/ 10

Laurent Perrinet - Montreal AI and Neuroscience conference, December 13th, 2025 - Montréal, Québec

2

Convolutional Neural Networks

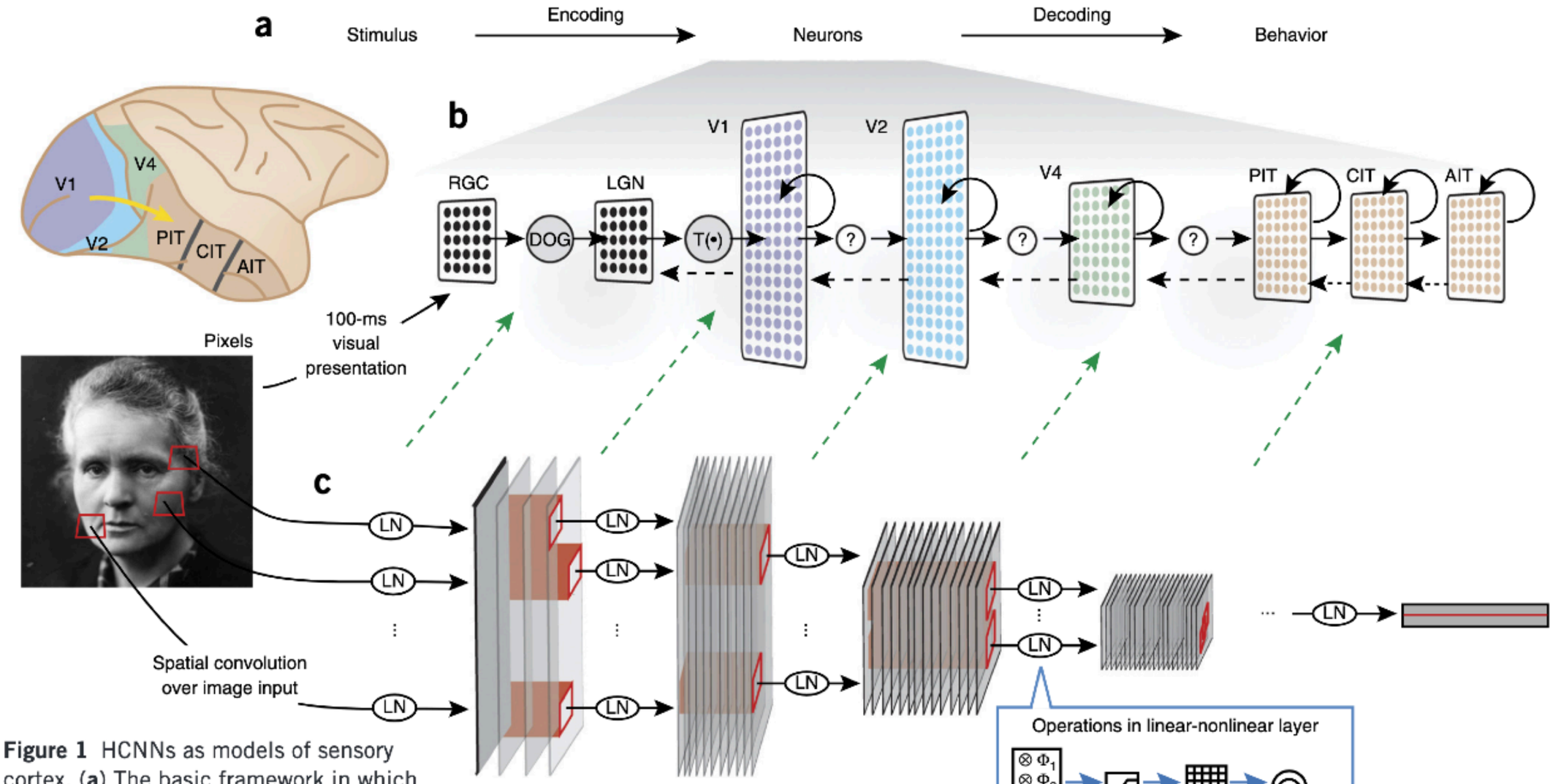

Figure 1 HCNNs as models of sensory cortex. (**a**) The basic framework in which sensory cortex is studied is one of encoding—the process by which stimuli are transformed into patterns of neural activity—and decoding, the process by which neural activity generates behavior. HCNNs have been used to make models of the encoding step; that is, they describe the mapping of stimuli to neural responses as measured in brain. (**b**) The ventral visual pathway is the most comprehensively studied sensory cascade.

