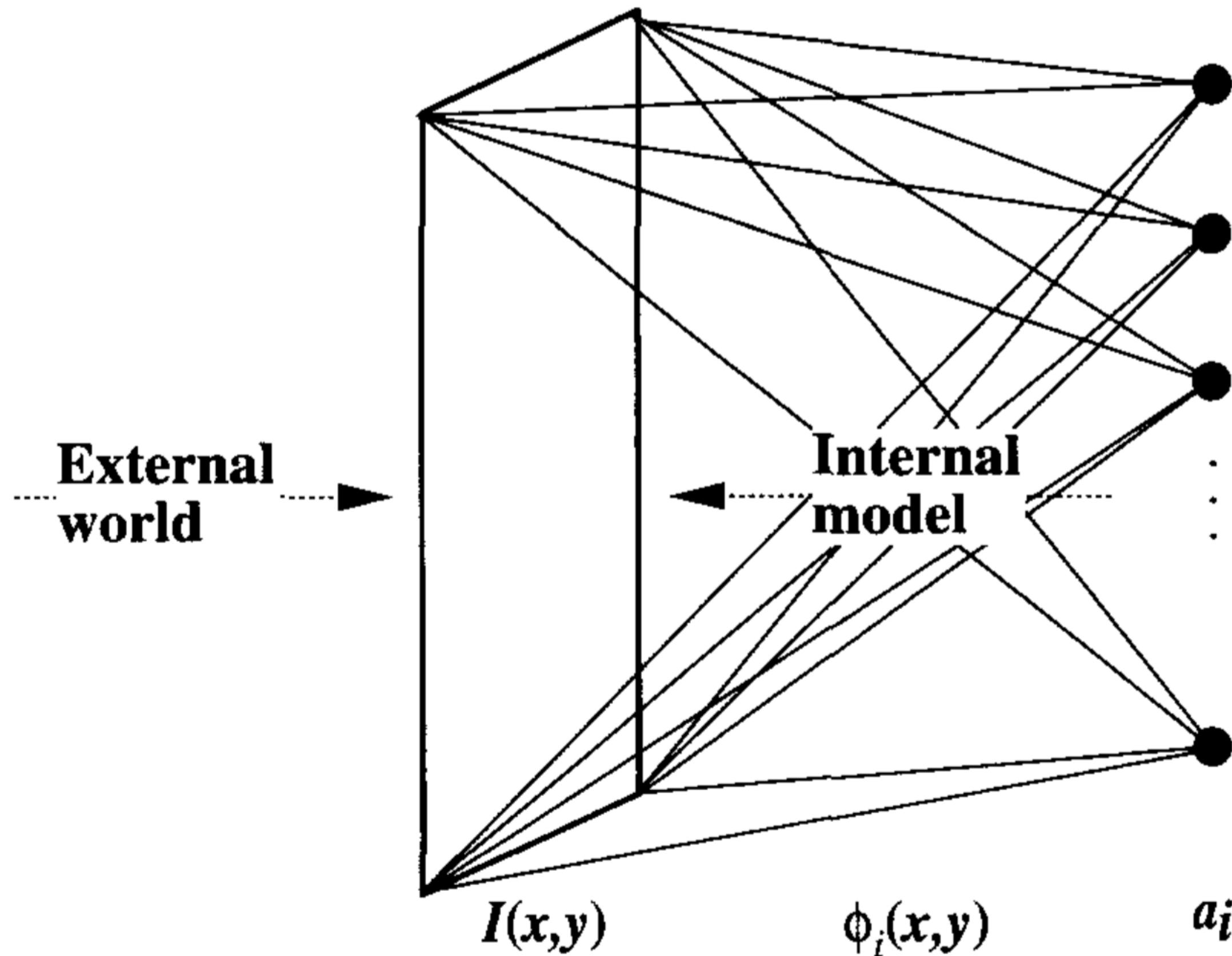
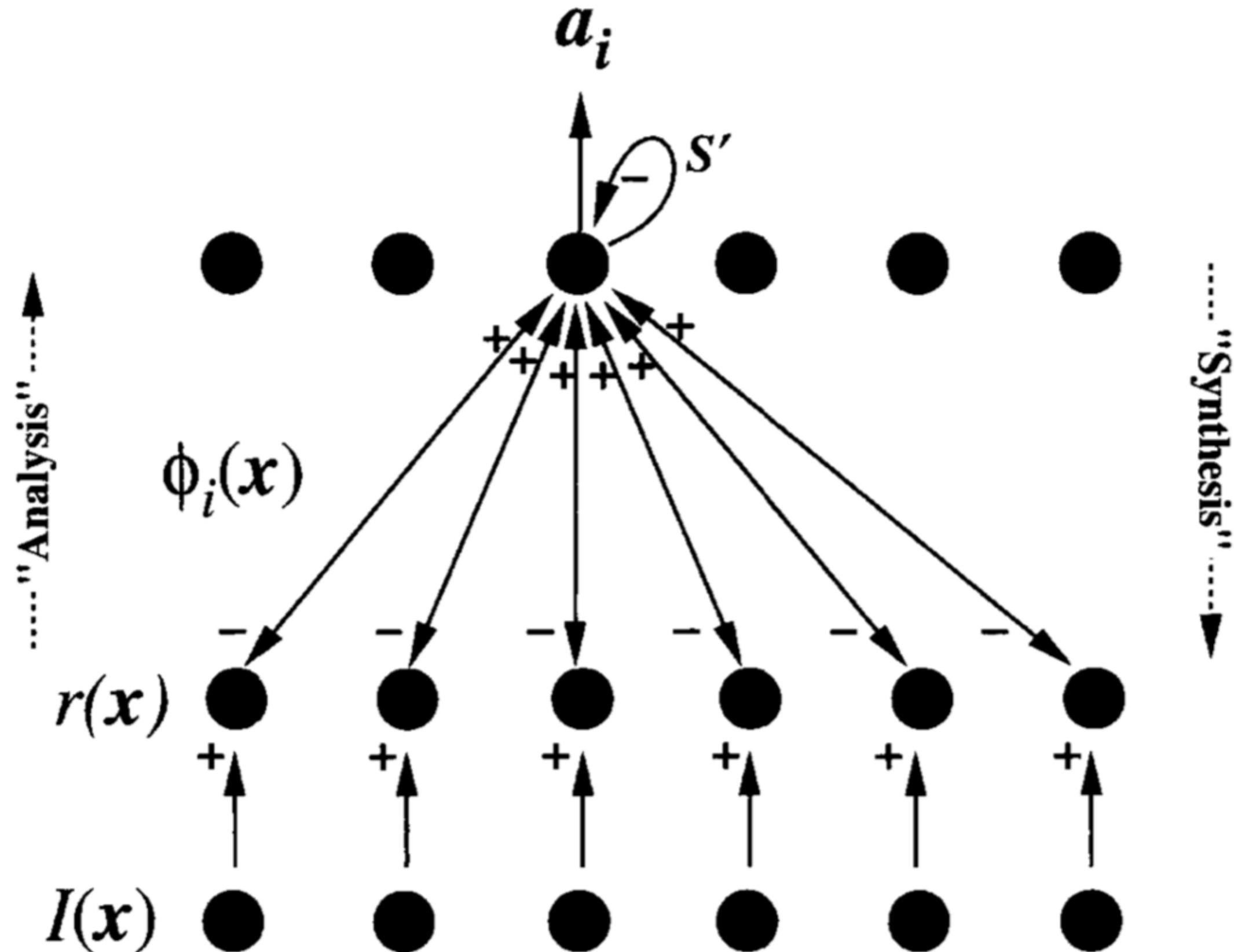


FIGURE 1. Sparse coding. (a) An image is represented by a small number of “active” code elements, a_i , out of a large set. Which elements are active varies from one image to the next. (b) Since a given element in a sparse code will most of the time be inactive, the probability distribution of its activity will be highly peaked around zero with heavy tails. This is in contrast to a code where the probability distribution of activity is spread more evenly among a range of values (such as a Gaussian).

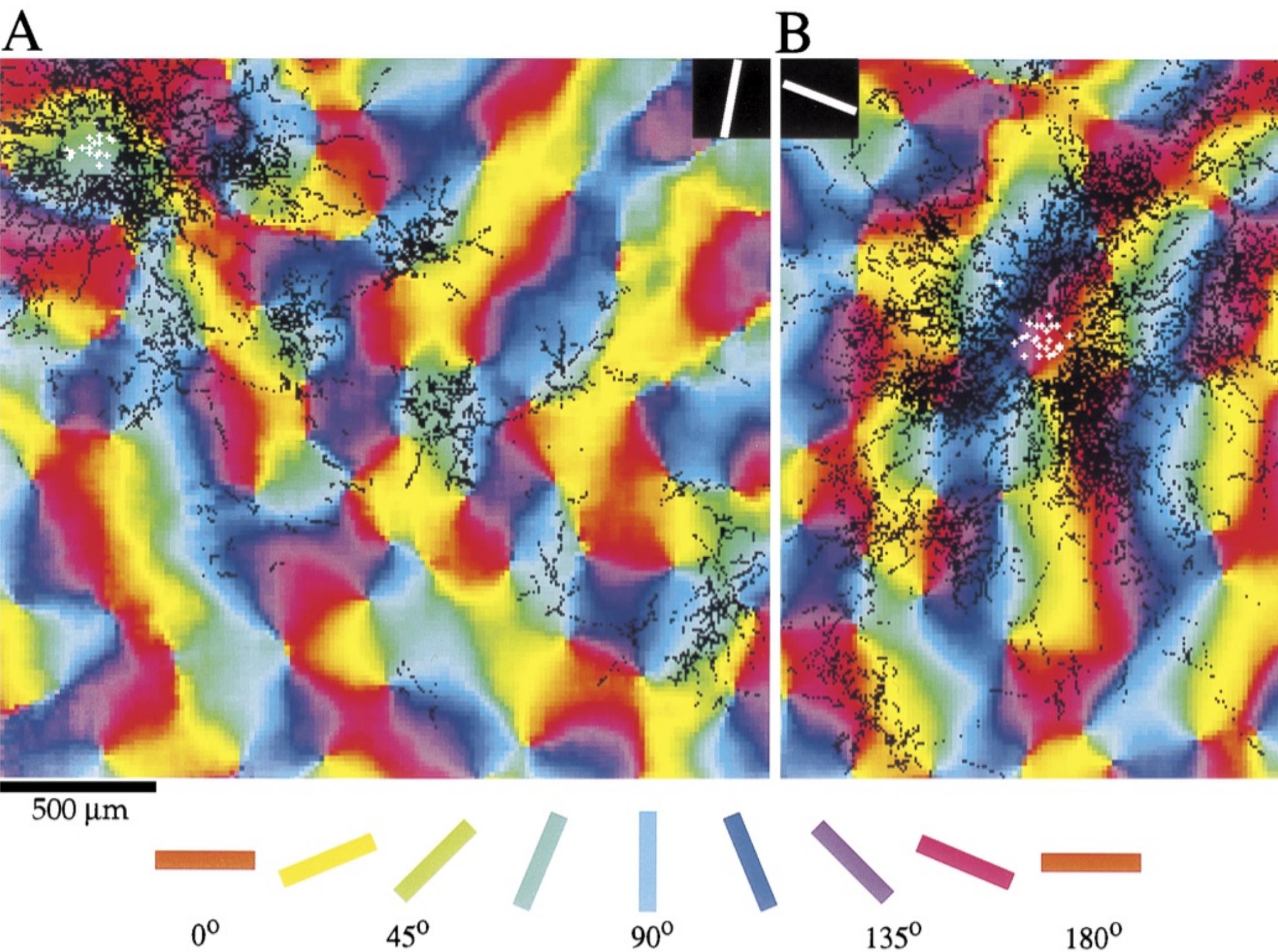
Olshausen and Field (1997) *Sparse coding with an overcomplete basis set: A strategy employed by V1?*



