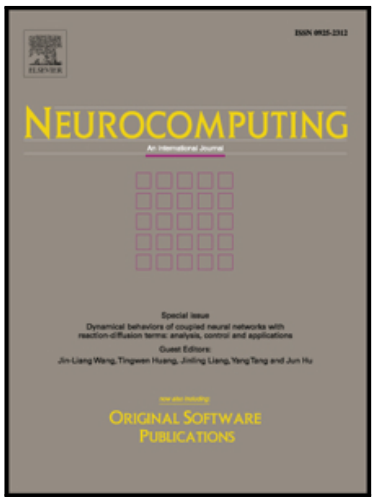

Deep Object Recognition Across Domains based on Adaptive Extreme Learning Machine

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Abstract: Deep learning with a convolutional neural network (CNN) has been proved to be very effective in feature extraction and representation of images. For image classification problems, this work aims at exploring the capability of extreme learning machine on high-level deep features of images. Additionally, motivated by the biological learning mechanism of ELM, in this paper, an adaptive extreme learning machine (AELM) method is proposed for handling cross-task (domain) learning problems, without loss of its nature of randomization and high efficiency. The proposed AELM is an extension of ELM from single task to cross task learning, by introducing a new error term and Laplacian graph based manifold regularization term in objective function. We have discussed the nearest neighbor, support vector machines and extreme learning machines for image classification under deep convolutional activation feature representation. Specifically, we adopt 4 benchmark object recognition datasets from multiple sources with domain bias for evaluating different classifiers. The deep features of the object dataset are obtained by a well-trained CNN with five convolutional layers and three fully-connected layers on ImageNet. Experiments demonstrate that the proposed AELM is comparable and effective in single and multiple domains based recognition tasks.

Keywords: Deep learning; image classification; support vector machine; extreme learning machine; object recognition

1. Introduction

Recently, deep learning as the hottest learning technique has been widely explored in machine learning, computer vision, natural language processing and data mining. In the early, convolutional neural network (CNN), as the most important deep net in deep learning, has been applied to document recognition and face