Using goal-driven deep learning models to understand sensory cortex (2016) Daniel L K Yamins & James J DiCarlo

Model Size vs Accuracy

1e8

Total Parameters

2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25

0.74 0.76 0.78 0.80 0.82 0.84

Accuracy

Inference Time vs Accuracy

Wall Clock Time (ms/image)

22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0

0.74 0.76 0.78 0.80 0.82 0.84

Accuracy

Datasets:
- full
- bbox

Masking:
- do_mask=False
- do_mask=True

Models:
- convnext_tiny
- convnext_base
- convnext_large

Deep Image Prior

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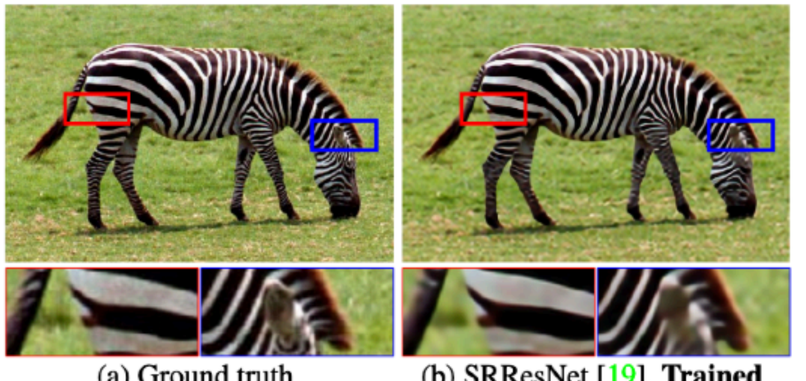
Abstract

Deep convolutional networks have become a popular tool for image generation and restoration. Generally, their excellent performance is imputed to their ability to learn realistic image priors from a large number of example images. In this paper, we show that, on the contrary, the structure *of a generator network is sufficient to capture a great deal of low-level image statistics* prior to any learning. *In order to do so, we show that a randomly-initialized neural network can be used as a handcrafted prior with excellent results in standard inverse problems such as denoising, super-resolution, and inpainting. Furthermore, the same prior can be used to invert deep neural representations to diagnose them, and to restore images based on flash-no flash input pairs.*



(a) Ground truth (b) SRResNet [19], **Trained**

(c) Bicubic, **Not trained** (d) Deep prior, **Not trained**

Figure 1: **Super-resolution using the deep image prior.**

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nature human behaviour

Article

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End-to-end topographic networks as models of cortical map formation and human visual behaviour