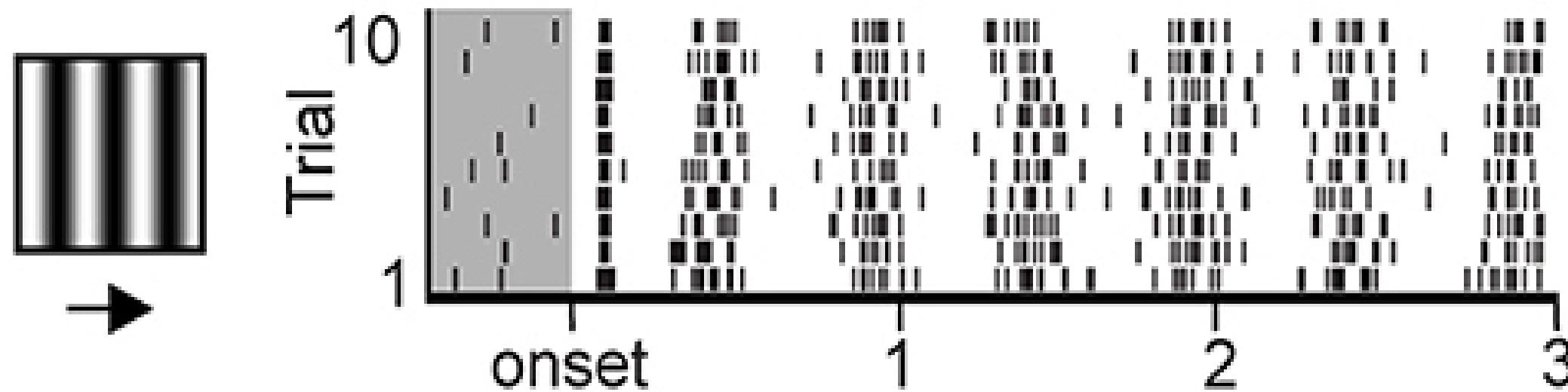
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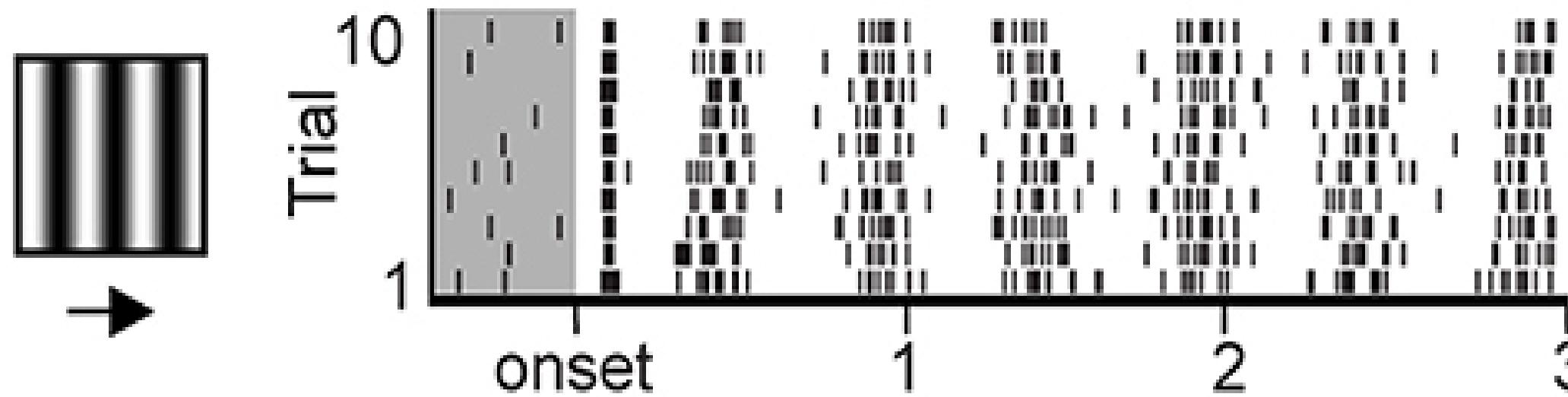
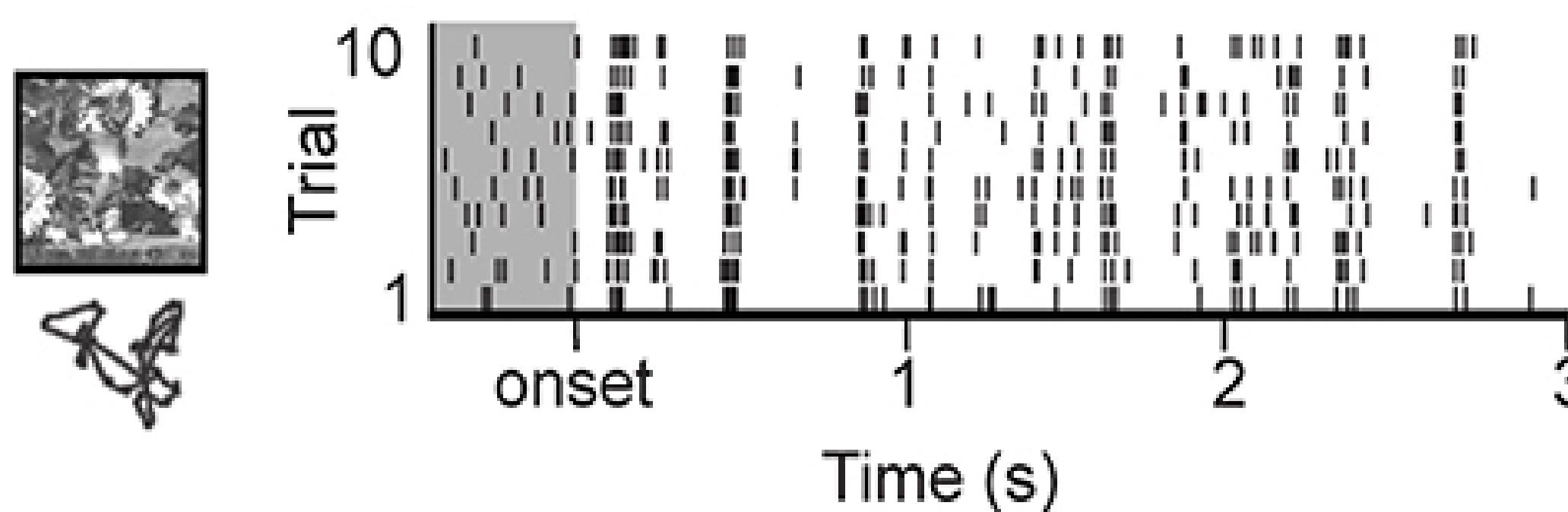
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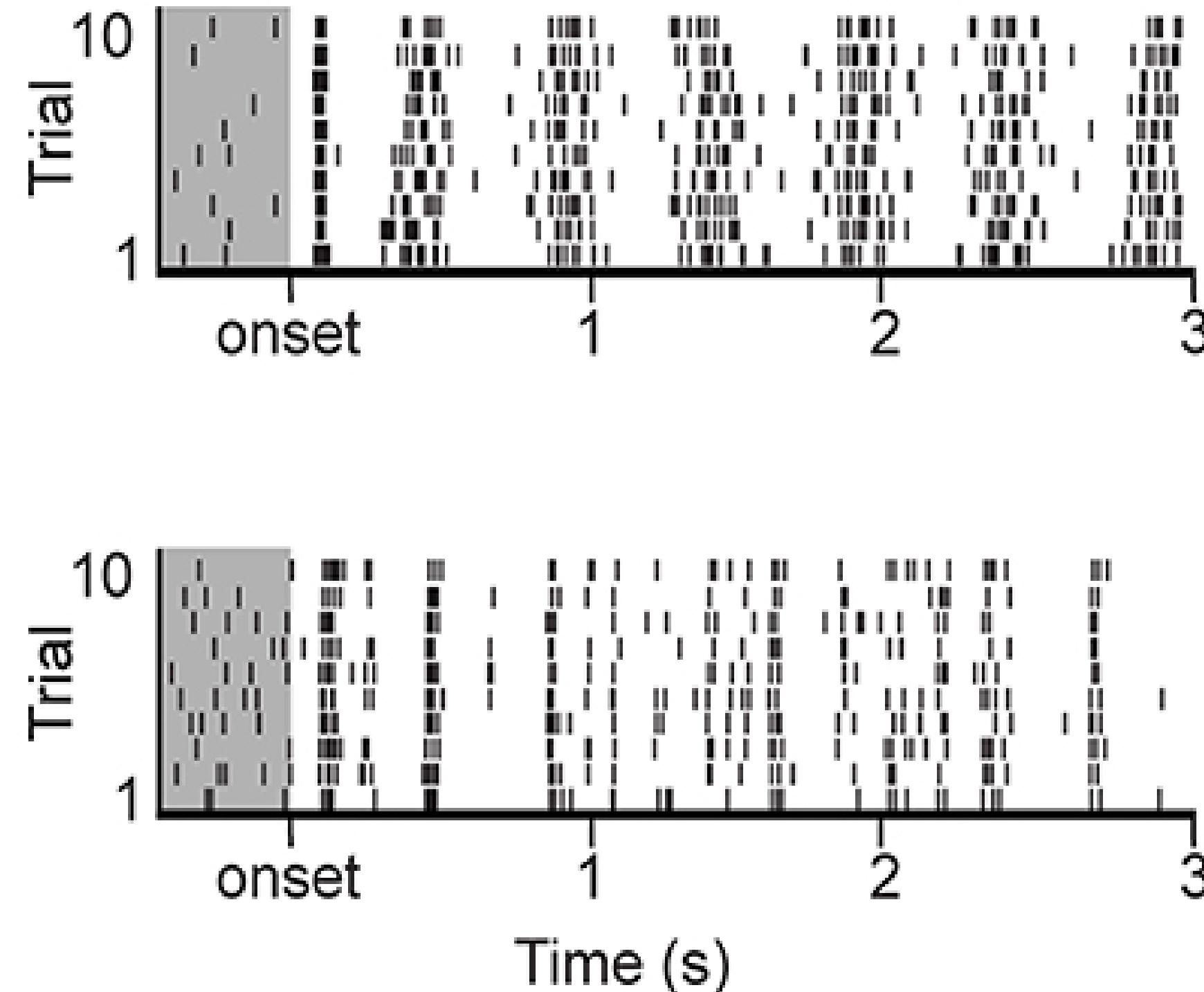
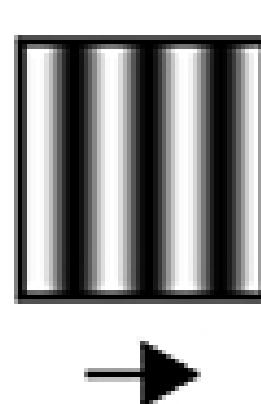
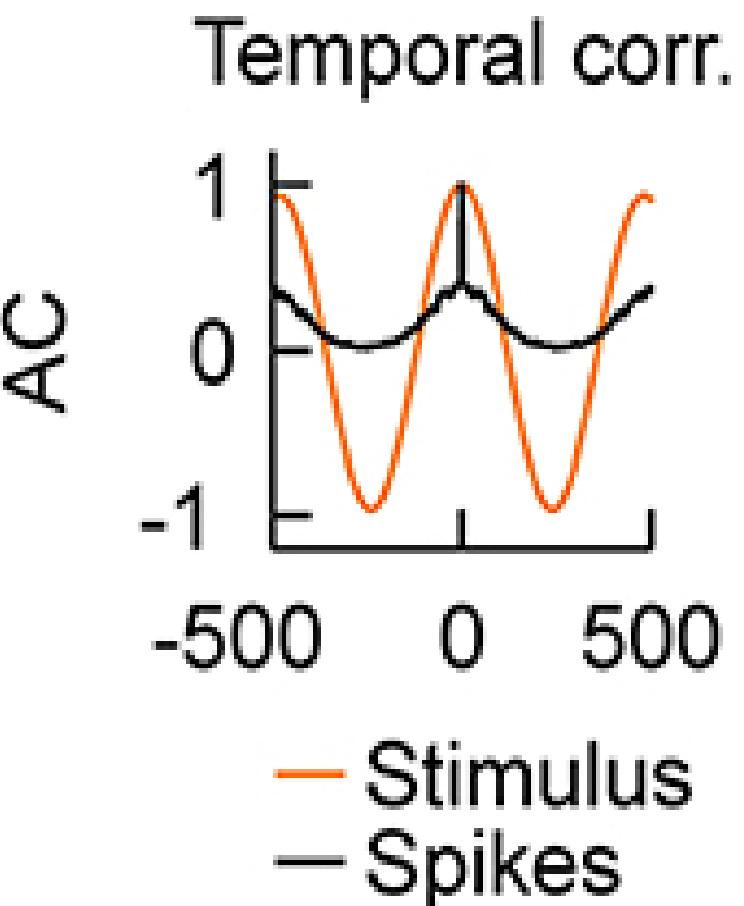
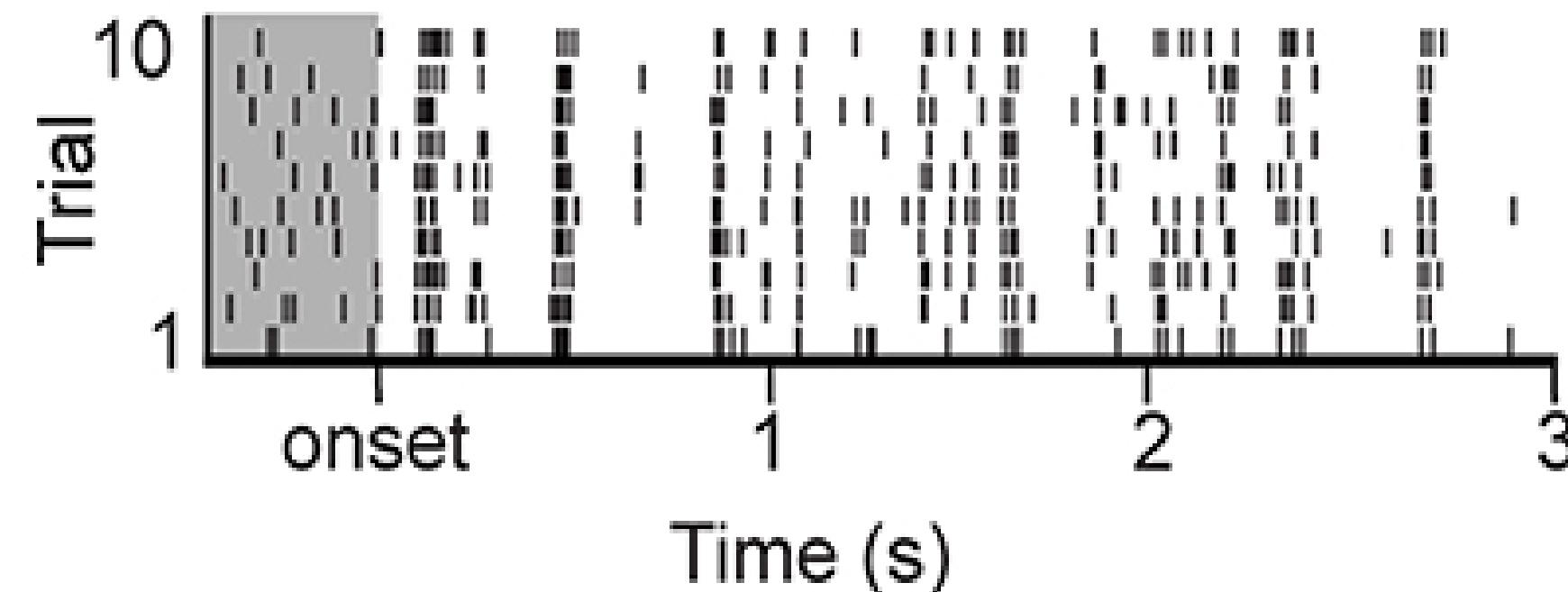
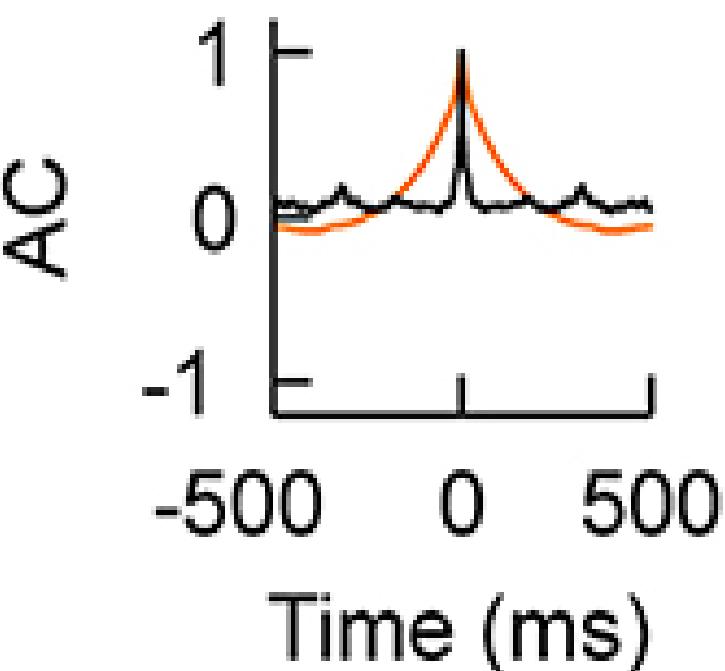
Bosking et al. (1997) *Journal of Neuroscience*

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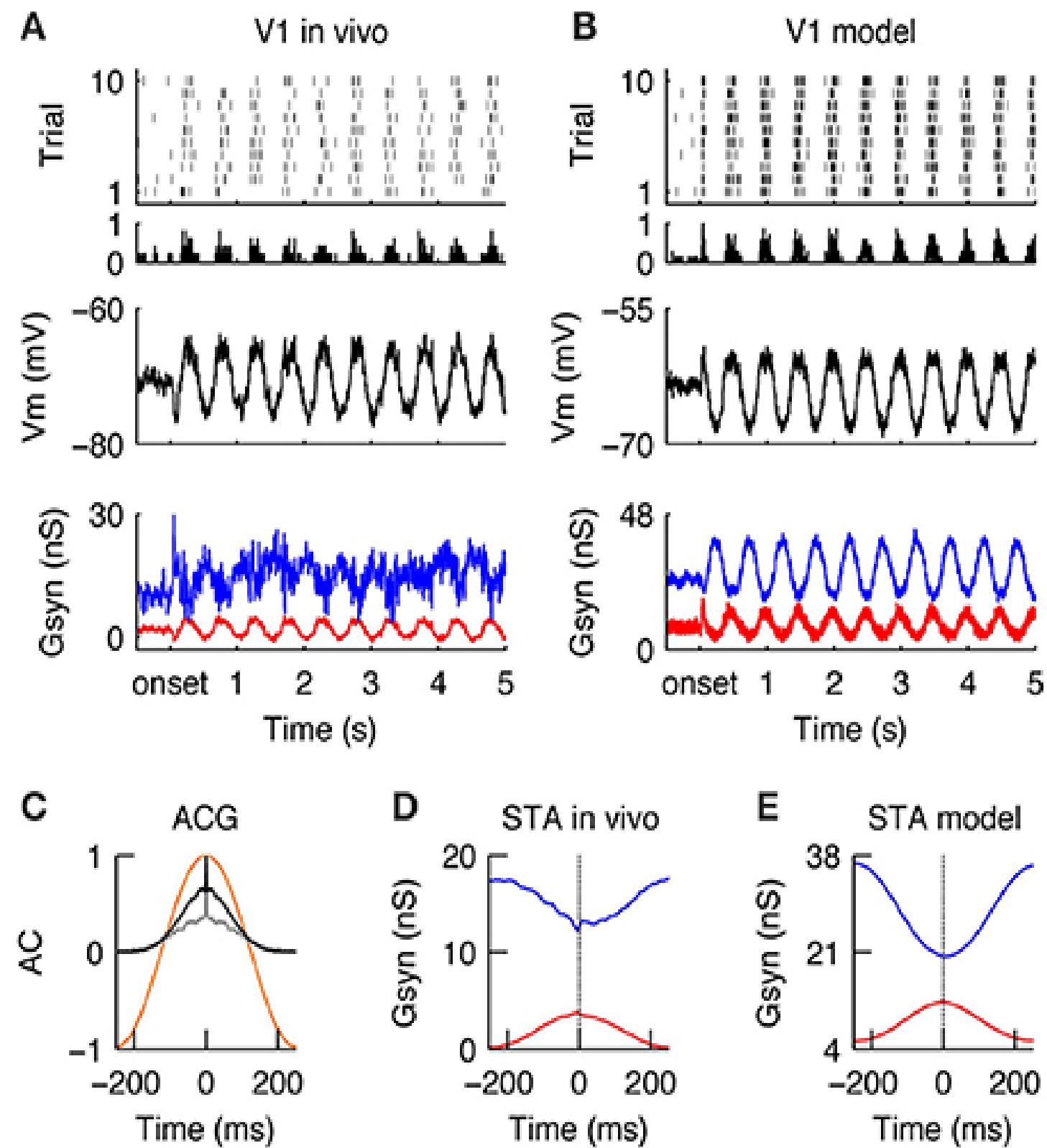
Kremkow, LP, Monier, Alonso, Aertsen, Fregnac, Masson (2016) Push-pull receptive field organization and synaptic depression: Mechanisms for reliably encoding naturalistic stimuli in V1

