IMAGE COMPRESSION AND RECONSTRUCTION USING FEATURE EXTRACTION

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Considerable research has been devoted to the development of methods for reducing the transmission bandwidth of video signals such that the reconstructed image is of a high quality. Typically, these methods perform a statistical encoding of the intensity levels of a quantized picture, or they perform some transformation and subsequent data reduction in order to achieve bandwidth reduction [3]. Such methods rarely achieve data compression ratios in excess of ten-to-one without noticeable loss of quality in the reconstructed picture.

In attempting bandwidth reductions of video signals, very little emphasis has been placed on the actual contents of the picture. Although methods have been investigated for performing data compression by coding features extracted from digitized pictures, they have not been very successful because of the fidelity criterion [5]. These methods have produced in some instances compressions of at best twenty-to-one. We feel that methods which extract and encode features from the digitized pictures can achieve compression ratios in excess of 100:1. Furthermore, we feel that there are areas of applications in which the contents of the picture is more important than its esthetic, quality. In order to determine how practical this viewpoint is, we have performed preliminary experiments on video data compression which encodes features extracted from digitized images.

Edge Finding and Encoding

The pictures we compress are quantized to 64 levels. The edge finding algorithm used was designed to perform thinning as it finds the edge points so that the line follower has single pixcel lines to follow [1]. In addition, the algorithm averages out much of the influence of the two levels of quantization noise inherent in the vision system. The edge follower attempts to make as long a line as possible by finding edge points which continue in the general direction of a segment up to a distance of three pixcels.

The encoding of these edge segments is achieved by approximating them with straight line segments [4], Data compression is determined by calculating the ratio of the number of bits in the intensity array and the number of bits in the encoding. Each point in the encoding needs 17 bits to represent it: 8 bits for each of the x and y directions and a bit to indicate whether the point is an endpoint of its curve segment.

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Results

Using aerial photographs of the Champaign County countryside pictures were compressed and then reconstructed on a Tektronix graphics display terminal [2]. The photographs were characterized by a preponderance of constant intensities with many long boundaries between regions and many long, straight and curving lines. Ratios in excess of 100:1 were achieved and the reconstructed pictures appeared as line drawings of the boundaries of fields, highways and streams. Man-made objects were the easiest things to recognize because they,generally have smooth-curved outlines.

Our results are very encouraging not only because we were able to achieve the ratios hoped for, but also because there is considerable room to improve our system. In particular the edge following routine can be changed from its present upward and left bias to that of following a curve completely in the direction it travels, even when it intersects another curve segment. Secondly, the encoding algorithm can be improved in at least two areas. It can use second order approximations to the curves and further encoding can be performed on the output of curve fitting routines. Thirdly, better edge finding routines can be found which achieve better segmentations of the picture thereby resulting in better reconstructions of the picture.

References

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