CONCLUSIONS AND SUGGESTIONS

CONCLUSIONS

We have presented a model-based image compression method for loosy-coding of images. The model is based on the edge features detected by using GED, representing the image in a domain called $\lambda\tau$-space where λ represents the smoothness of the intensity and τ represents the continuity of the intensity information. The centipede model contains edge location, intensity on the edge, contrast of the edge and the widths. It has been shown that the model yields a powerful representation of the image such that the reconstructed image is perceptually closer to the original image than the existing edge-based methods can achieve for reasonable edge information.

We have also presented a contour selection algorithm in which edge segments are sorted with respect to their length, mean contrast through the segment along the normal direction, and mean curvature directly derived from differential chain code representation of the contour. One can select the most perceptual contours just by taking the leading contours in this order. We have experimentally shown that such a selection is meaningful and performs good selection in terms of NMSE and visual appearance of the reconstructed image.

The algorithm has two parts. In the first part, the edges are detected and processed by edge tracing algorithm to obtain distinct contours and contour selection algorithm to eliminate some of the contours which convey perceptually less information. In the second part, the parameters of the centipede are extracted by one dimensional profile of the edge along the normal direction. The output of the first part is a binary image and coded by differential chain code followed by Huffman coding. Model parameters are fit to polynomials of some order. An approximation to the original image from the model parameters is obtained by minimizing the hybrid energy functional.

The performance of the centipede model is evaluated by both quantitatively and qualitatively. Compression ratio is up to 180:1 for synthetic images and 10:1-100:1 for real images. Reconstructed images are evaluated both quantitatively with NMSE (normalized mean square error), SNR (signal-to-noise ratio) and PSNR (peak-to-peak SNR) and qualitatively with visual appearance of artifacts. We have experimentally shown that the proposed model preserves perceptually important features even at the high compression ratios.

SUGGESTIONS

The width in the centipede model is a rough estimate of the edge scale. This causes some edge contours to being blurred. Since surface reconstruction is done on $\lambda\tau$-space, a good estimation can be obtained by determining appropriate (λ,τ) pair for each edge element. It is sure that this will enhance the reconstructed image requiring extra computation.

The proposed contour selection algorithm can be improved by utilizing the region segmentation information in such a way that a contour which does not belong to at least two distinct region boundaries can be eliminated.

Since the improvement in coding of binary images will also improve the compression performance, the block coding of the edge segment is required to go down the average bit rate per pixel below 1 bpp.

One of the most important advantages of edge-based coding techniques is the ability of processing even on the compressed image directly. Since the compressed image contains information on some aspect of the image such as edges and scales, the features can be used for further processing without decompressing.

We have currently been applying the principal component analysis directly on the edge information to face images for detection purpose. We try to prove that eigenedge decomposition of the face edges are less sensitive to the lighting conditions.