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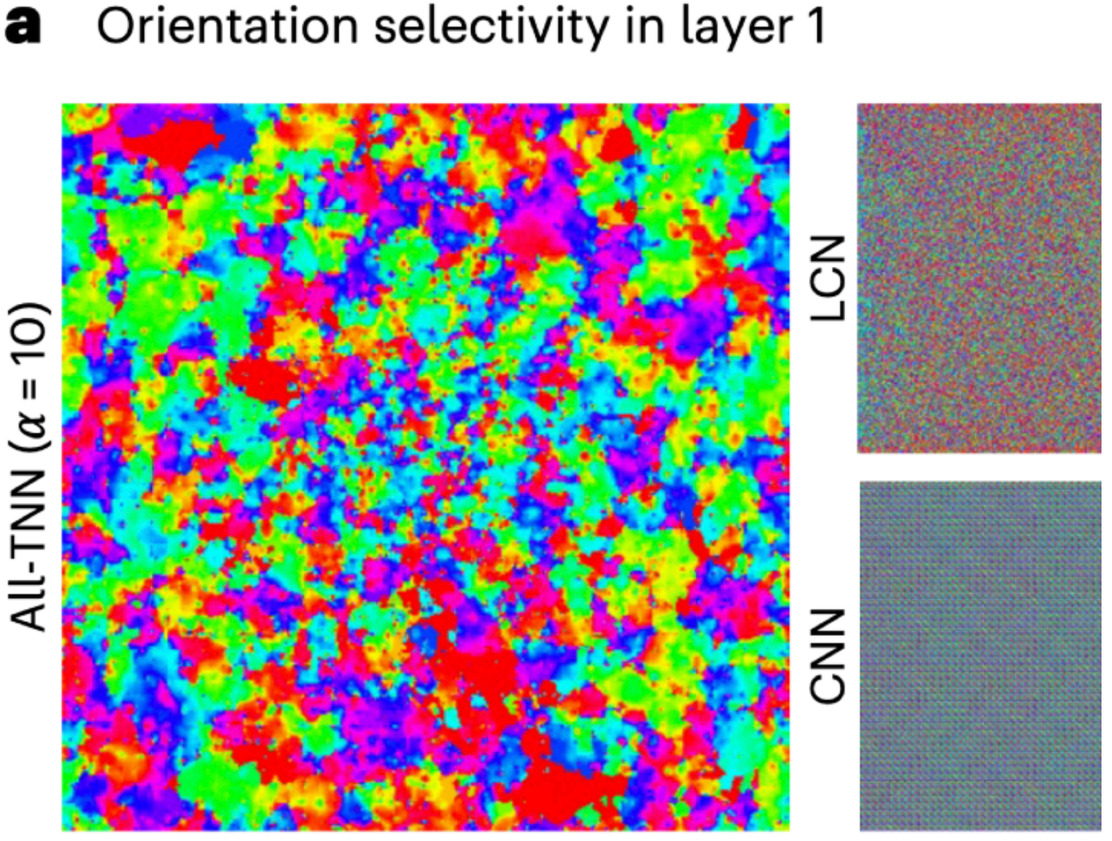
Zejin Lu[1,2,7] ✉, Adrien Doerig[1,3,7], Victoria Bosch[1,7], Bas Krahmer[4], Daniel Kaiser[5,6,8], Radoslaw M. Cichy[2,8] & Tim C. Kietzmann[1,8] ✉



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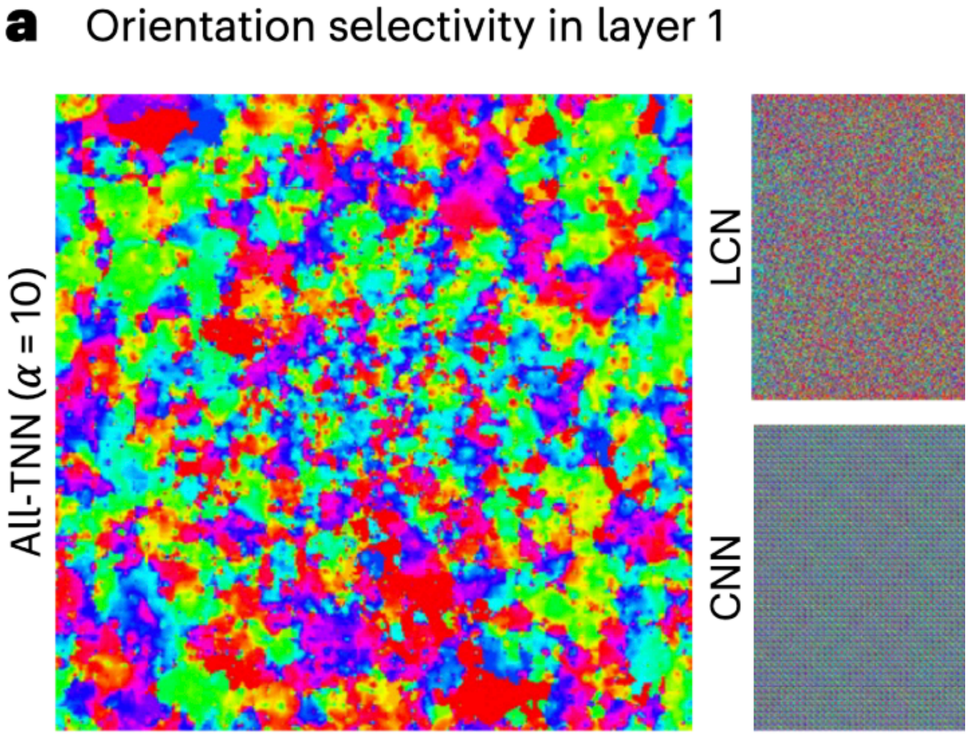

Retinotopy