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Hierarchical Curriculum Learning for No-Reference Image Quality Assessment

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Abstract
Despite remarkable success has been achieved by convolutional neural networks (CNNs) in no-reference image quality assessment (NR-IQA), there still exist many challenges in improving the performance of IQA for authentically distorted images. An important factor is that the insufficient annotated data limits the training of high-capacity CNNs to accommodate diverse distortions, complicated semantic structures and high-variance quality scores of these images. To address this problem, this paper proposes a hierarchical curriculum learning (HCL) framework for NR-IQA. The main idea of the proposed framework is to leverage the external data to learn the prior knowledge about IQA widely and progressively. Specifically, as a closely-related task with NR-IQA, image restoration is used as the first curriculum to learn the image quality related knowledge (i.e., semantic and distortion information) on massive distorted-reference image pairs. Then multiple lightweight subnetworks are designed to learn human scoring rules on multiple available synthetic IQA datasets independently, and a cross-dataset quality assessment correlation (CQAC) module is proposed to fully explore the similarities and diversities of different scoring rules. Finally, the whole model is fine-tuned on the target authentic IQA dataset to fuse the learned knowledge and adapt to the target data distribution. Experimental results show that our model achieves state-of-the-art performance on multiple standard authentic IQA datasets. Moreover, the generalization of our model is fully validated by the cross-dataset evaluation and the gMAD competition. In addition, extensive analyses prove that the proposed HCL framework is effective in improving the performance of our model.

Keywords No-reference image quality assessment · Hierarchical curriculum learning · Prior knowledge · Cross-dataset quality assessment correlation

1 Introduction

With the rapid development of digital technology, the requirement for high-resolution images is dramatically increasing in more and more applications, such as unmanned aerial vehicle, medical imaging and surveillance. However, in the process of image compression, transmission and processing, the image quality is inevitably affected by various

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