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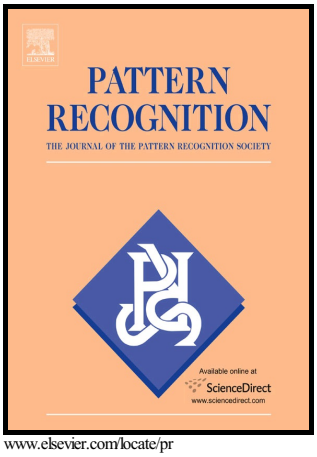

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Constructing Deep Sparse Coding Network for Image Classification

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Abstract

This paper introduces a deep model called Deep Sparse-Coding Network (DeepSCNet) to combine the advantages of Convolutional Neural Network (CNN) and sparse-coding techniques for image feature representation. DeepSCNet consists of four type of basic layers: The *sparse-coding layer* performs generalized linear coding for local patch within the receptive field by replacing the convolution operation in CNN into sparse-coding. The *Pooling layer* and the *Normalization layer* perform identical operations as that in CNN. And finally the *Map reduction layer* reduces CPU/memory consumption by reducing the number of feature maps before stacking with the following layers. These four type of layers can be easily stacked to construct a deep model for image feature learning. The paper further discusses the multi-scale, multi-locality extension to the basic DeepSCNet, and the overall approach is fully unsupervised. Compared to CNN, training DeepSCNet is relatively easier even with training set of moderate size. Experiments show that DeepSCNet can automatically discover highly discriminative feature directly from raw image pixels.

Keywords: Sparse Coding, Deep Model, Multi-scale, Multi-locality, Image Classification,

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