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Visual encoding and decoding of natural scenes

Human visual perception is mediated by a constellation of several dozen distinct cortical areas. Although we know something about the most general properties of many of these structures, in most cases there is no quantitative computational model that can predict responses to novel stimuli. I will describe a very general Bayesian estimation framework that can be used to construct and evaluate predictive models. Because these models describe how neurons encode visual information they provide a quantitative link between behavioral and hemodynamic (fMRI) observations and potential neural mechanisms. I will show that this approach reveals many of the fundamental principles of representation in intermediate visual areas such as V2, V4 and MT, and I will demonstrate how these models can also be used to decode the contents of perceptual systems (“brain reading”).