Image Interpolation via Graph-Based Bayesian Label Propagation

Abstract:

In this paper, we propose a novel image interpolation algorithm via graph-based Bayesian label propagation. The basic idea is to first create a graph with known and unknown pixels as vertices and with edge weights encoding the similarity between vertices, then the problem of interpolation converts to how to effectively propagate the label information from known points to unknown ones. This processcan be posed as a Bayesian inference, in which we try to combine the principles of local adaptation and global consistency to obtain accurate and robust estimation. Specially, our algorithm first constructs a set of local interpolation models, which predict the intensity labels of all image samples, and a loss term will be minimized to keep the predicted labels of the available low-resolution (LR) samples sufficiently close to the original ones. Then, all of the losses evaluated in local neighborhoods are accumulated together to measure the global consistency on all samples. Moreover, a graph-Laplacian-based manifold regularization term is incorporated to penalize the global smoothness of intensity labels, such smoothing can alleviate the insufficient training of the local models and make them more robust. Finally, we construct a unified objective function to combine together the global loss of the locally linear regression, square error of prediction bias on the available LR samples, and the manifold regularization term. It can be solved with a closed-form solution as a convex optimization problem. Experimental results demonstrate that the proposed method achieves competitive performance with the state-of-the-art image interpolation algorithms.