Abstract

In the past few years, there has been an exponential growth in the research of deep learning, it can apply in Image classification, object and text recognition, pose estimation and scene labeling, etc. Auto Encoder, Deep Belief Networks, sparse coding and Convolutional neural networks (CNNs) are commonly used models in deep learning [26]. CNN has demonstrated state-of-the-art accuracy in image classification on large image datasets. However, CNN shows poor performance in classifying small dataset since their large number of parameters overfits the training data. But, the classification characteristics of CNN on small data are important for many practical applications. This study analyzes the performance of CNN for transfer learning-based training approaches and other optimization methods. Evaluation is performed on the manually prepared dataset. Our study shows that fine-tuning network with lower learning rate gives higher accuracy for small dataset classification.

Convolutional Neural Networks have gained remarkable success in computer vision, which as the ability to learn rich image representations from large-scale annotated data. When large amount of data might be not always available, limited number of obtained ground-truth data is sometimes inadequate to train the CNN without overfitting and training from scratch cause convergence issues. Hence implementation of the CNNs becomes challenging, however, transfer learning and data augmentation techniques are shown to provide solutions for this challenge. In this thesis, the target task is to implement food product image classification using CNN based transfer learning and other optimization methods. Experiments are performed on a manually prepared food product dataset. In order to accomplish the target task, I execute experiments by apply three different methods: 1) prepare pre-trained weights using available food product dataset in Liebherr; 2) fine-tuning a pre-trained CNN model to feature extractor layer and then training classifier layer with new generated dataset; 3) conduct experiments to improve overall accuracy of the model with different network architecture, hyperparameter tuning, data augmentation and ensemble learning. Experimental results show that CNNs based transfer learning, hyperparameter tuning, data augmentation and combining different models prediction using ensemble learning can achieve better classification results in our task with a small amount of dataset.

Keywords: instance segmentation, object detection, deep learning, data augmentation