IV. ABSTRACT

Since their introduction two decades ago, wavelets have gained considerable interest in signal processing. Wavelets, because of their multilevel decomposition capability, are a natural choice for compression. The idea of representing a signal at multiple resolutions allows to capture its main trends in only a few coefficients while localizing discontinuities precisely.

The proposed work is explained in the following manner:

1. Statement of the problem

2. Proposed solution

1. Statement of the problem

Case 1: It is well known that wavelets are optimal for representing uni-dimensional signals with a finite number of discontinuities, in the sense that the mean-square error of a non-linear approximation from the k maximal wavelet coefficients is minimized. In case of images, for the sake of simplicity and efficiency, wavelets are often applied in a separable manner on the horizontal and vertical axes. This results in only a partial de-correlation of signal, which translates into clusters of highly energetic coefficients along the image contours. Although this residual dependency is reduced and partially captured by sub-band codes, in case of image compression, it would be more effective to have a transform which overcomes these drawbacks by filtering along the image contours.
Case 2: In internet and mobile multimedia applications, visual signals need to be coded at low bit rates. The conventional image compression methods attempt to allocate the available bits for every non-zero, quantized transform co-efficient in the whole image. When the compression ratio increases, the bits per pixel decrease as a result of the use of bigger quantization step sizes, and the resultant coded picture quality deteriorates. At low bit rates, these standard schemes usually cause severe blockiness and other coding artifacts because of the insufficient bit representation of each coefficient.

2. Proposed solution

The problem defined in the above two cases is resolved in the following manner:

The most popular wavelets used in image compression are the daubechies wavelets as well as the symlets. Both these standard wavelets are non-symmetric and their compression performance is image-dependent. The properties of wavelets is exploited to the maximum extent and the limitations of the standard wavelets are overcome by developing a new family of wavelets for image compression, the Adslets which have a higher number of vanishing moments, are symmetric/anti-symmetric and are image independent. The transforms found in the literature and in use for image compression are shift sensitive and limited in their directional selectivity. This drawback has been overcome by employing the Hyperanalytic Wavelet Transform (HWT) for compressing the images. To improve the execution speed without sacrificing the PSNR as well as the Compression performance, HWT is used in conjunction with SPIHT. All the above algorithms are applied after down sampling. Adapted down sampling is used to choose the optimal samples which makes the algorithm image independent.
Detailed Plan of Proposed Research Work

- Literature survey for existing algorithms and their limitations
- Statement of the problem
- Development of an algorithm employing adaptive down sampling in conjunction with DCT to make the coding image-independent
- Construction of an Adapted Image based on the dominant features in the image. This image is a feature enhanced, customized reference image.
- Development of another algorithm based on wavelets to achieve higher coding quality with low bit rates
- Implementation of the developed algorithm in conjunction with different wavelet transforms (DWT and HWT with SPIHT) on the adapted image to achieve a better compression rate
- Comparison of the performance of the new wavelet algorithm with the existing separable wavelet transform.
- Design of the a new family of wavelets, the Adstringo Wavelets (Adslets) specifically featured for compression performance.
- Comparison of the compression performance of the developed algorithms using both the existing standard wavelets as well as the newly designed Adslets
- Performance analysis of the proposed algorithms measured on the basis of QP, PSNR and CR.

The above algorithms are unique and not found in the literature.