EFFICIENT IMAGE COMPRESSION TECHNIQUE USING SELF ORGANIZING FEATURE MAPS

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Abstract:
Due to the widespread use of Multimedia applications, the need for image compression is increasing day-by-day. The image compression schemes are aimed to reduce the transmission rates for still images without sacrificing much of the image quality. In this paper, an Artificial Neural Network (ANN) approach for image compression is presented. The Codebook for Linear Vector Quantization (LVQ) is designed using Self Organized Feature Maps (SOFM). Arithmetic Coding is then used to remove redundancies between indexes of vectors corresponding to the neighboring blocks in the original image, which then leads to further compression. The simulation results demonstrate the improved coding efficiency of the proposed method, when compared with JPEG. The proposed scheme allows achieving a compression ratio upto approximately 40:1 with reasonable image quality. Further, the simulation results demonstrate that an additional bit-rate reduction of upto approximately 30-50% can be achieved using Arithmetic Coding, without any further degradation of the image quality. When compared with JPEG, the proposed coder results reconstructed images having 0.1-0.25 dB better quality in terms of PSNR than that of JPEG coder.

Keywords: Image Compression, JPEG, Artificial Neural Networks,

SOFM **1. Introduction**:

Due to extensive use of multimedia based applications, need to store and transmit the images has become abundant and is bound to increase in future. Images are compressed by techniques which exploit the redundancy so that the number of bits required to represent the image can be reduced with acceptable degradation of the decoded image [1]. Although many image compression standards have been developed and are available in literature [2], but there is a need to design more efficient coding algorithms. The two fundamental image compression techniques frequently used are Transform Coding [1, 2] and Vector Quantization [3, 4]. In transform coding, correlation between pixels in an image is reduced. Image data is first transformed into transform coefficients. The most commonly used transform is the Discrete Cosine Transform, which is also used in JPEG standard. Only those of the transformed coefficients having significantly higher energy are then transmitted after quantization and entropy coding. In the recent past, neural network approach is being exploited in many applications including the image compression, due to its fast speed and parallel processing structure [5]. A Back-propagation Neural Network for image compression has been reported [6] with fixed number of hidden layer neurons (lesser than that of input and output neurons). The network is trained for a sufficient number of epochs and the final weights are transmitted. The compression ratio in this case is lower than that of standard JPEG (around 8:1). The basic Backpropagation Neural Network is further extended to construct a hierarchical Neural Network by adding two more Hidden layers into existing network as proposed in [7]. An application of Neural Networks to implement vector quantization has now become well established. Kohonen's algorithm is a reliable and efficient way to achieve vector quantization and has been proved to be faster than other algorithms. The Kohonen's Self Organizing Feature Maps (SOFMs) are also used to avoid the problem of dead units that arise e.g. in the LBG algorithm. Since the consecutive blocks of an image along the horizontal and vertical directions are similar in most cases, so as per the Self organizing property of SOFM, two consecutive and similar blocks will be coded into similar code words. The variable length coding of the indexes of these code words will thus improve the compression ratio [8]. In a Self Organizing feature map algorithm, input vectors derived from the image data are categorized into various classes depending upon the similarity of the vectors.