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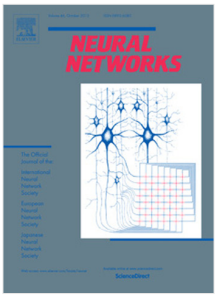

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Few-Shot Learning in Deep Networks through Global Prototyping

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Abstract

Training a deep convolution neural network (CNN) to succeed in visual object classification usually requires a great number of examples. Here, starting from such a pre-learned CNN, we study the task of extending the network to classify additional categories on the basis of only few examples ("few-shot learning"). We find that a simple and fast prototype-based learning procedure in the global feature layers ("Global Prototype Learning", GPL) leads to some remarkably good classification results for a large portion of the new classes. It requires only up to ten examples for the new classes to reach a plateau in performance. To understand this few-shot learning performance resulting from GPL as well as the performance of the original network, we use the t-SNE method [1] to visualize clusters of object category examples. This reveals the strong connection between classification performance and data distribution and explains why some new categories only need few examples for learning while others resist good classification results even when trained with many more examples.

Keywords: Convolutional Neural Networks, Object Recognition, Deep Learning, Few-Shot Learning, Transfer Learning

1. Introduction

Given the recent success of Deep Convolution Neural Networks (CNNs) for visual object classification (reviewed, e.g., in [2]), the learning of additional categories based on only a few examples ("few-shot learning") is widely seen as an outstanding remaining challenge. Here, we study the few-shot learning task by using a pre-learned CNN as starting point. For the few-shot learning of additional new categories we then discuss a prototype-type based approach that is straightforward and may even be seen as a close-to-minimal approach for a

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