

JPEG2000 Compliant Lossless Coding of Floating Point Data

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Many scientific applications require that image data be stored in floating point format due to the large dynamic range of the data. These applications pose a problem if the data needs to be compressed since modern image compression standards, such as JPEG2000, are only defined to operate on fixed point or integer data. This paper proposes straightforward extensions to the JPEG2000 image compression standard which allow for the efficient coding of floating point data. The extensions are based on the idea of representing floating point values as “extended integers,” and these extensions maintain desirable properties of JPEG2000, such as scalable embedded bit streams and rate distortion optimality. Like JPEG2000, the proposed methods can be applied to both lossy and lossless compression. However, the discussion in this paper focuses on, and the test results are limited to, the lossless case. Test results show that one of the proposed lossless methods improve upon the compression ratio of standard methods such as gzip by an average of 16%.

The efficiency of the proposed methods were tested by converting 5 test images to floating point format and then losslessly compressing the untransformed and losslessly wavelet transformed images. The five test images included the barbara, goldhill, and peppers images, and 640 by 512 versions of the bicycle and woman test images. Results comparing the proposed method with standard gzip are shown in Table 1.

Table 1: Compression ratios achieved by losslessly compressing 5 test images using gzip and the proposed method without and with wavelet transform.

Image	gzip	nowave	wave
barbara	1.15	1.36	1.14
bike640x512	1.18	1.38	1.10
goldhill	1.17	1.36	1.14
peppers	1.14	1.37	1.11
woman640x512	1.15	1.36	1.14

The test results show that the proposed lossless compression method with no wavelet transform outperforms the gzip method in all cases. Compression with the wavelet transform gives slightly degraded performance. Thus if no resolution scaling is needed, the proposed method without wavelet transform is clearly the best choice for lossless compression. Even if resolution scaling is needed, the proposed method may still be the better choice since the proposed methods allow for the full data flexibility of JPEG2000.

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