Multipath sparse coding using hierarchical matching pursuit

Abstract

Complex real-world signals, such as images, contain discriminative structures that differ in many aspects including scale, invariance, and data channel. While progress in deep learning shows the importance of learning features through multiple layers, it is equally important to learn features through multiple paths. We propose Multipath Hierarchical Matching Pursuit (M-HMP), a novel feature learning architecture that combines a collection of hierarchical sparse features for image classification to capture multiple aspects of discriminative structures. Our building blocks are MI-KSVD, a codebook learning algorithm that balances the reconstruction error and the mutual incoherence of the codebook, and batch orthogonal matching pursuit (OMP); we apply them recursively at varying layers and scales. The result is a highly discriminative image representation that leads to large improvements to the state-of-the-art on many standard benchmarks, e.g., Caltech-101, Caltech-256, MITScenes, Oxford-IIIT Pet and Caltech-UCSD Bird-200.

Related Material

[pdf]
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