Local Learned Dictionaries Optimized to Edge Orientation for Inverse Halftoning

Abstract:

A method is proposed for fully restoring local image structures of an unknown continuous-tone patch from an input halftoned patch with homogenously distributed dot patterns, based on a locally learned dictionary pair via feature clustering. First, many training sets consisting of paired halftone and continuous-tone patches are collected, and then histogram-of- oriented-gradient (HOG) feature vectors that describe the edge orientations are calculated from every continuous-tone patch, to group the training sets. Next, a dictionary learning algorithm is separately conducted on the categorized training sets, to obtain the halftone and continuous-tone dictionary pairs, optimized to edge-oriented patch representation. Finally, an adaptively smoothing filter is applied to the input halftone patch, to predict the HOG feature vector of an unknown continuous-tone patch, and to select one of the previously learned dictionary pairs, based on the Euclidean distance between the HOG mean feature vectors of the grouped training sets and the predicted HOG vector. In addition to using the local dictionary pairs, a patch fusion technique is used to reduce some artifacts, such as color noise and overemphasized edges on smooth regions. Experimental results show that the use of the paired dictionary selected by the local edge orientation and patch fusion technique not only reduced the artifacts in smooth regions, but also provided well expressed fine details and outlines, especially in the areas of textures, lines, and regular patterns.