COMPRESSION OF AERIAL ORTHO IMAGES BASED ON IMAGE DENOISING

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ABSTRACT

This work is concerned with compression of an important class of computer images, called aerial ortho images, that result from geodetic transformation computations [Kins94]. The computations introduce numerical noise, making the images nearly incompressible losslessly because of their high entropy (e.g., 7.65 bits per pixel, bpp), resulting in compression ratios of 1.06:1, 1.08:1, and 1.62:1 for the Arithmetic Coding [Kins91], GZIP, and lossless JPEG [HuSm94], respectively. The use of classical lossy compression schemes is also not desirable because their effects on the original image are unknown, e.g., it is possible that the actual image is altered while the noise is not removed. We then propose the use of image denoising coupled with lossless image compression, that preserves selected image characteristics. Two denoising schemes for a compression ratio of 2:1 are compared. The first scheme is based on a Donoho’s wavelet shrinking scheme which preserves image smoothness [Dono92]. We study the effect of various shrinking parameter values on the compression ratio and image quality, where 35.5 dB peak signal-to-noise ratio (PSNR) is obtained for a compression ratio of 2.03:1. This approach preserves high-frequency information, so that sharp edges do not become blurred as in classical filtering methods. This is critically important, because the main feature of ortho images is in its flatness and its precision of edge position. The second scheme is based on preserving pixel predictability [KoSc93], leading to a variant of planar predictive coding. This approach adds, to the edge preserving capability, the limitation in pixel deviation between the original and denoised images to be within one grayscale level. As a result, two different predictive coding schemes achieve a compression ratio of 2:1 at 49.9 dB and 51.2 dB PSNR, outperforming a lossy JPEG compression, that obtains 44.7 dB and 47 dB PSNR at 2.08:1 and 1.87:1 compression ratios, respectively.

REFERENCES