

Information maximization in face processing

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Abstract

This presentation explores principles of unsupervised learning and how they relate to face recognition. Dependency coding and information maximization appear to be central principles in neural coding early in the visual system. We argue that these principles may be relevant to how we think about higher visual processes such as face recognition as well. We first review examples of dependency learning in biological vision, along with principles of optimal information transfer and information maximization. Next, we examine algorithms for face recognition by computer from a perspective of information maximization. The eigenface approach learns first and second-order dependencies among face image pixels, and maximizes information transfer only in the case where the input distributions are Gaussian. Independent component analysis (ICA) learns high-order dependencies in addition to first and second-order relations, and maximizes information transfer for a more general set of input distributions. Face representations based on ICA gave better recognition performance than eigenfaces, supporting the theory that dependency learning is a good strategy for high level visual functions such as face recognition. Finally, we review perceptual studies suggesting that dependency learning is relevant to human face perception as well, and present an information maximization account of perceptual effects such as the atypicality bias, and face adaptation aftereffects.