A**C**

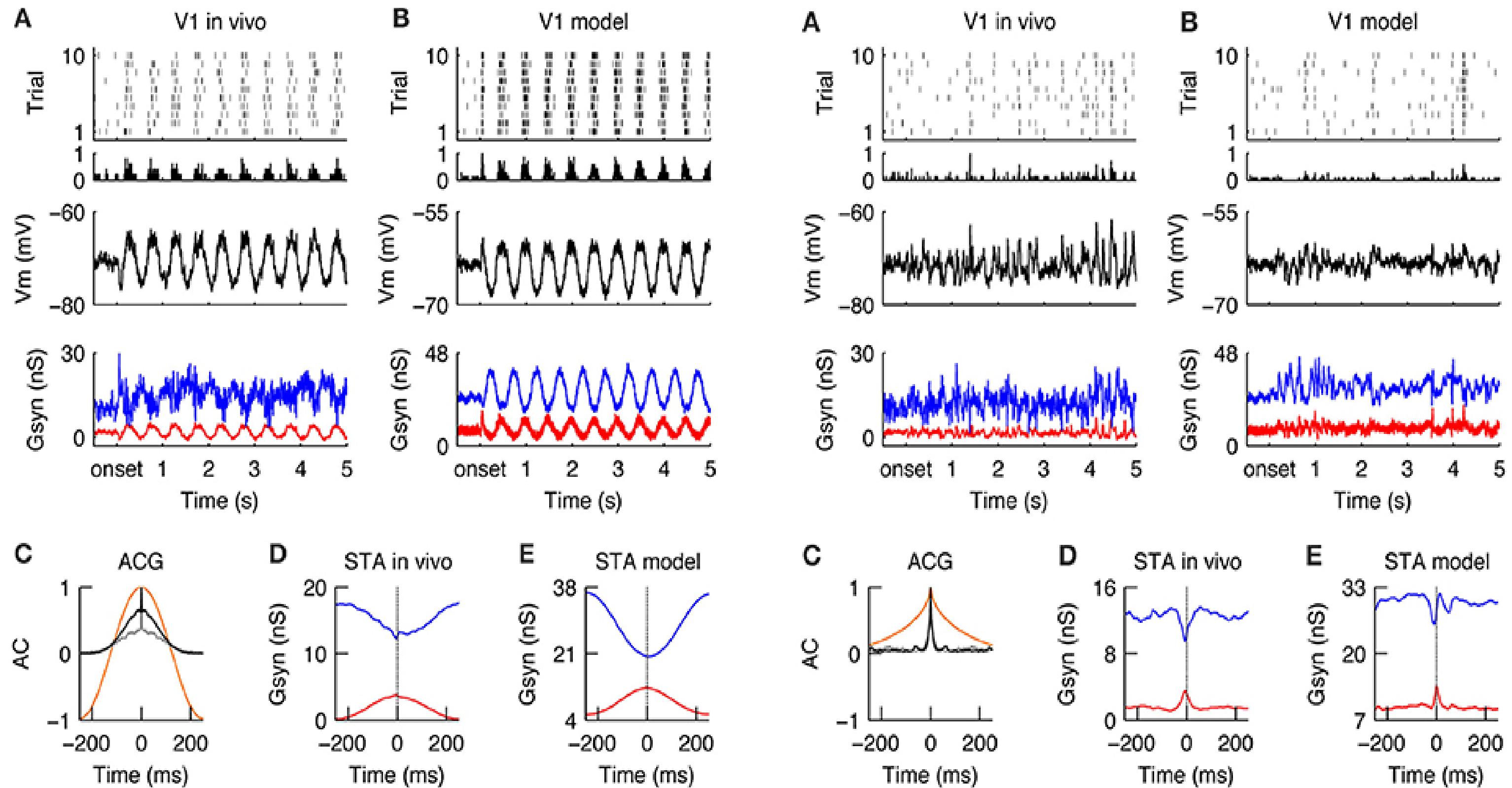
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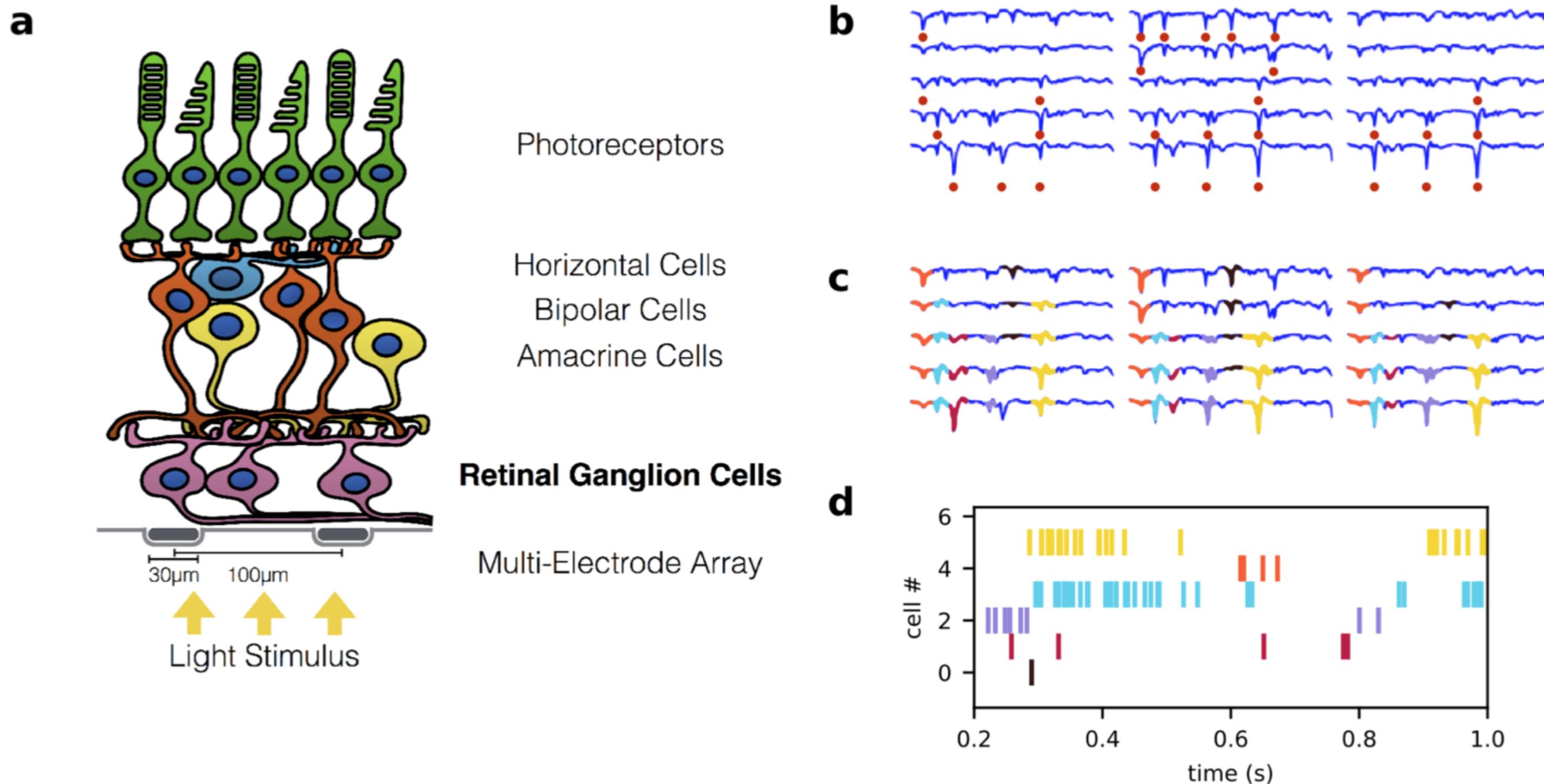
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Outline

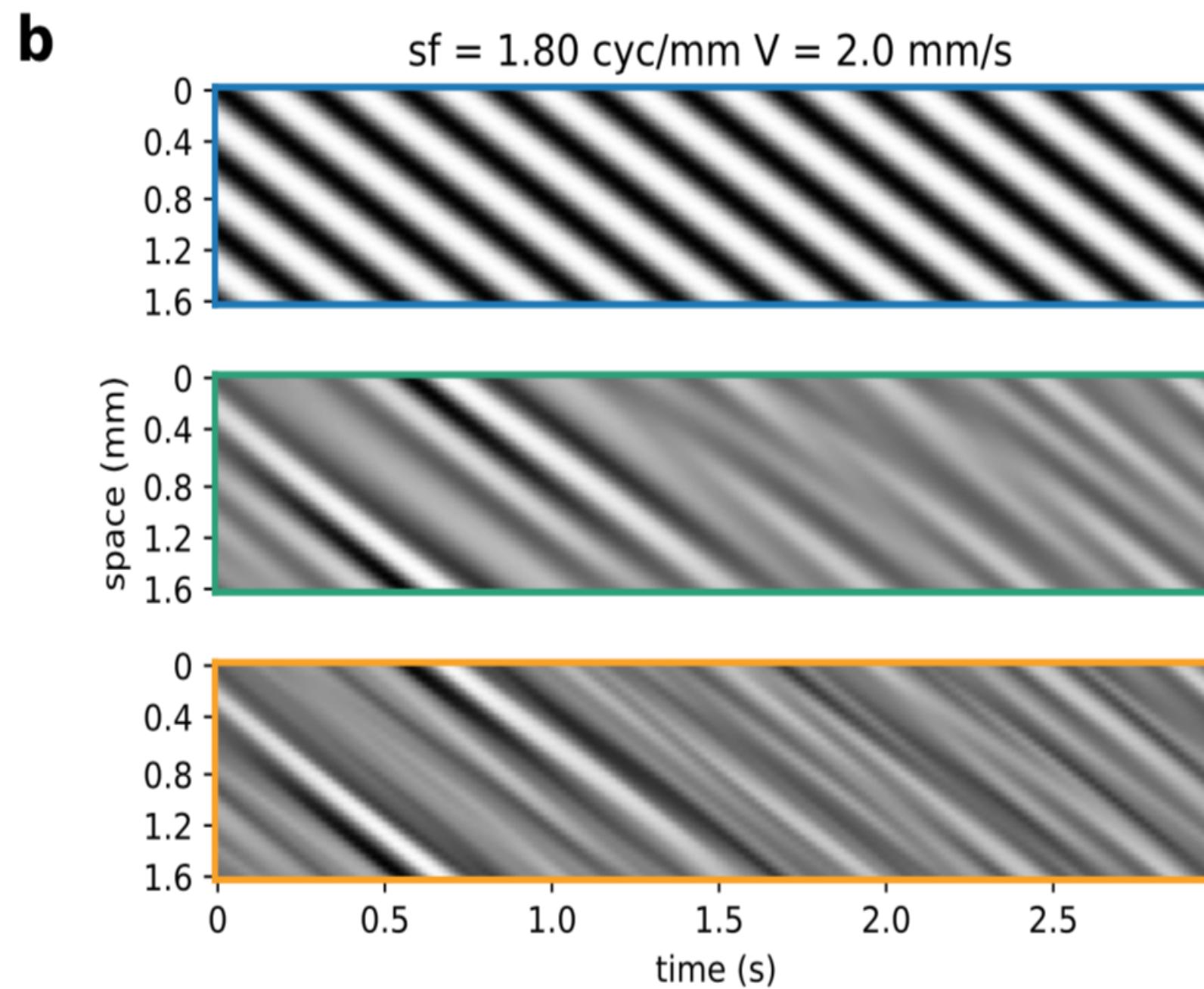
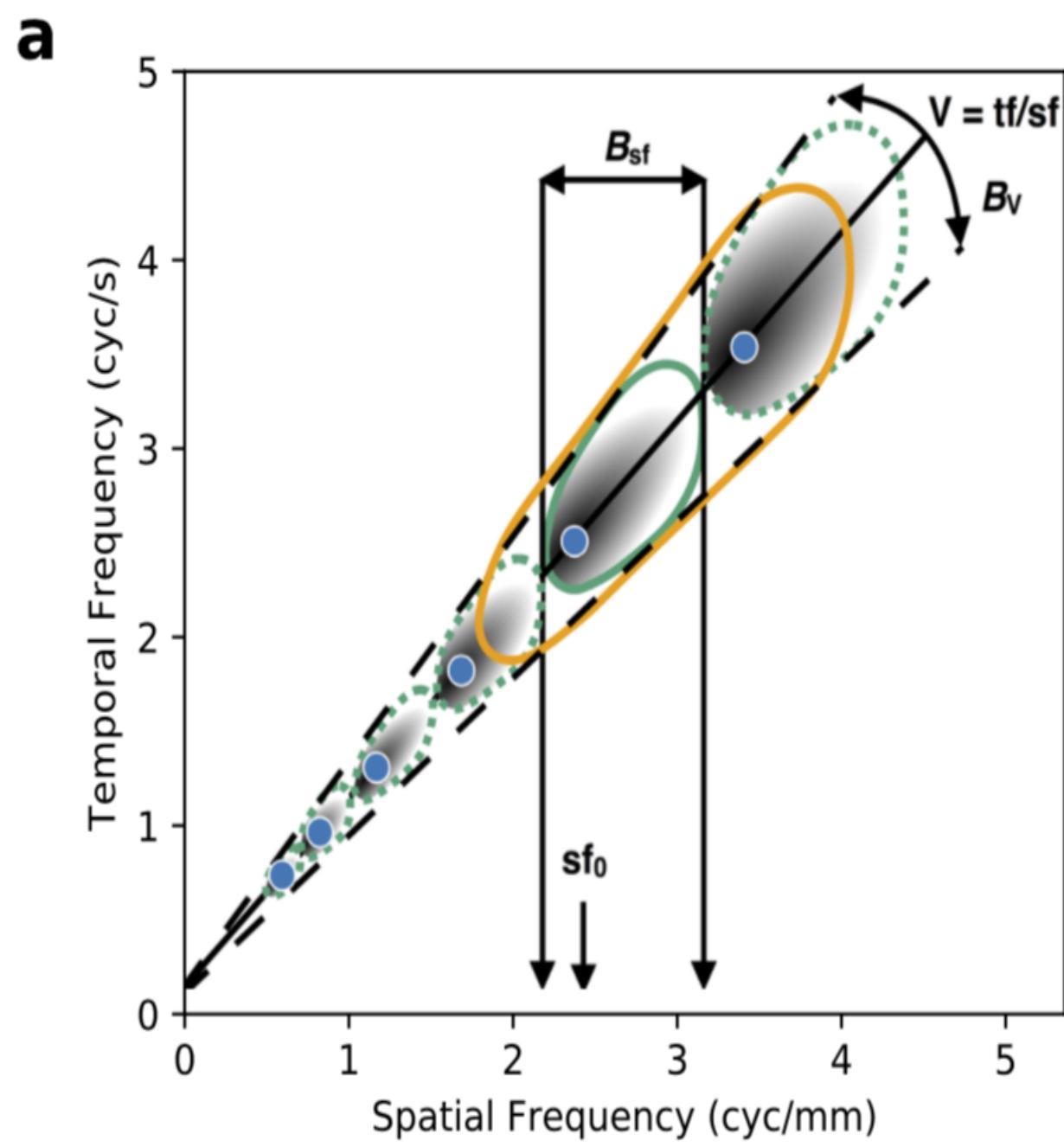
1. Efficiency, vision and neurons
2. Sparse coding in the retina?
3. Sparse Hebbian Learning

