
Detection and Recognition of Objects in Visual Cortex
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The project is a collaboration to explore the hypothesis that the cortical organization and the neural mechanisms of visual recognition can be explained by a coherent theoretical framework built on two existing computational models for recognition. The work at MIT is guided by a quantitative hierarchical model of recognition, probing the relations between identification and categorization and the properties of selectivity and invariance of the neural mechanisms in IT cortex. The work at Northwestern University is testing a key prediction of the model about the nature of the pooling operation (a max operation vs. a linear sum) performed by complex cells in V1. Finally, work at Caltech is extending the basic model of recognition by integrating it with a saliency-based attentional model. As a specific example I will discuss the problem of visual recognition of objects – say faces – and the key trade off between selectivity and invariance. I will show how an architecture suggested by the computational problem predicts a specific property of complex cells in visual cortex. Similarly, the need to generalize – the key aspect of learning – leads to tuning of cells, for which there are plausible neural circuits that can be experimentally verified. Thus a model developed to be consistent mainly with visual recognition performance of primates and with the known physiological and anatomical constraints can be used to interpret several existing data and to make predictions at several different levels, including the level of *cognitive science, system physiology:* and *cortical microcircuits.*

Project Website

http://cbcl.mit.edu/projects/index-projects-NIH-Conte.htm

Publications

Poggio, T. and E. Bizzi. Generalization in Vision and Motor Control, *Nature*, Vol. 431, 768-774, 2004.