# Quantization Distortion in Block Transform- Compressed Data

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## Abstract

The popular JPEG image compression standard [1] is an example of a block transform-based compression scheme; the image is systematically subdivided into *blocks* that are individually transformed, quantized, and encoded [2]. The compression is achieved by quantizing the transformed data, reducing the data entropy and thus facilitating efficient encoding. It is well documented that block transform compression schemes exhibit sharp discontinuities at data block boundaries; this blocking phenomenon is a visible manifestation of the compression quantization distortion. For example, in compression algorithms such as J] 'EG these blocking effects manifest themselves visually as discontinue i ties between adjacent 8x8 pixel image blocks.

In genera] the distortion characteristics of block transform-based compression techniques are understandable in terms of the properties of t he transform basis functions and the transform coefficient quantization error. In particular, the blocking effects exhibited by JPEG arc explained by two simple observations demonstrated in this work: a disproportionate fraction of the total quantization error accumulates on block edge pixels; and the quantization errors among pixels within a compression block are highl y correlated, while the qu anti za tion errors between pixels in separate blocks are uncorrelated.

For the analyst attempting to extract quantitative information from block transform-com pressed data, the non-trivial spatial and correlational character of quantization noise has potentially important consequences. Further, a predictive distortion model facilitates the design and application of st rategies for mitigating com pressi on artifacts [3]. Hence a quantitative modeling of the compression distortion pattern is desirable. In this work a generic model of' block transform compression quantization noise is introduced, applied to synthesized and real one and two dimensional data using the DCT as the transfor m basis, and results of the model are shown to predict distortion patterns observed in data compressed with JPEG.

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## References

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[2] R.J. Clarke, *Transform Coding of Images*, Academic Press, 1985.

[3] R. Brown and A.F. Boden, "*A Posteriori* Restor ation o f Block Transform-Compressed Data," these proceedings.