Modeling Mid-Level Visual Representations through Clustering in a Convolutional Neural Network

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Presentation Abstract Summary The nature of visual properties used in cortical perception is subject to considerable ongoing study. Features of intermediate complexity are particularly uncertain. Convolutional Neural Network (CNN) models, however, have proven to be quite effective in modeling human vision (Yamins et al., 2014) and have performed with great accuracy on image classification tasks (Krizhevsky et al., 2012). Study of representations within layers of CNN models may suggest selectivities in the similarly hierarchical brain. We apply a popular CNN to four diverse stimulus sets. Through clustering, we identify classes of preferred visual patterns for an intermediate model layer (layer 4, out of 8). We find a subset of patterns reflect intuitive visual similarities within and across the datasets, while a broader set of patterns were less accessible to intuitive interpretation. We also observe a heightened correlation between cortical voxel activity and CNN layer 4 responses to a shared dataset, and notably observe increased correlation when weighting model neuron responses based on clustering from each of the four data sets. Our findings suggest behavioral and cortical relevance to visual properties uncovered by clustering on multiple image data sets.

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Keywords

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