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Do Deep Neural Networks Model Nonlinear Compositionality in the Neural Representation of Human-Object Interactions?

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Abstract

Visual scene understanding often requires the processing of human-object interactions. Here we seek to explore if and how well Deep Neural Network (DNN) models capture features similar to the brain's representation of humans, objects, and their interactions. We investigate brain regions which process human-, object-, or interaction-specific information, and establish correspondences between them and DNN features. Our results suggest that we can infer the selectivity of these regions to particular visual stimuli using DNN representations. We also map features from the DNN to the regions, thus linking the DNN representations to those found in specific parts of the visual cortex. In particular, our results suggest that a typical DNN representation contains encoding of compositional information for human-object interactions which goes beyond a linear combination of the encodings for the two components, thus suggesting that DNNs may be able to model this important property of biological vision.