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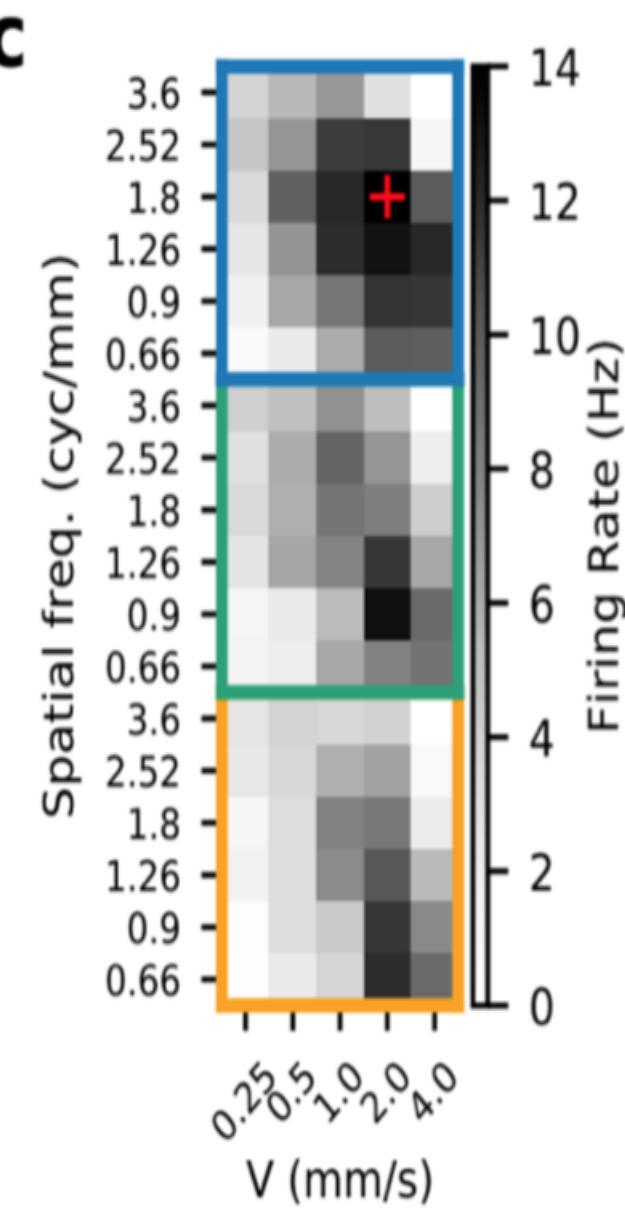
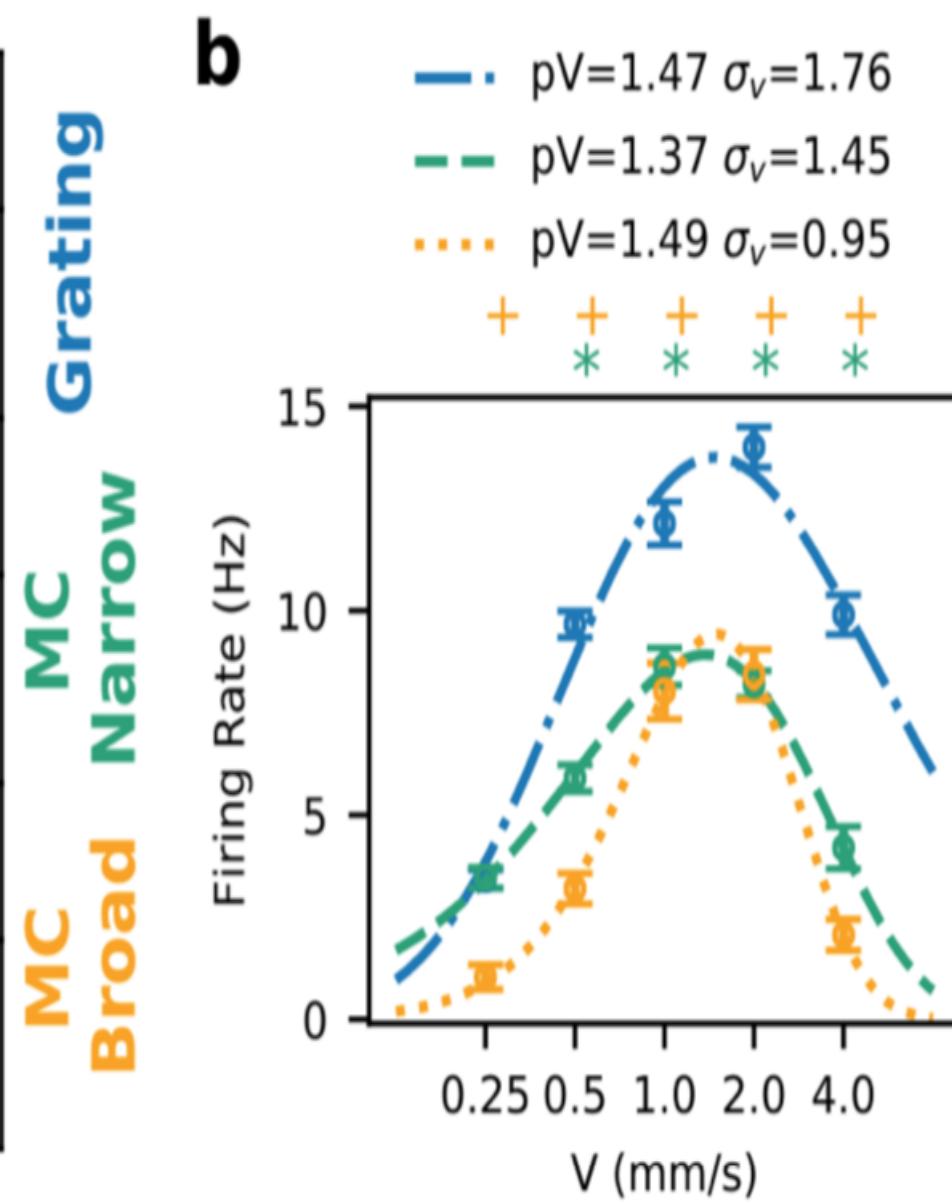
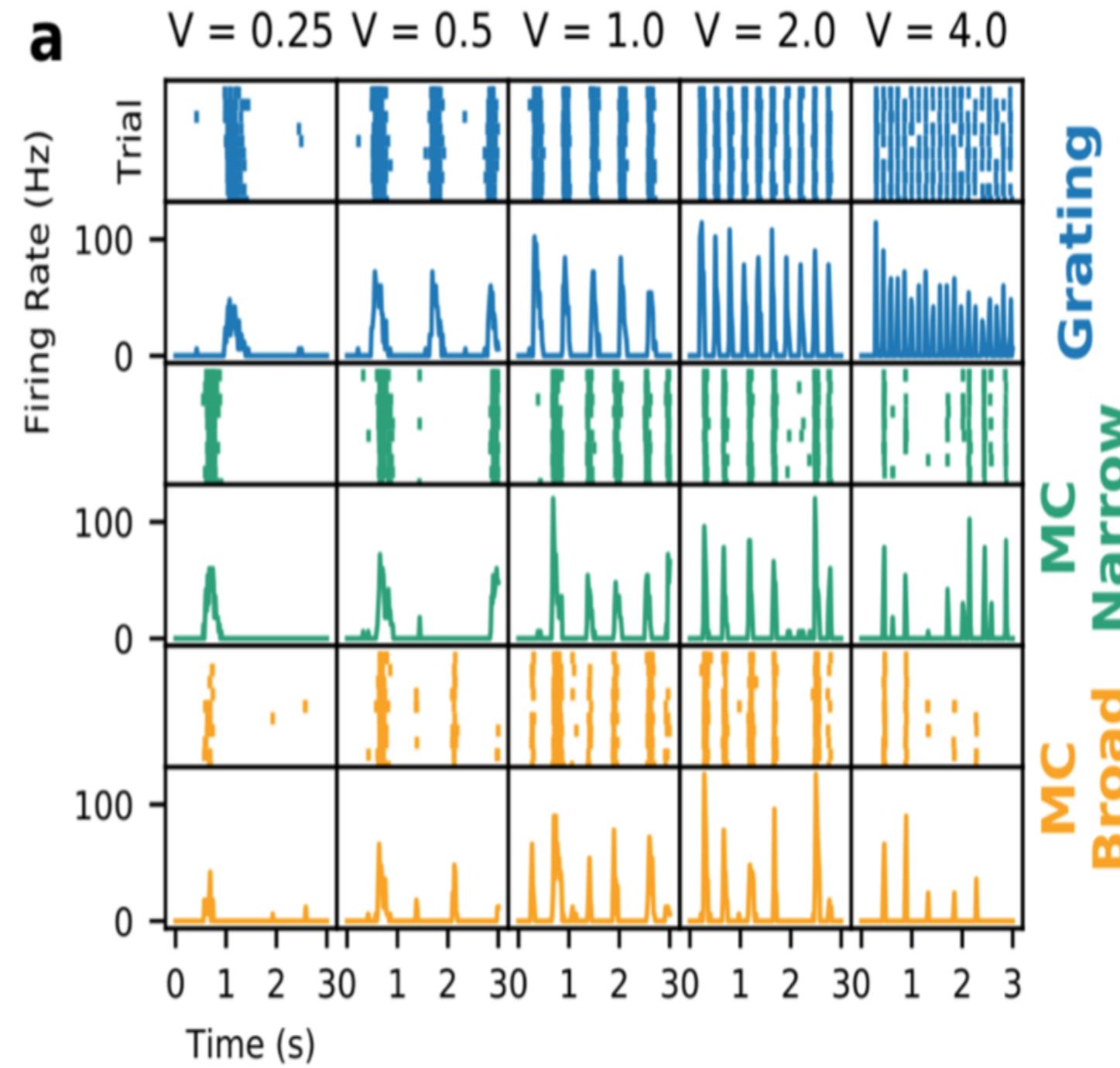
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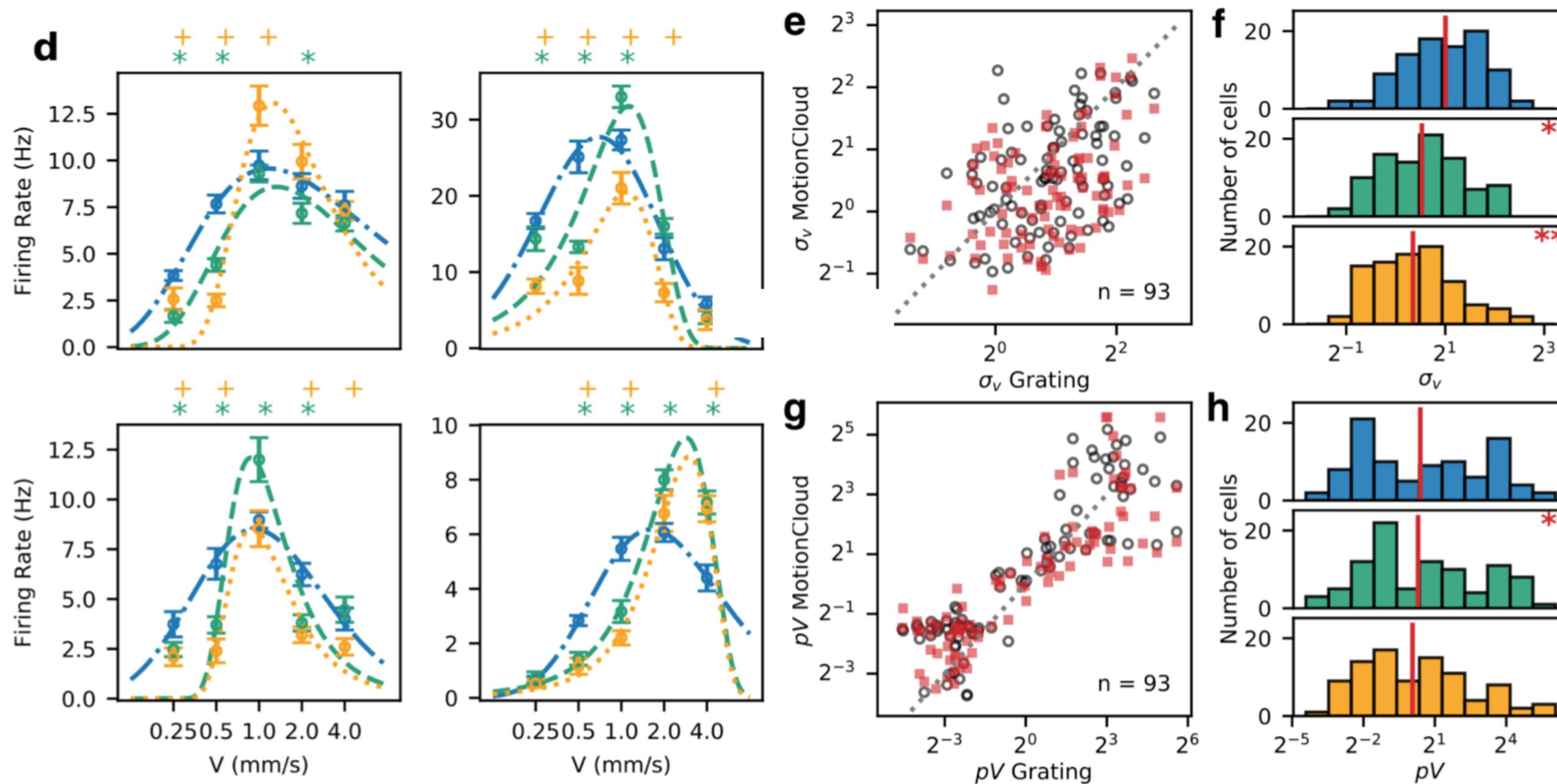
Ravello, LP, Escobar, Palacios (2018) *Scientific Reports*



