Guest Editorial: Special Issue on New Advances in Deep-Transfer Learning

WHILE Deep learning (DL) has achieved great success in big data applications, transfer learning (TL) is an important paradigm mainly for small/insufficient data applications, which utilizes the data/knowledge in one task to facilitate the learning in another relevant task. How to integrate DL and TL to combine their advantages is an interesting and important research topic. Deep-Transfer Learning (DTL) is proposed to address this issue. Deep learning extracts knowledge from big data, which can then be used by TL for a new task/domain with small/insufficient data.

This special issue aims to present the most recent advances in DTL. Following a rigorous peer review process, three papers have been accepted to be included in the special issue.

In deep convolutional neural networks (DCNN), the pooling operation is usually adopted to produce condensed and transformation invariant feature maps for the input image. However, it will inevitably result in information loss, which has not been addressed yet in designing filters of DCNNs. In the first paper, Wang *et al.* proposed Gaussian Transfer Convolutional Neural Networks (GT-CNN), which introduce Gaussian filters to pool convolutional filters of DCNNs. In GT-CNN, the pooling on features can be transferred to the pooling on filters, which are achieved in the same end-to-end framework. More importantly, the Gaussian filters of multiple scales and orientations further improve the capability of GT-CNN, leading to a more robust feature representation for the input image. This method was evaluated on various datasets, including MNIST, CIFAR-10 and CIFAR-100, and outperformed the state of the arts. Moreover, GT-CNN was also applied to the Remote Sensing Image dataset, NWPU-RESISC45, and demonstrated its superiority.

Driver drowsiness is gaining research interests as it is a major cause of traffic accidents. In the second paper, Reddy *et al.* proposed a Multi-Task DeepNet (MTDNN) to inspect Electroencephalogram (EEG) synchronization changes from the alert state to the drowsy state. EEG based reaction time prediction and drowsiness detection are formulated as primary and auxiliary problems in the context of multitask learning. Statistical analysis suggests that this method can be used to distinguish between alert and drowsy states of mind. The proposed MTDNN outperformed baseline regression models like Support Vector Regression (SVR), Least Absolute Shrinkage and Selection Operator (LASSO), Ridge Regression (RR), kNN, and ANFIS (Adaptive Neuro Fuzzy Inference Scheme) in terms of Root Mean Squared Error (RMSE), Mean Absolute Percentage Error (MAPE) and Correlation Coefficient (CC) metrics.

To effectively use the decision knowledge from multiple source domains to predict the labels of samples in the target domain, Ji *et al.* proposed a novel doubly reweighting multi-source transfer learning framework, called DRMTL. DRMTL aims to simultaneously optimize the structural risk function, domain reweighting adaptation, pointwise reweighting adaptation and manifold consistency. The characteristics of DRMTL include: 1) the importance of each source domain can be evaluated using the proposed flexible weighting index; 2) the loss between an unknown label prediction and its prediction by some source decision function for a target sample can be reweighted using a novel domain separator; and 3) the manifold structure of the target domain is effectively used in this framework. Experimental results from several real-world datasets revealed that the proposed approach outperformed several state-of-the-art transfer learning algorithms.

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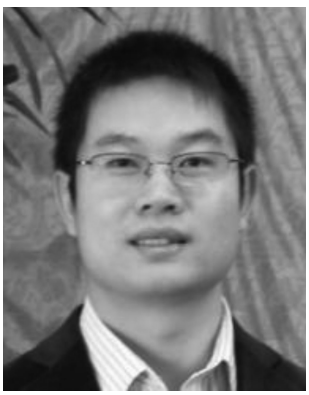

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