

# Stack-Run Adaptive Wavelet Image Coding

A. Majid Awan<sup>1</sup>

Nasir M. Rajpoot<sup>2</sup>

S. Afaq Husain<sup>1</sup>

<sup>1</sup>Faculty of CSE, GIK Institute of Engg. S&T, Pakistan

<sup>2</sup>Dept. of Computer Science, University of Warwick, UK

email: gcs0105@giki.edu.pk, nasir@dcs.warwick.ac.uk, syed\_a\_h@giki.edu.pk

Wavelets are not well-suited to represent oscillatory patterns, a special form of texture. However, results from various image coding methods based on wavelet packets, such as [1], show that they are particularly good in coding images with oscillatory patterns. In this paper, we present an adaptive wavelet transform based image coder which employs a stack-run representation for quantized transform coefficients in order to benefit from the intra-subband redundancies. Our compression algorithm can be divided into four parts: In the first part, an adaptive wavelet packet basis is selected for representing the given image using certain entropy-based cost function. Next, the wavelet packet coefficients are quantized using an optimal scalar quantizer for Laplacian distribution. In the third part, we represent the quantized coefficients with stack-run coding [3] generating a redundant symbol stream. Finally, this symbol stream is entropy coded using a higher order arithmetic coder. The coder variations were based on three different filters: symmlet-8, biorthogonal 17/11, and biorthogonal 9/7 filters. Each of these variations employed three additive cost functions for basis selection: Coifman-Wickerhauser (CW) entropy, energy, and  $l_1$ -norm. Coding gains achieved by our SRWP coder over both SPIHT [2] and FAWP [1] coders are noticeable, especially for *Barbara* (1.2dB over SPIHT and 0.4dB over FAWP). Another interesting result is the consistently better performance of the symmlet-8 filters over filters in popular use.

## References

- [1] F.G. Meyer, A.Z. Averbuch, and J-O. Strömberg. Fast adaptive wavelet packet image compression. *IEEE Transactions on Image Processing*, 9(5):792–800, May 2000.
- [2] A. Said and W.A. Pearlman. A new fast and efficient image codec based on set partitioning in hierarchical trees. *IEEE Transactions on Circuits & Systems for Video Technology*, 6:243–250, June 1996.
- [3] M.J. Tsai, J.D. Villasenor, and F. Chen. Stack-run image coding. *IEEE Transactions on Circuits and Systems for Video Technology*, 6:519–521, October 1996.