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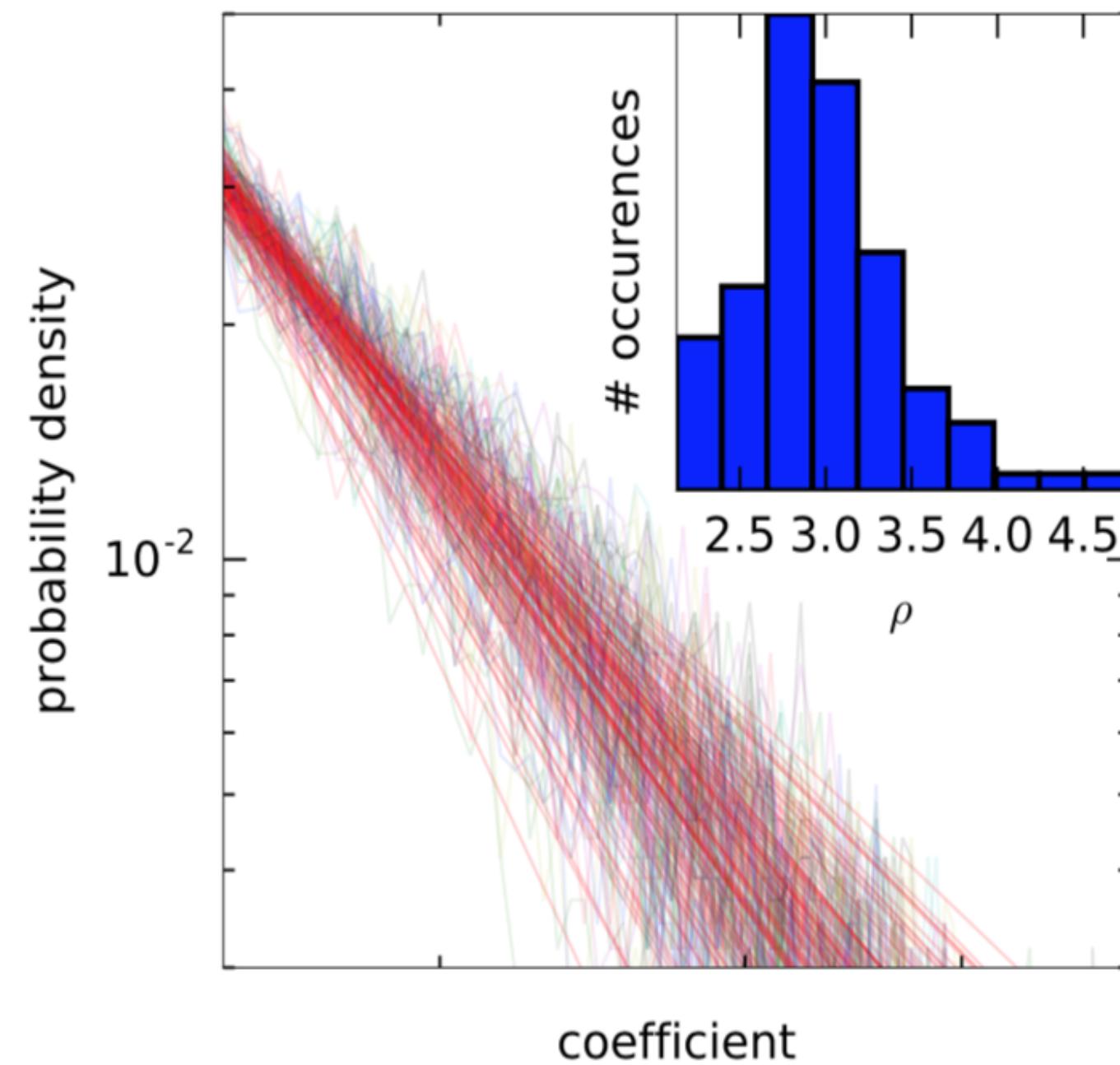
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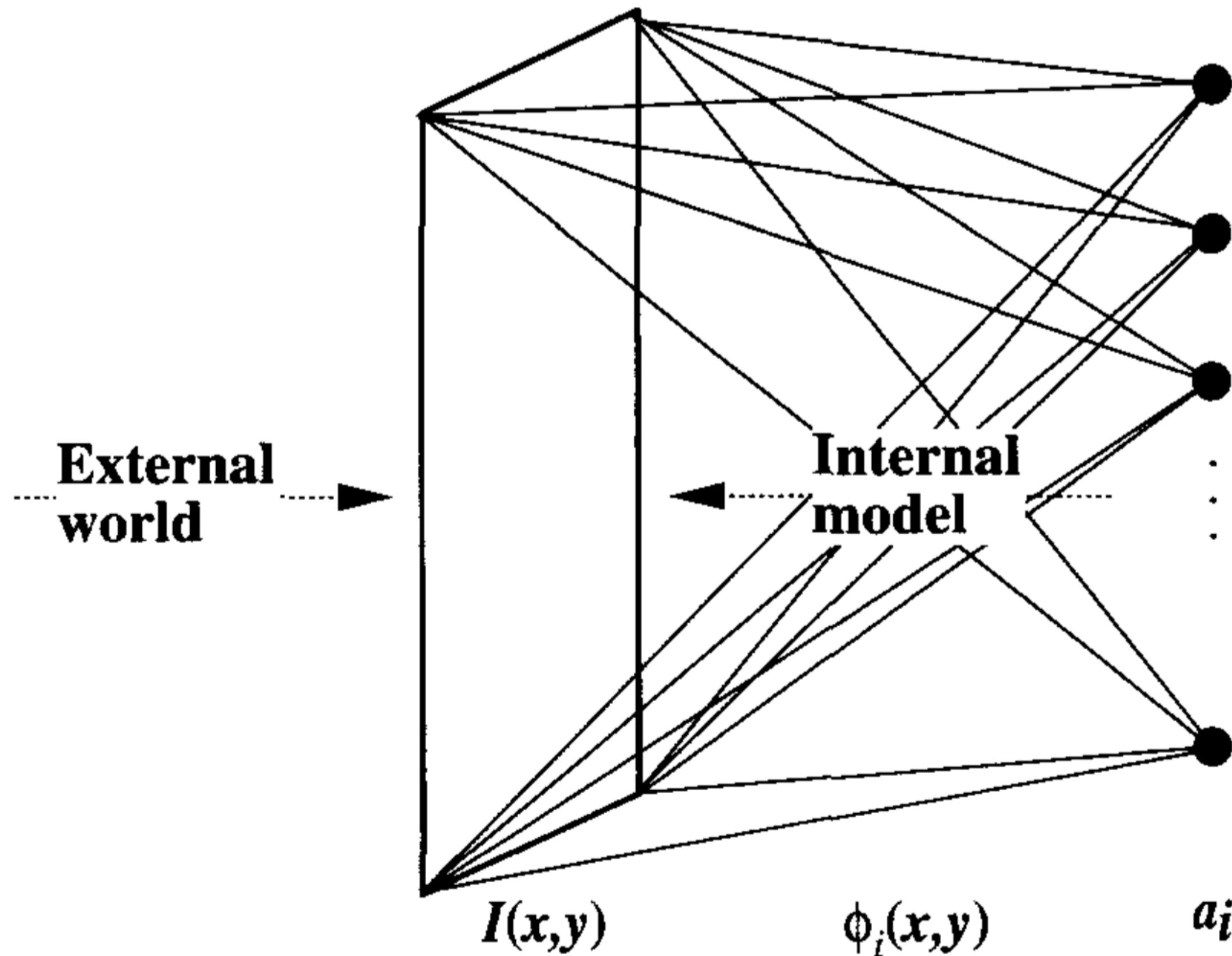


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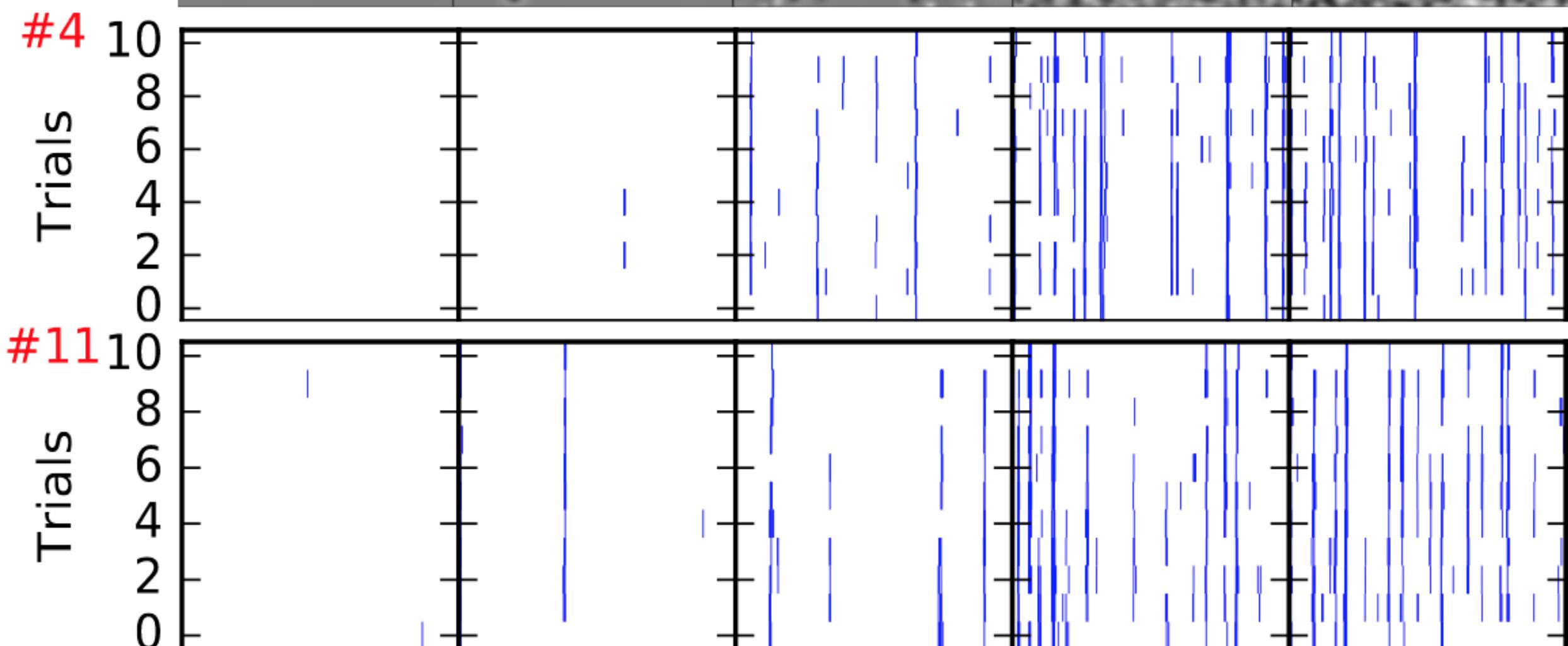
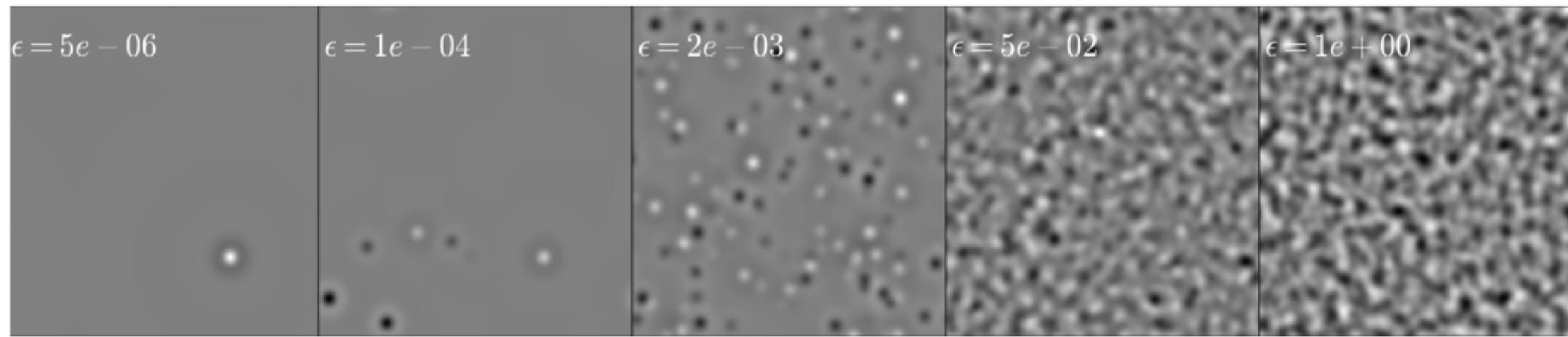
Ravello, Escobar, Palacios, LP (2019) *in prep*



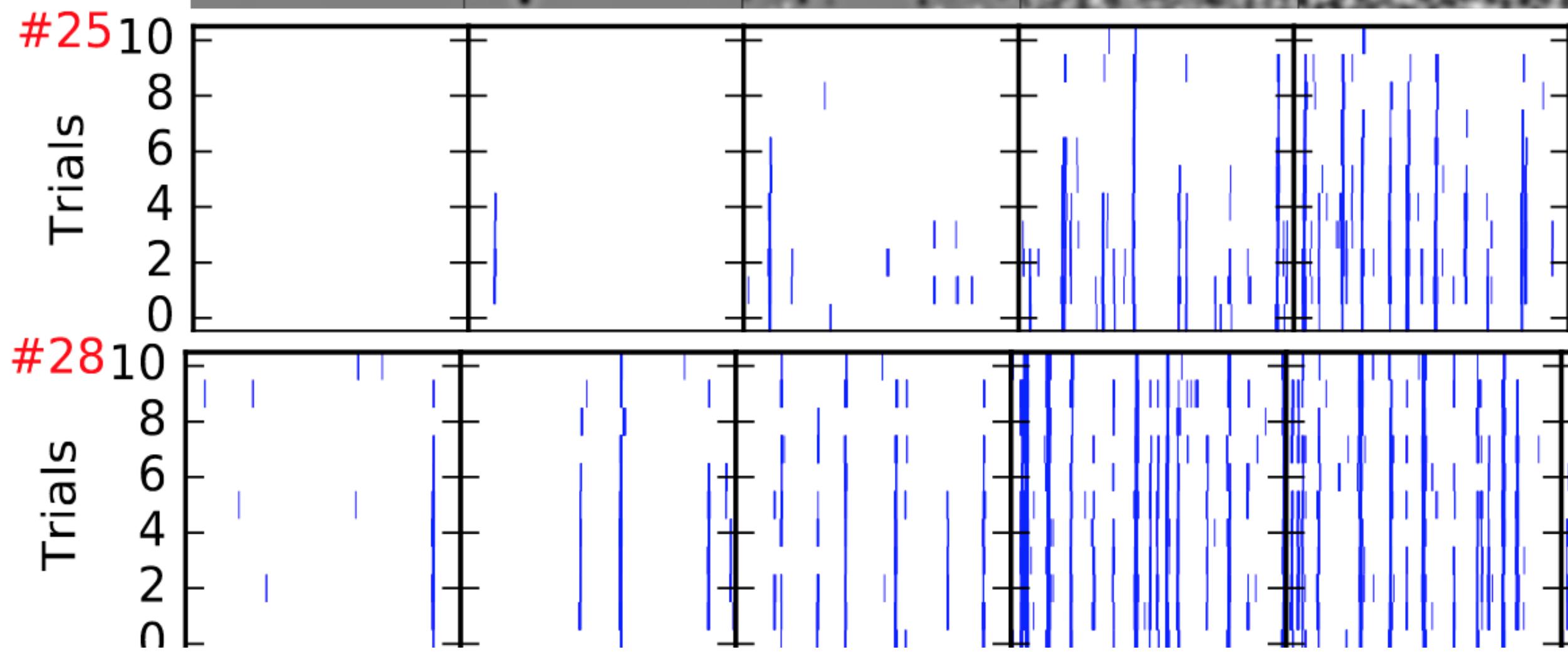
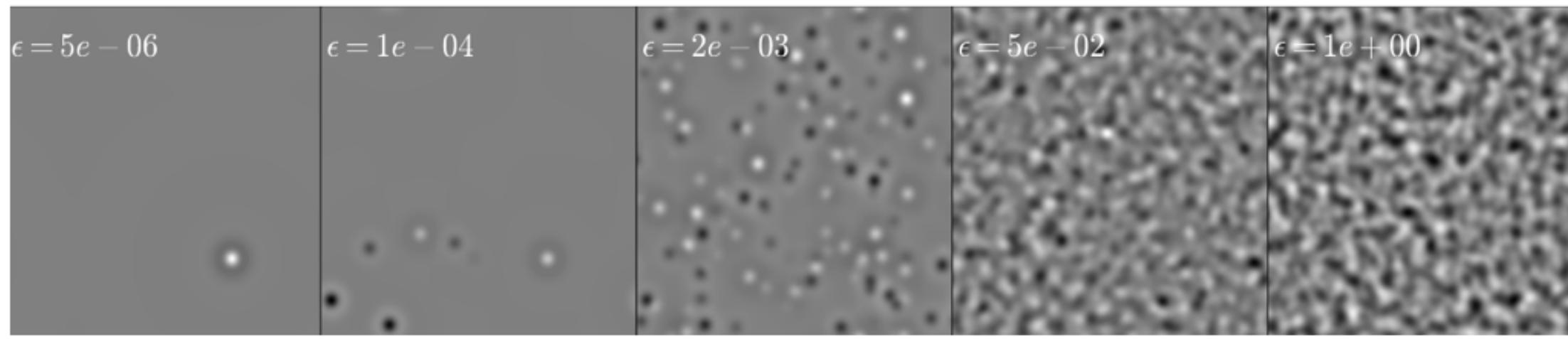
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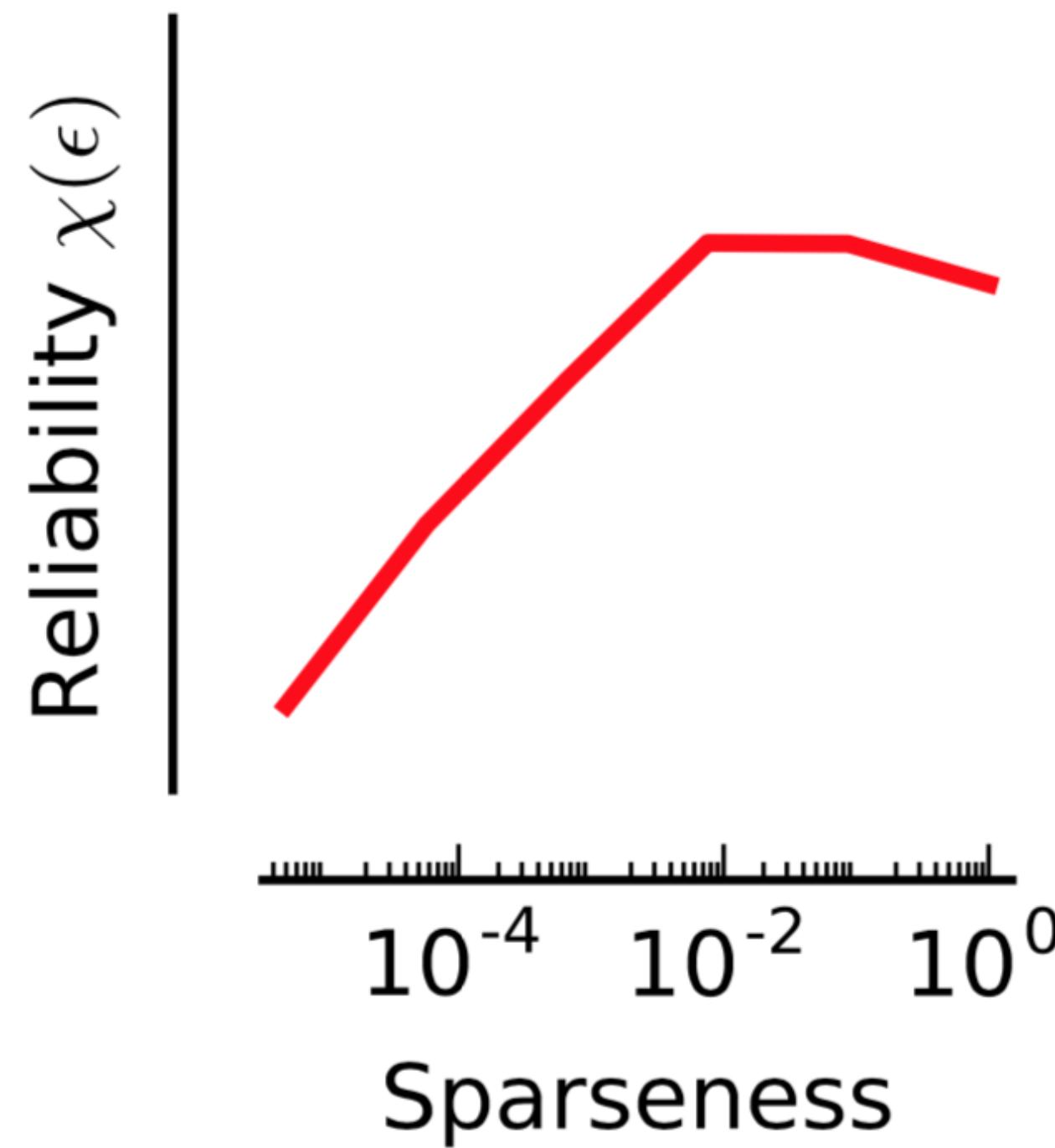
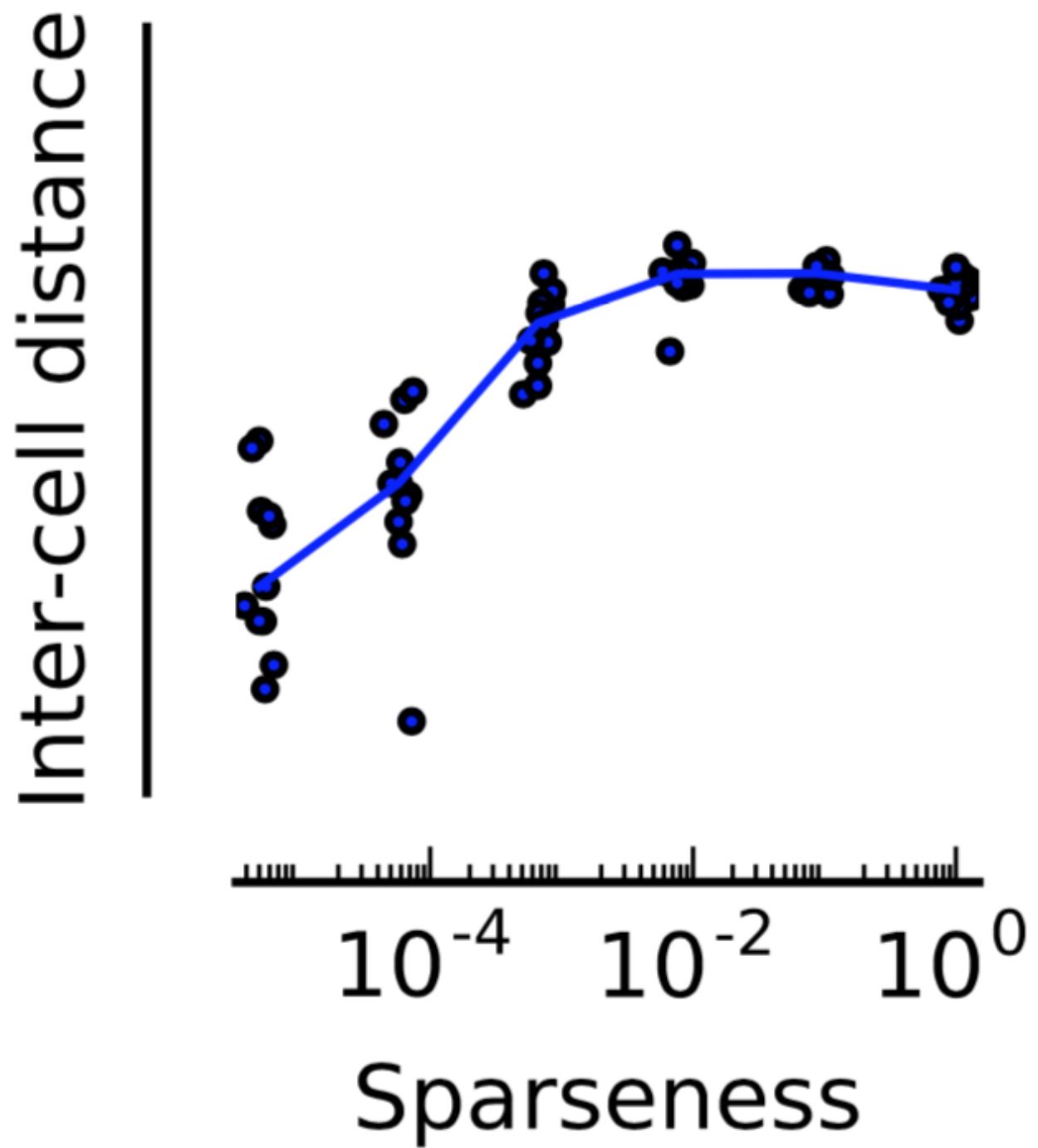




