ABSTRACT

The thesis aims to propose new hybrid algorithms for wavelet based image compression of continuous tone still images to achieve low bit rates. The algorithms have been proposed by combining Discrete Wavelet Transform, Absolute Moment Block Truncation Coding, Singular Value Decomposition and Clustering of data for the purpose of vector quantization. The proposed algorithms offer improved compression ratio. The proposed methods utilize the property of wavelet transform in which most of the detail subband coefficients remain quantized to zero. Also, a set of Daubechies wavelet templates are designed to be used with Cellular Neural Networks in high speed image compression applications.

In this thesis two hybrid image compression algorithms that are based on Absolute Moment Block Truncation Coder (AMBTC) and DWT are proposed. The proposed method is very attractive due to its reduced computational complexity. AMBTC preserves the first order moments of the given block of data. Simulation studies indicate that the proposed method which uses AMBTC with DWT results in a high compression ratio of 16:1.

Also, four hybrid algorithms have been proposed that use data clustering approach in wavelet domain. The clustering approaches considered are K-Means, Fuzzy C-means, Genetic and LBG algorithms. In image compression, clustering technique is considered as a method of Vector
Quantization. The algorithms are proposed based on the assumption that the computing power is not the limiting factor. The parameters considered for evaluating the performance of the proposed methods are compression ratio and subjective quality of the reconstructed images.

In the hybrid algorithm involving Singular Value Decomposition (SVD), two image compression algorithms that combine DWT and SVD transform followed by two different clustering techniques are proposed. The wavelet coefficients in the approximation subband are not highly decorrelated as required. SVD transform is applied to the approximation subband. The transform coefficients are then clustered to reduce the bit rate either by using K-means clustering technique or Fuzzy C-means clustering technique. Simulations have been performed to study the effect of rank approximation in SVD and number of cluster centers on the subjective quality of the reconstructed images and the resulting compression ratio.

In this thesis, a set of templates for Daubechies wavelet filter are proposed for Cellular Neural Network (CNN) in image compression. The CNN is a recurrent nonlinear artificial neural network used in image compression for its high processing speed. A global search algorithm, namely, Particle Swarm Optimization (PSO) is used to evolve the forward and inverse DWT cloning templates of CNN. The performance of the evolved templates is analyzed by applying the templates for the computation of DWT and inverse DWT and by comparing the results with those obtained using the direct filter implementation.