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Combining Generative and Discriminative Learning of Feature Hierarchies for Object Recognition

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Abstract We propose a new hierarchical representation of visual features that is constructed by a statistical learning method. Starting from local, low-level features computed at various types of interest points locations, the method combines features hierarchically. At each level of the hierarchy, pairs of features are identified that tend to occur at stable positions relative to each other, by clustering the configurational distributions of observed feature co-occurrences using Expectation-Maximization (EM). Stable pairs of features thus identified are combined into higher-level features. This learning scheme results in a graphical model that constitutes a probabilistic representation of a flexible visual feature hierarchy. For detection, evidence is propagated using Nonparametric Belief Propagation (NBP), a recent generalization of particle filtering. Discriminant models are learned on the basis of our feature hierarchy by combining a SVM classifier with a feature selection step based on the Fisher score. In experiments, the proposed approach demonstrates effective learning and robust detection of butterflies in natural scenes.

Presentation preference

Poster