Ravello, Escobar, Palacios, LP (2019) *in prep*



Ravello, Escobar, Palacios, LP (2019) *in prep*



Ravello, Escobar, Palacios, LP (2019) *in prep*

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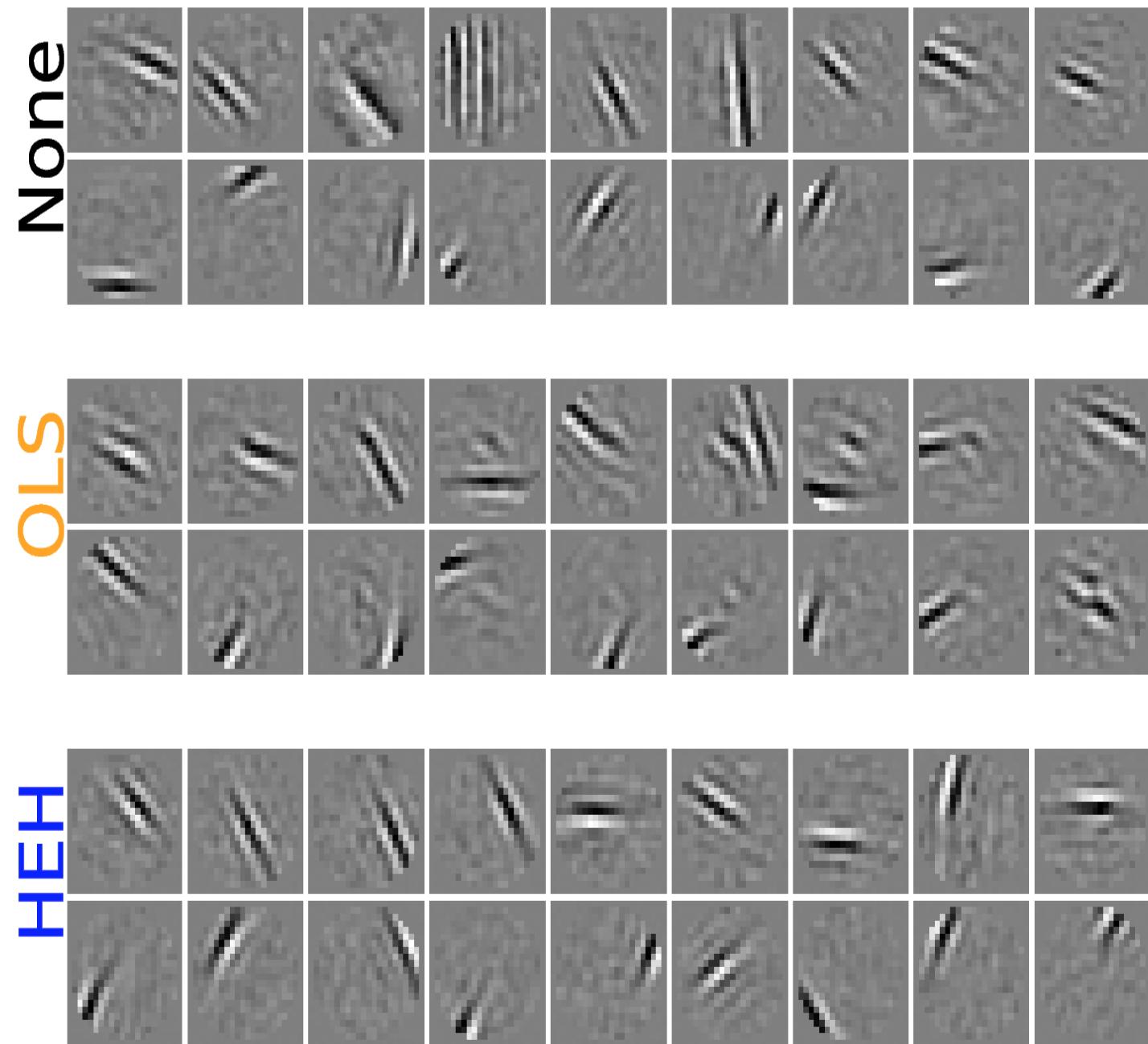
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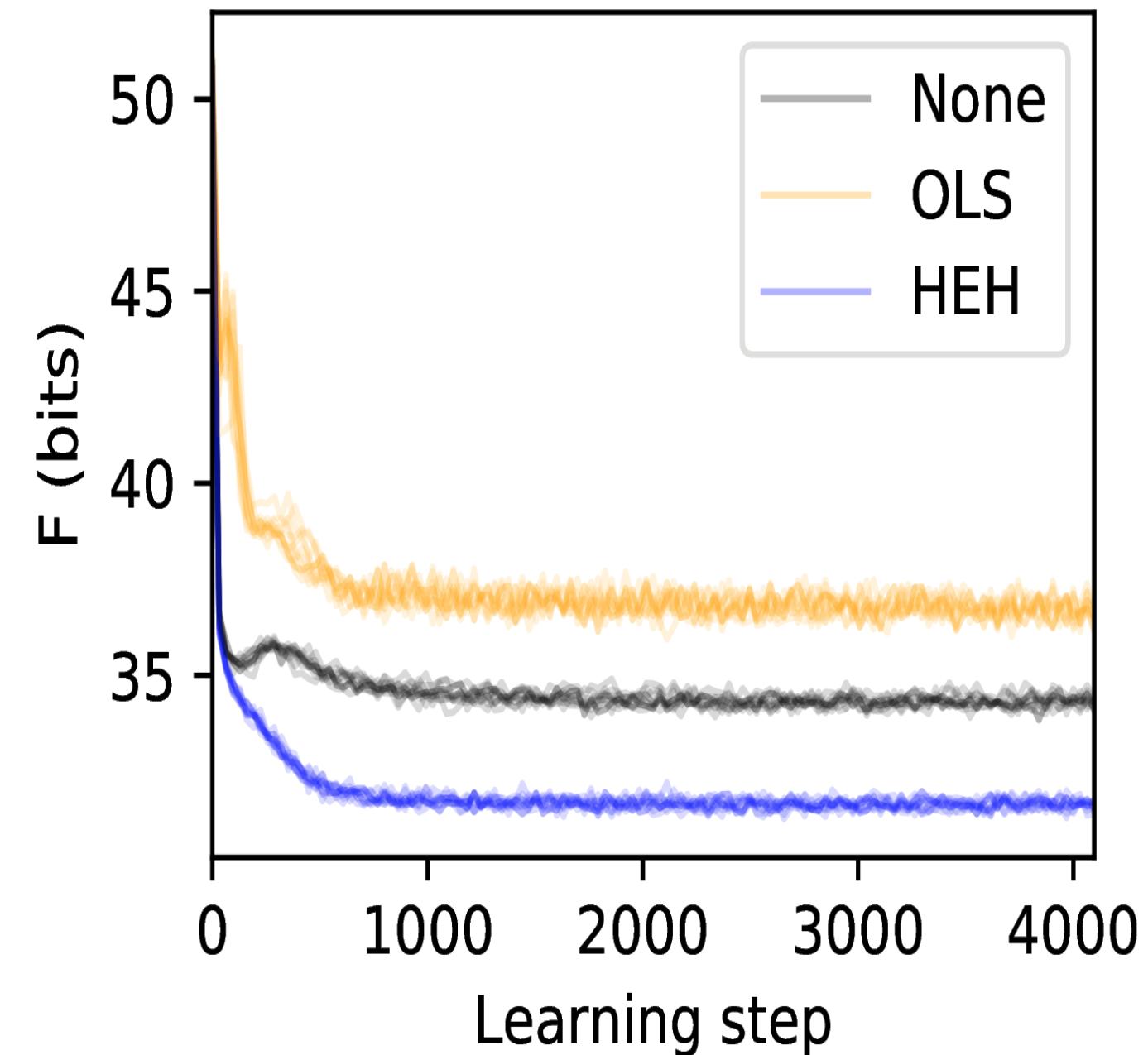
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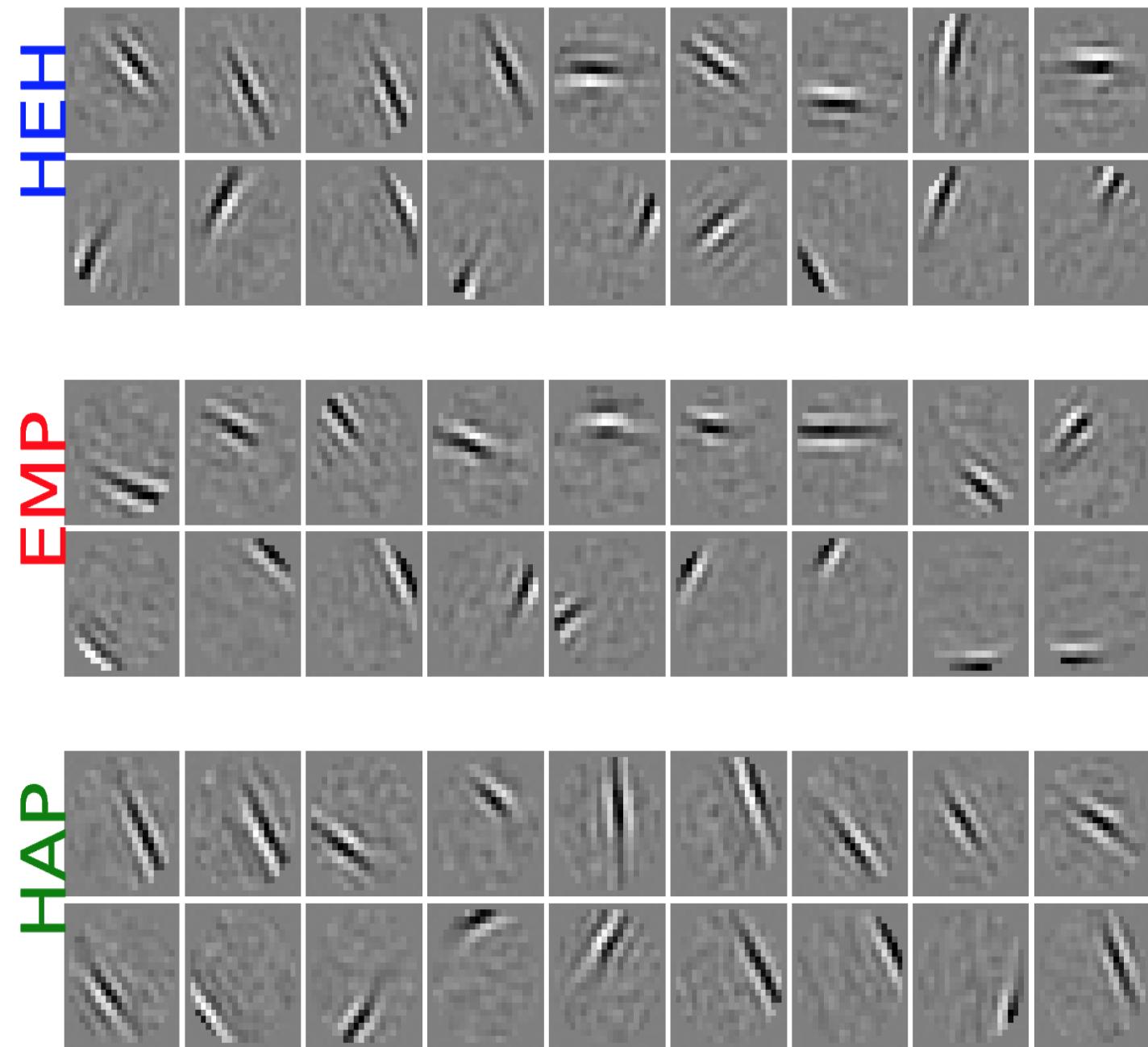
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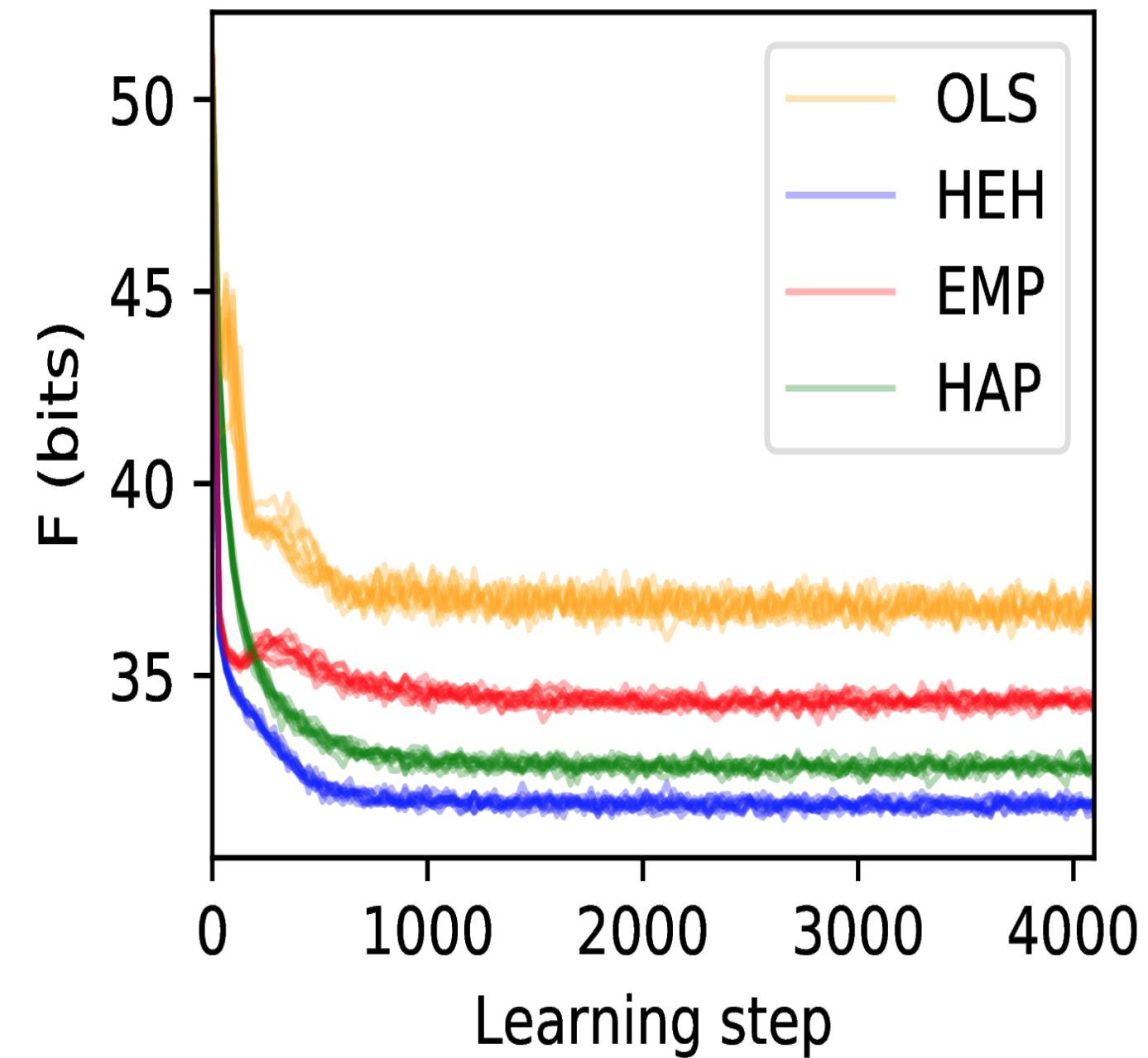
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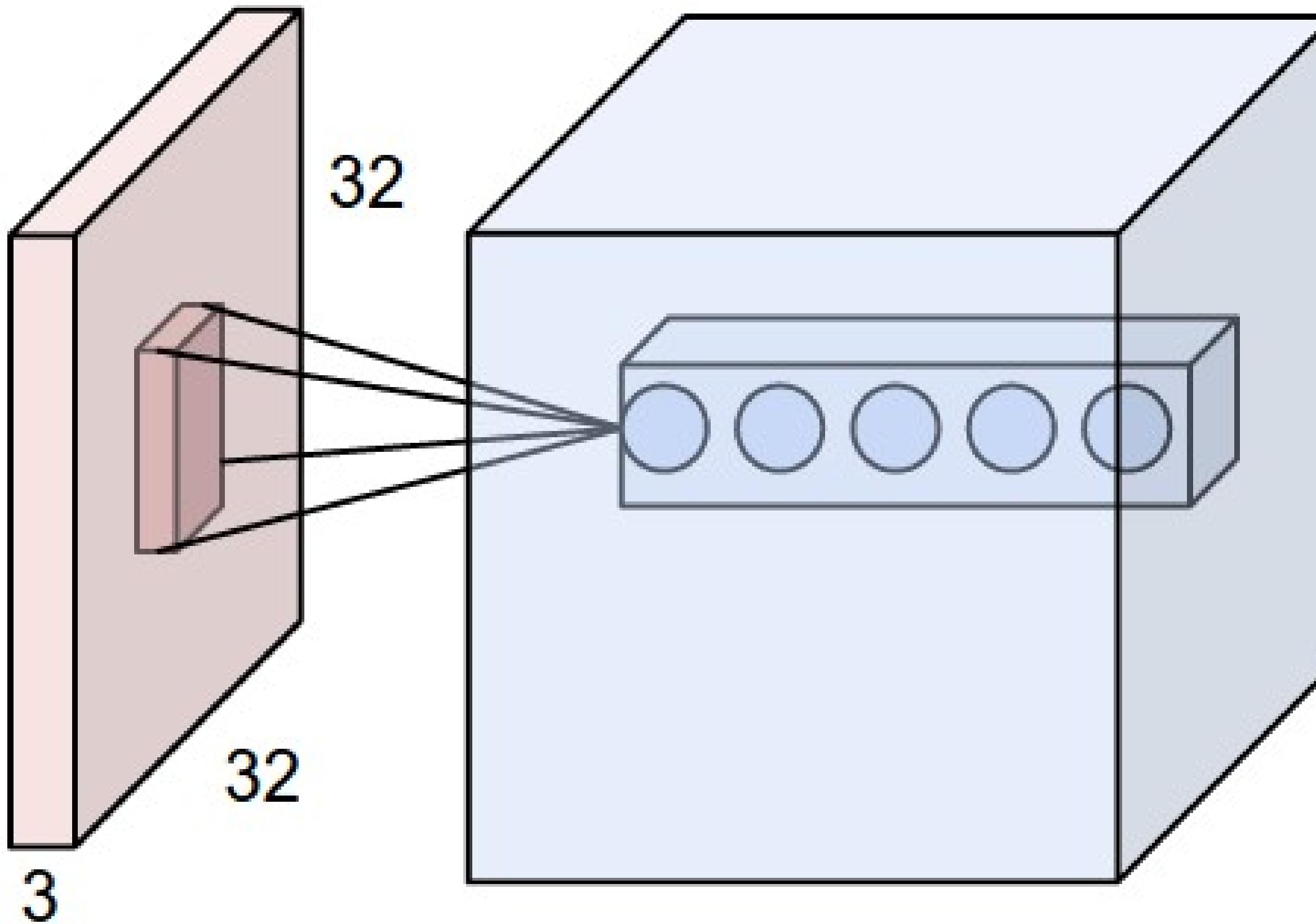


