Multiple Kernel Deep Network

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Abstract:
Object recognition is one of the challenging problems in the machine learning field, as well as the computer vision. In this study, we suggest multiple kernel deep network, employing both advantages of multiple kernel learning and deep learning. Multiple kernel learning (MKL) is one of the stat-of-the-arts learning algorithms proposed for object recognition. In contrast to selecting specific single kernel, MKL utilizes the combination of kernels to concatenate feature spaces and use information from different sources. By optimizing the combination of kernels, MKL outperforms the previous single kernel approaches. Also, deep learning algorithms automatically extract data-driven features without having to manually define the features. Simultaneously, deep learning achieves good performances for object recognition.

Our approach, multiple kernel deep network, extracts features by various deep learning algorithms, such as Deep Boltzmann Machine, stacked sparse autoencoder, deep-ICA and so on. The features will include different properties and sources of images to enrich the information for object recognition. Then, the features are learned by MKL to find optimal feature combination. In short, each building block of multiple kernel deep network is formed by optimal feature combination learned by MKL and these features are obtained by different kinds of deep learning algorithms. These building blocks organize the hierarchy of deep network. We conduct the experiments of object classification for Caltech 101, Caltech 256 and STL-10 database to validate our model. The results show competitive classification accuracy compared with the previous models. As a result, we demonstrate that multiple kernel deep network can achieve the meaningful achievement for the object recognition tasks. Also, our model can be expected to apply other vision problem like scene understanding.

Keyword: Object recognition, Multiple kernel learning, Deep learning