Title: Constructing flexible representations

Abstract: People still outperform computers on a diverse set of problems, ranging from learning a language to recognizing objects in a scene. To understand human performance on these problems, cognitive scientists appeal to representation as a key explanatory device. However, little is known about how experience and context affect the representations people use to encode stimuli. Understanding the effects of context and experience is essential because when people encode the same stimulus using different representations, their response to that stimulus may be different. My research program addresses these issues by developing formal accounts of how people infer representations, which provide a more precise understanding of how people's representations flexibly adapt to experience and context. This approach yields new testable predictions and inspires the development of novel machine learning techniques that achieve human-level performance. To approach this problem, I focus on feature representations, where a feature is a subset of an image. The models I developed flexibly construct feature representations for a set of observed objects using nonparametric Bayesian statistics. These models capture how people infer features in previous and novel behavioral experiments based on (a) the statistical co-occurrence of parts, (b) categorization, (c) perceptual biases and transformation invariance (e.g., translations, rotations), and (d) the order in which objects are presented.