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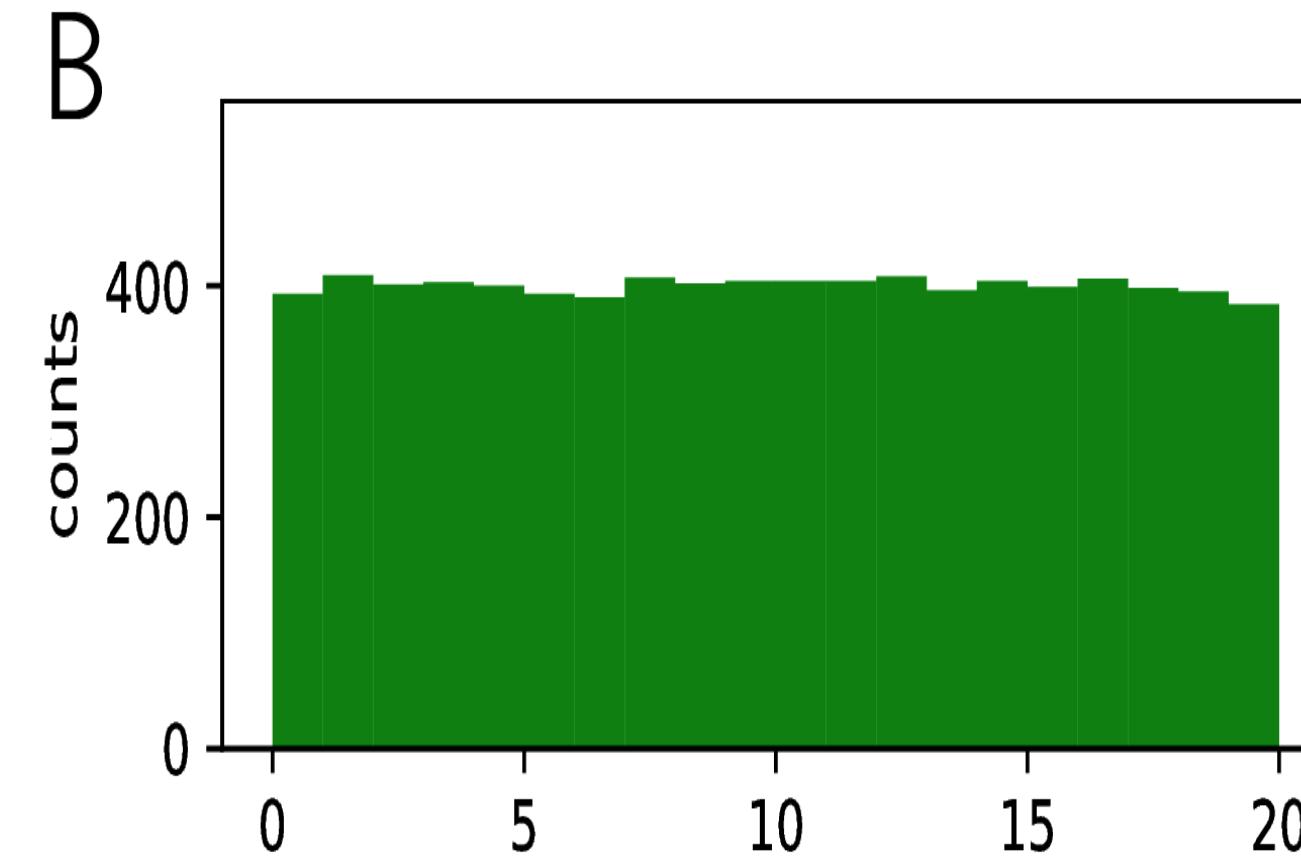
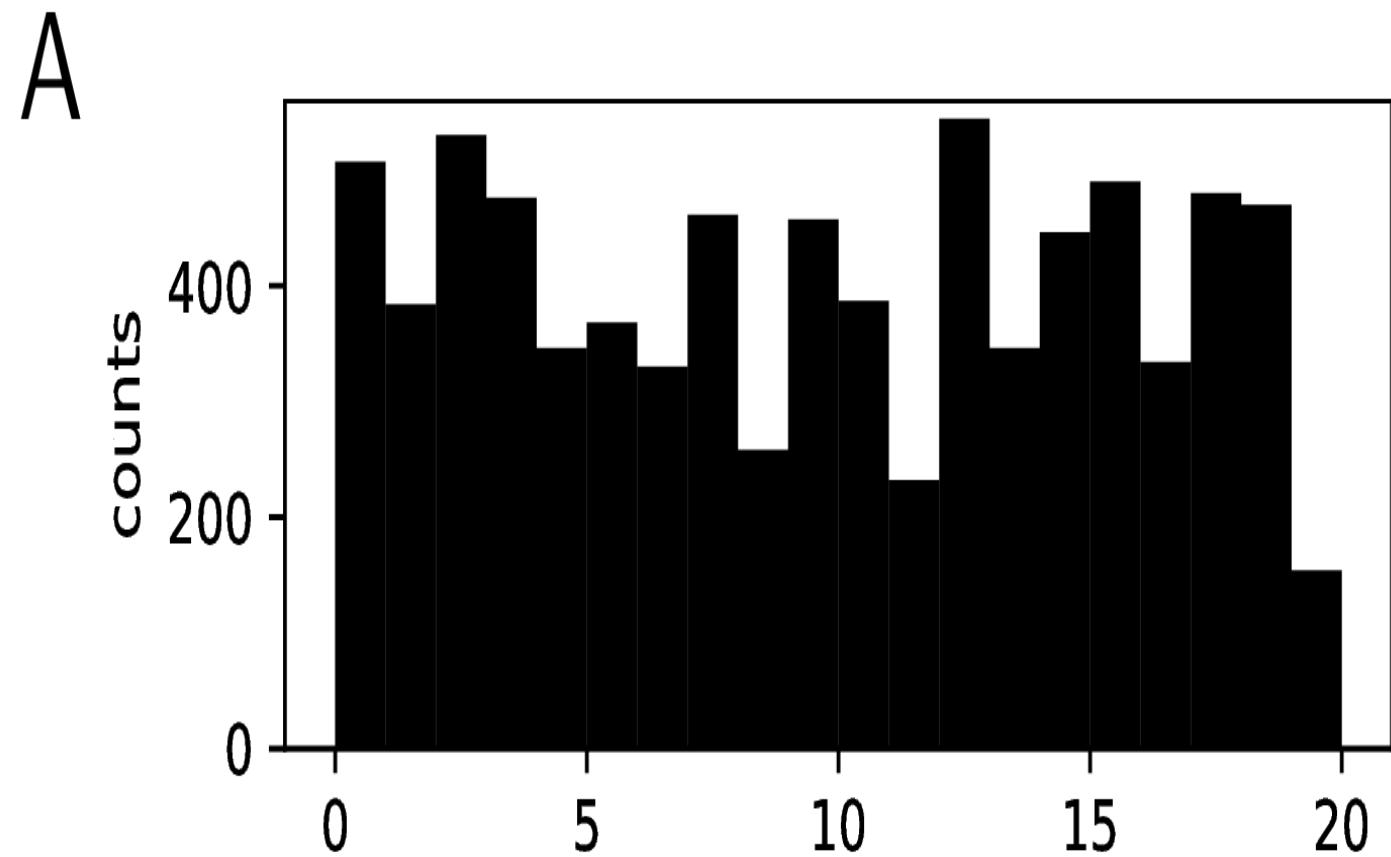
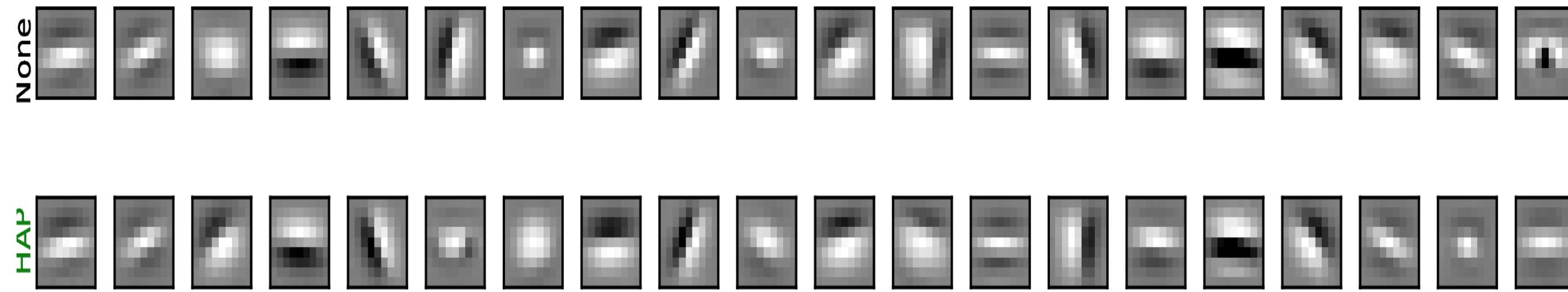


