8 CONCLUSIONS FROM RESULTS

In the present thesis, wavelet based lossy compression techniques are studied. Experimentation done related to the study is presented in chapter 2 to 6. For experimentation, set of standard test images such as Lena, Barbara is used. Test set includes gray images as well as color image. Code for experimentation is executed in MATLAB. All results are taken on same set of images. Conclusion of every experimentation is given in respective chapters. Overall conclusions are listed below.

- Four wavelet filter families Daubechies, Coiflet, Symlet and Biorthogonal are evaluated for compression application. Compression ratio and corresponding PSNR are the evaluation parameters. Using Biorthogonal 6.8 filter, maximum compression ratio is achieved.

- Compression using scalar quantization and arithmetic coding is implemented. Effect of context based arithmetic coding on compression ratio is studied. For context prediction seven different predictors are used. They are linear, nonlinear and adaptive type. Using adaptive predictor ‘MED’ maximum compression ratio is obtained. New context classification technique is implemented. Due to efficient classification compression ratio more than ‘MED’ is achieved. Vector quantization using ‘same level all orientation’ and ‘same orientation all levels’ crossband vectors, is implemented. More compression is achieved using ‘same orientation all levels’

- Fractal compression with 2 level three level and 4 level decomposition is implemented.

- Comparison of scalar, vector and fractal compression shows that fractal compression gives higher PSNR than vector quantization and scalar quantization. Vector quantization gives higher PSNR than scalar quantization, specially at lower compression ratio.
PSNR VALUES OF LENA IMAGE

- However when MOS test is conducted performance of comparison order is different for different images. For Lena results shows that vector quantization is better than fractal compression. Thus PSNR is not very reliable measure of quality. Therefore Quality evaluation is performed using 5 objective parameters of different types and one graphical parameter i.e. Hosaka plot. The objective measure which shows maximum correlation with subjective test is more reliable measure of quality. Correlation of ‘quality index’ is found to be maximum. New quality measure which is based on overall contrast in each wavelet band is implemented. Correlation of the new measure is also good, it is 0.94.

- Overall quality can be also expressed in terms of artifacts. Two types of artifacts, which are found in wavelet based compression schemes are ringing artifact and blur. Subjective test for blur and ringing is carried out. This test is not very common in practice. Scalar quantization produces minimum blur. Fractal compression produces less ringing compared to scalar and vector quantization at compression ratio less than 0.6. Above this rate scalar quantization outperforms i.e. less ringing than fractal compression.

- New blur and ringing metric is implemented which shows very good correlation with subjective testing.
subjective ringing rating

Subjective blur rating

New Fast vector quantization and fast fractal compression techniques are implemented

- Using TIE and classified codebook, fast search method is implemented. Encoding time is reduced to 6% but quality is degraded by 1-1.5 db
- Nonlinear interpolative VQ is implemented encoding time is reduced to 5% compression ratio is also improved. Quality of the image is better than full search VQ, for the obtained compression ratio.
• Priority based progressive encoding technique is also implemented. This technique encodes the vectors according to the variance magnitude. Depending on budget available more vectors are coded. This technique gives better quality at low rates than conventional coding method.

For fast fractal encoding two new algorithms are tried

• Domain pool reduction technique based on variance is used to increase the speed. Speed up factor of 8 is obtained. However, quality loss by 1 to 2 dB with respect to full search is observed. This technique can be used for gray images as well as color images.

• Especially for color images hybrid scheme using fractal and VQ is implemented. Speed factor of 3 is achieved. At the same time compression ratio is increased.

Progressive coding technique SPIHT gives very good compression at higher compression ratio. Its performance is even better than JPEG2000. But for near lossless or higher compression ratio, quality-compression ratio performance is poor.

• Two stage coding scheme is implemented. After critical rate i.e. rate above which SPIHT is not beneficial binary arithmetic coding is used. This scheme gives more compression than SPIHT alone.

8.1 Future Scope
The work done reveals that fractal compression is an efficient lossy compression technique, however fast fractal compression techniques need to be found, which will not affect quality.

Compression schemes based on HVS parameters is the area in which lots work is required. Such schemes may be more effective in terms of quality and compression ratio norm.