Context-Based Entropy Coding of DCT Coefficients for Image Compression

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ABSTRACT

This paper proposes Context-based entropy coding of DCT coefficients for image compression. The main compression step is :(1) Divide the input image into the 8*8 block, use Discrete Cosine Transform (DCT) for every block; (2) Find out suitable quantization coefficient, quantize DCT coefficient; (3) Use the Direct Current coefficient (DC) to predict that Alternating Current (AC) coefficient, get AC error coefficient, (4) Use the differential pulse code modulation (DPCM) to DC coefficient, get DC error coefficient; (5) Context coding is used in DCT coefficient. Models of Context Coding: (1)Zero Coding, (2) Refine Coding, (3) Run-length Coding. When enter compression step,quantization coefficient will be recomputed. The performance which doesn't need extra quantization table is better than the performance which needs to use fixed quantization table.When using arithmetic coding, consider the relation of coefficient can improve the performance of compression. According to predict AC coefficient can improve the Transform, using DC coefficient to predict AC cocefficient can improve the performance of compression. Because coefficient transform is one kind of block-based coefficient transform. When image would be compressed overly, the restructure image will cause distinct Blocking Effect. Post-processing can improve the performance of compression.

Keywords : Discrete Cosine Transform, Progressive Compreesion, Embedded DCT, Context coding, AC Coefficient Predicted

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REFERENCES

[1] J. In, S. Hsiarani and F. kossentini,“ On RD optimized progressive image coding using JPEG,” IEEE Transactions on Image Processing, Vol. 8, No. 11, Nov. 1999, pp.1630-1638, Nov. 1999.

[2] Ying Chen and Pengwei Hao,“ Integer Reversible Transformation to Make JPEG Lossless,” IEEE International Conference on Signal Processing, Vol.1, pp. 835- 838, Sept. 2004.

[3] D.M. Monro and G.J. Dickson,“ Zerotree coding of DCT coefficients,” International Conference on Image Processing, Vol. 2, pp. 625-628, Oct 1997.

[4] T.D. Tran,“ The binDCT: fast multiplierless approximation of the DCT,” IEEE Signal Processing Letters, Vol. 7, No. 6, pp.141-144, Jun. 2000.

[5] A. Said and W.A. Pearlman,“ A new, fast, and efficient image codec based on set partitioning in hierarchical trees,” IEEE Transactions on Circuits and Systems for Video Technology, Vol. 6, No. 3, pp.243 - 250, June 1996.

[6] Chao Xu, “ EBCOT-based discrete wavelet transform scheme with row-overlapped Z-scan,” IEEE Transactions on Consumer Electronics, pp. 451-452, Jane 2005.

[7] William A. Pearlman, Asad Islam, Nithin Nagaraj, and Amir Said,“ Efficient, low-complexity image coding with a set-partitioning embedded block coder,” IEEE Transactions on Circuits and Systems for Video Technology, Vol.14, No.11, pp.1219 - 1235, Nov. 2004.

[8] Amir Said,“ Arithmetic Coding,” in Lossless Compression Handbook, K. Sayood, Ed. , Academic Press, San Diego, CA, 2003.

[9] Amir Said, Introduction to Arithmetic Coding Theory and Practice,Hewlett-Packard Laboratories Report, HPL-2004-76, Palo Alto, CA, April 2004.

[10] Jooheung Lee, N. Vijaykrishnan, M.J. Irwin, and R. Chandramouli," Block-based frequency scalable technique for efficient hierarchical coding," IEEE Transactions on Signal Processing, Vol. 54, No. 7, pp. 2559- 2566, July 2006.

[11] Hyun Wook Park and Yung Lyul Lee," A postprocessing method for reducing quantization effects in lowbit-rate moving picture coding," IEEE Transactions on Circuits and Systems for Video Technology, Vol. 9, No. 1, pp.1051-8215, Feb. 1999.

[12] Ying Luo and Rabab K. Ward," Removing the blocking artifacts of block-based DCT compressed images," IEEE Transactions on Image Processing, Vol. 12, No. 7, pp. 838- 842, July 2003.

[13] Geoffrey Davis and Sumit Chawla," Significance Tree Quantization of the Discrete Cosine Transform," IEEE International Conference on Image Processing, Vol. 1, pp. 600-603, Oct. 1997.

[14] Junqiang Lan and Xinhua Zhuang," Embedded image compression using DCT based subband decomposition and SLCCA data organization," IEEE Workshop on Multimedia Signal Processing, pp. 81-84, Dec. 2002.

[15] Jiankun Li, Jin Li and C.-C. J. Kuo," An embedded DCT approach to progressive image compression," IEEE International Conference on Image Processing, Vol. 1, pp. 201-204, Sept. 1996.

[16] D. Nister and C. Christopoulos," An embedded DCT-based still image coding algorithm," IEEE International Conference on Acoustics, Speech, and Signal Processing, Vol.5, pp.2617-2620, May 1998.

[17] Yan Yusong, Wang Chunmei, Su Guangda, and Shi Qingyun," Invertible Integer DCT Applied on Progressive until Lossless Image Compression," IEEE International Symposium on Image and Signal Processing and Analysis, Vol. 2, pp. 1018-1023, Sept. 2003.

[18] Yan Yusong, Wang Chunmei, Su Guangda, and Shi Qingyun," Invertible integer DCT applied on progressive until lossless image compression," Image and Signal Processing and Analysis, vol. 2, pp.1018- 1023, Sept. 2003.

[19] R. Singh and A. Ortega," Lookahead Search for Lossy Context-Based Adaptive Entropy Coding," International Conference on Image Processing,Vol. 3, pp. 845-848, Sep. 2000.

[20] Wilhelm Berghorn ,Tobias Boskamp,Markus Lang,and Heinz-Otto Peitgen," Context Conditioning and Run-Length Coding for Hybrid, Embedded Progressive Image Coding," IEEE Transactions on Image Processing,Vol. 10,No. 12,Dec. 2001.

[21] Bruno Aiazzi, Luciano Alparone, and Stefano Baronti," Context Modeling for Near-Lossless Image Coding," IEEE Signal Processing Letters, Vol. 9, No. 3, March 2002.

[22] Debin Zhao, Dapeng Zhang, and Wen Gao," Embedded Image Coding Based on Hierarchical Discrete Cosine Transform," Journal of Software, Vol.12, No.9, pp. 1287-1294, Sept. 2001.

[23] C. Tu and T.D. Tran," Context-based entropy coding of block transform coefficients for image compression," IEEE Transactions on Image Processing, Vol.11, No.11, pp.1271-1283, Nov. 2002.

[24] C.A. Gonzales, L. Allman,T. McCarthy, P. Wendt, and A.N. Akansu," DCT coding for motion video storage using adaptive arithmetic coding," Signal Processing: Image Communication, Vol. 2, No. 2, pp. 145-154, 1990.

[25] Shizhong Liu and Alan C. Bovik," Foveation embedded DCT domain video transcoding," Journal of Visual Communication and Image Representation, Vol.16, No.6, pp. 643-667, December 2005.

[26] R. Ashin, A. Morimoto and R.Vaillancourt," Image compression with multiresolution singular value decomposition and other methods," Mathematical and Computer Modelling, Vol. 41, No. 6-7, pp. 773-790, May 2005.