

Distributed Cortical Networks Represent Visual Object Categories based on a Hierarchical Semantic Structure Weldon Se

Weldon School of Biomedical Engineering School of Electrical and Computer Engineering

Haiguang Wen, Junxing Shi, Wei Chen, Zhongming Liu (zmliu@purdue.edu)

Introduction

We built a predictive encoding model based on a deep residual network (ResNet) [1] by using >10 hours video-fMRI training dataset. The predictive model synthesized cortical responses to 64,000 visual objects from 80 categories. We analyzed and compared the cortical representational similarity among categories against their semantic relationships, and separated the contributions from different levels of visual information to object categorization. A primary focus here was on testing a hypothesis that the brain uses nested spatial and representational hierarchies to support multi-level visual categorization.



The ResNet is composed of 50 hierarhical convolutional layers for object recognition



Encoding model predicted widespread cortical responses to natural visual stimuli



Cortical Representation of Human Face

a. Functional localizer

b. Model simulation



Cortical Category-Selectivity

a. Category selectivity





 He, K., Zhang, X., Ren, S., & Sun, J. (2016). Deep residual learning for image recognition. In Proceedings of the IEEE Conference on Computer Vision and Pattern Recognition (pp. 770-778).

[2] Grill-Spector, K., & Weiner, K. S. (2014). The functional architecture of the ventral temporal cortex and its role in categorization. *Nature Reviews Neuroscience*, 15(8), 536-548.

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Categorical Organization in the Brain