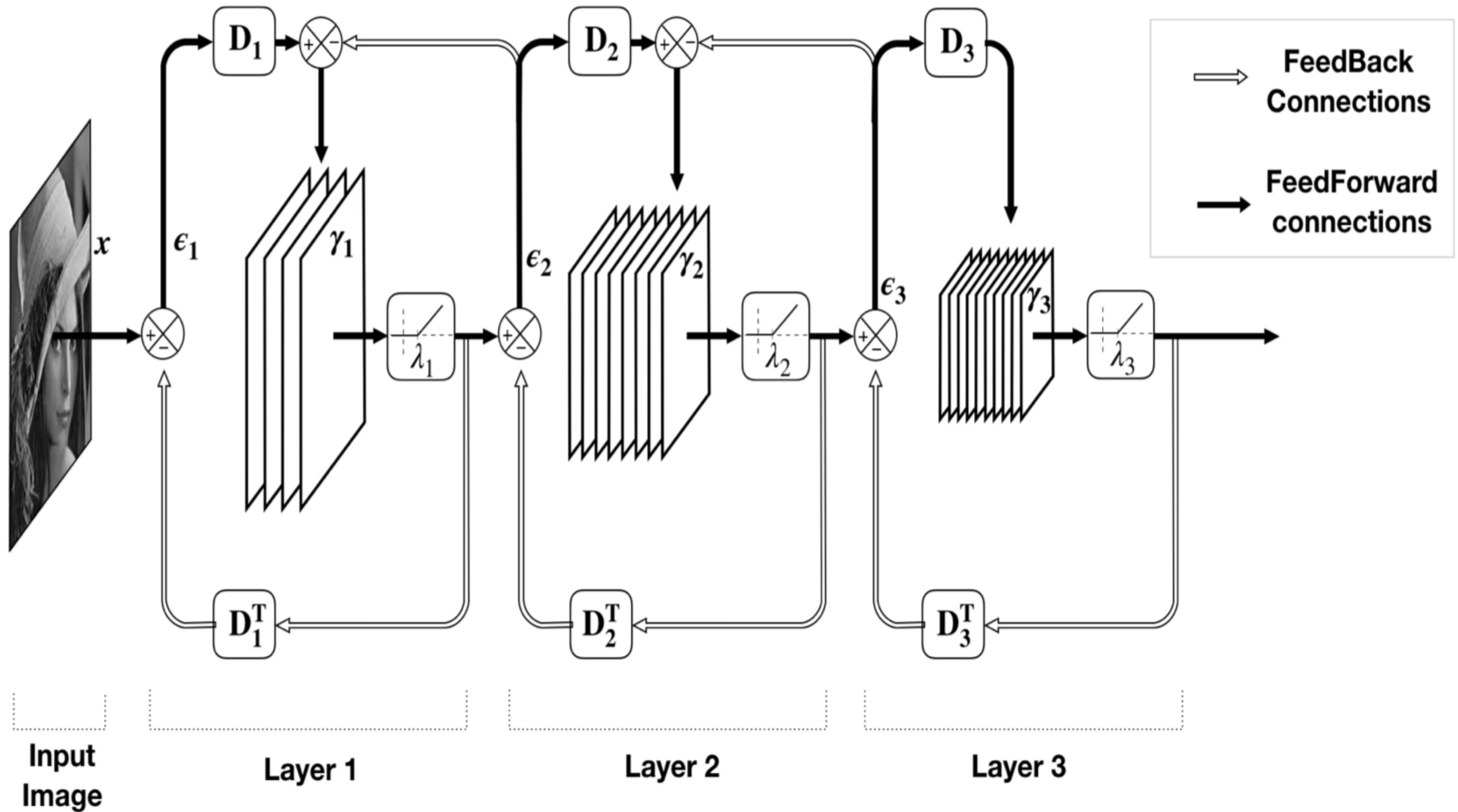
B





(from <http://cs231n.github.io/convolutional-networks/>)

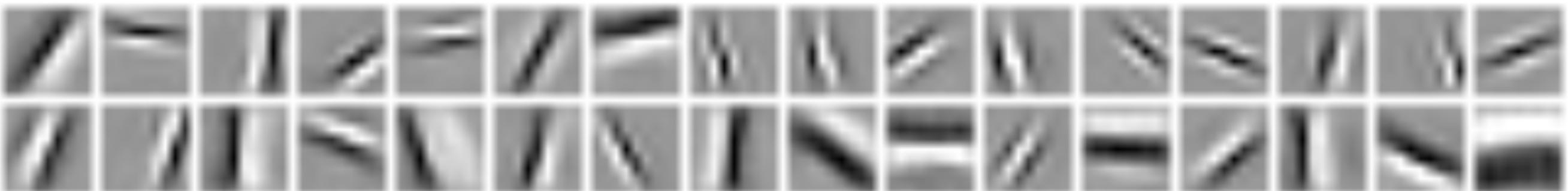




(a) Examples of AT&T images after pre-processing



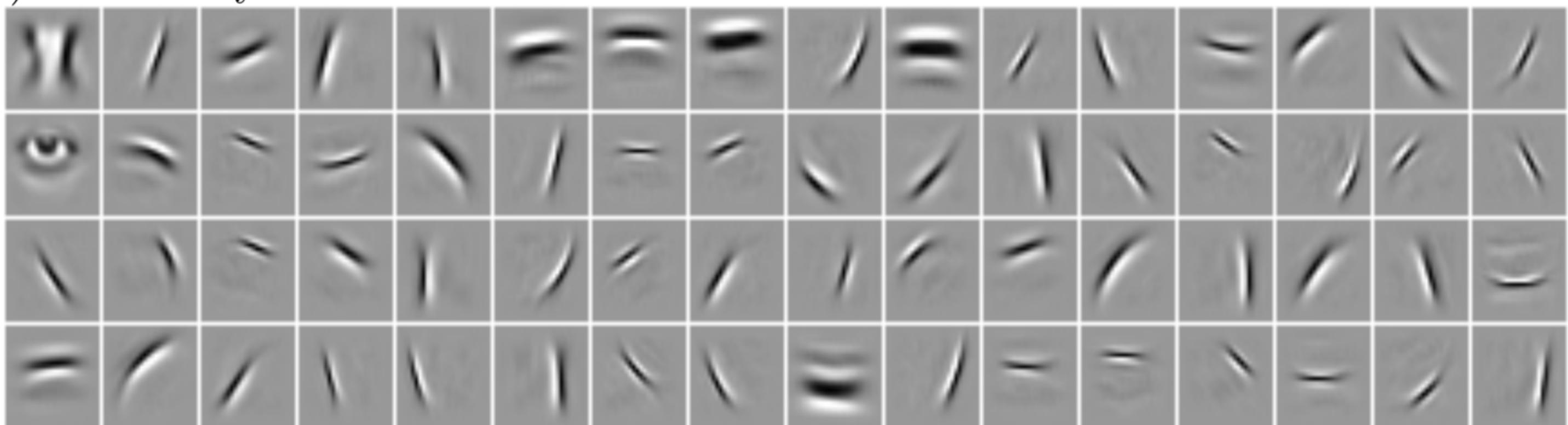
(b) First layer RFs



(c) First layer prediction

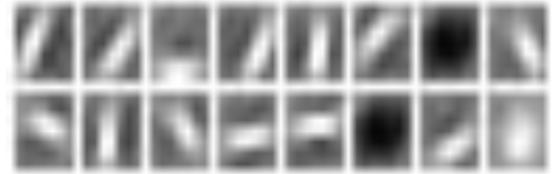
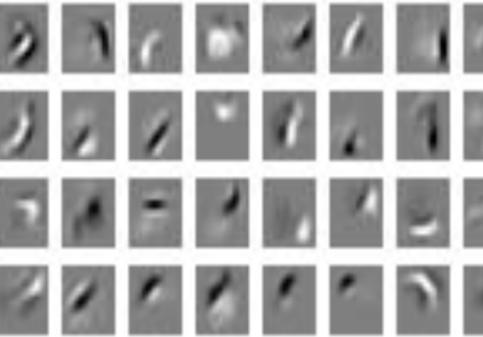
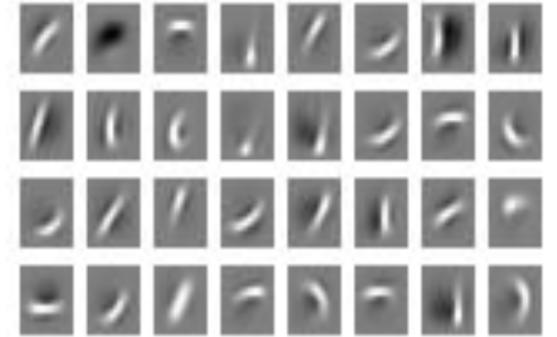
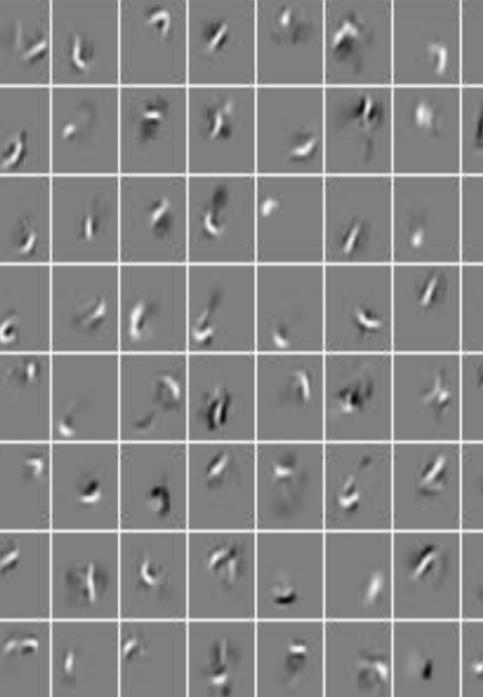
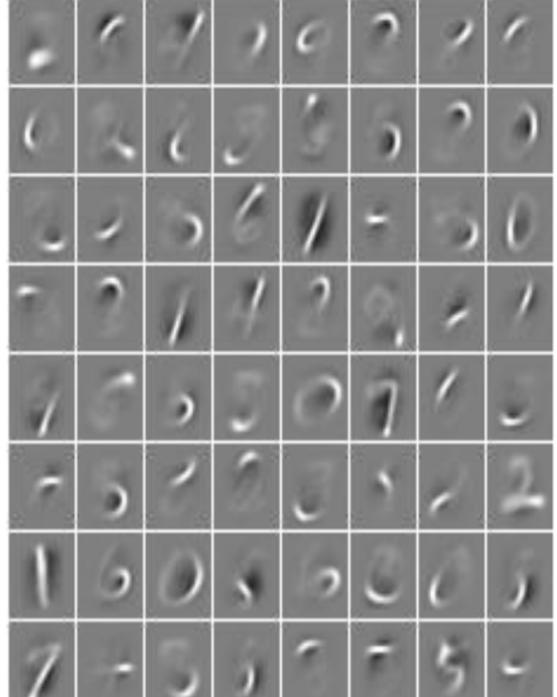


(d) Second layer RFs

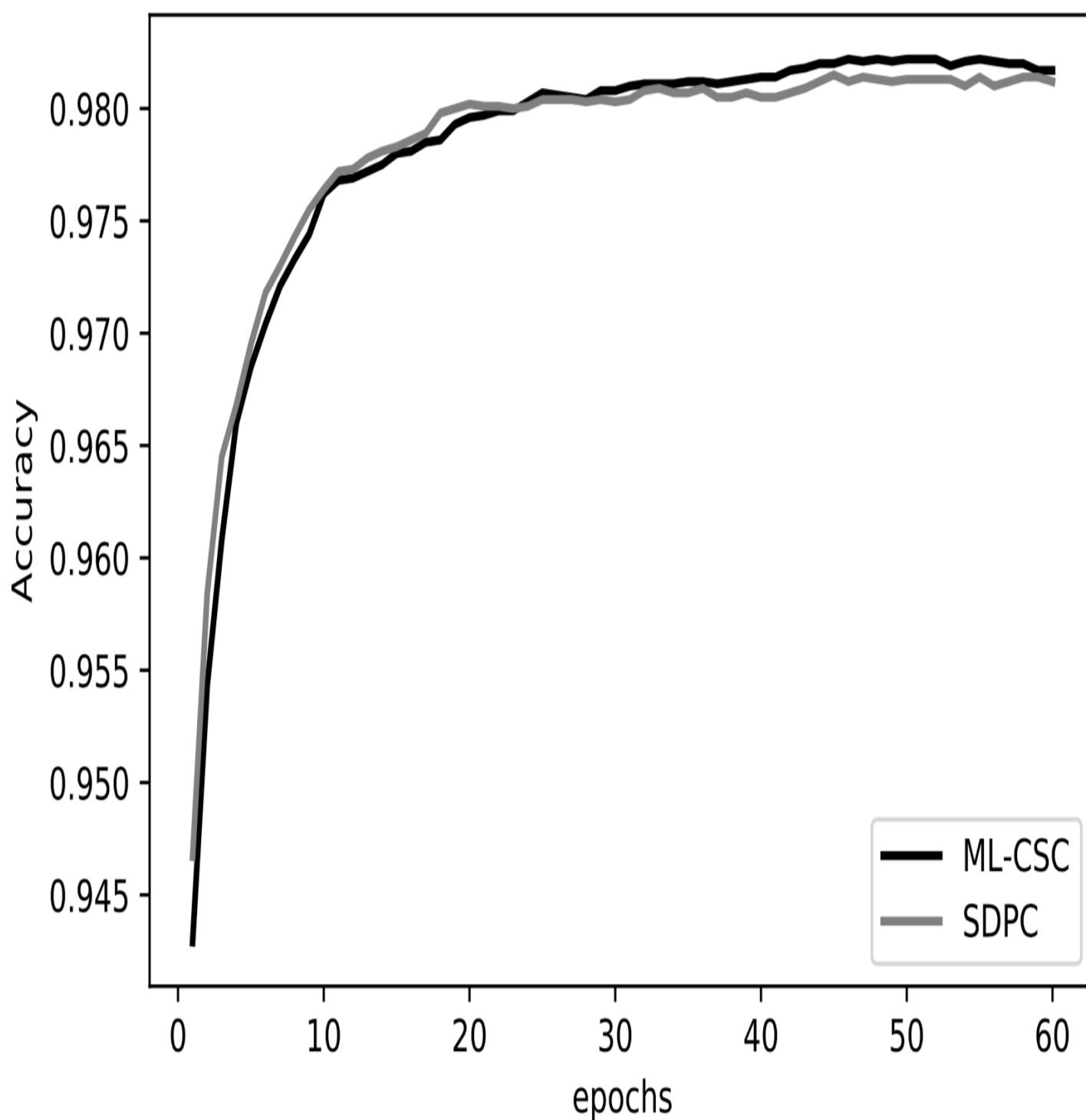


(e) Second Layer prediction



Layer	ML-CSC	SDPC
Layer 1		
Layer 2		
Layer 3		

Layer	ML-CSC	SDPC
Layer 1		
Layer 2		
Layer 3		



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