EM IMAGE COMPRESSION USING THE DISCRETE WAVELET TRANSFORM

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Abstract

The image from the Electron Microscope (EM) is effectively used to analyze the fine details of the object's surface. When the discrete wavelet transform is applied to the image, the plain surface of the object will be in the low-frequency subband and the edge will be in the high-frequency subbands. Thus, compression algorithm for the EM image must take every subband of the wavelet coefficients into account. A powerful image compression algorithm we consider is the Set Partitioning in Hierarchical Tree (SPIHT). This coding scheme exploits the self-similarity of the wavelet coefficients across different scales and searches for the high magnitude coefficients in every subband so its compression rate is better than the one by the Joint Photographic Group (JPEG) method. Furthermore, SPIHT does not cause Block Artifacts as the JPEG does. In this work, we propose an improvement of the SPIHT algorithm to increase the image compression capability by adding List of Forbidden Coefficients (LFC), extending the encoding and decoding condition, and assessing the image compression efficiency by using the Peak-signal-to-noise-ratio (PSNR) mehtod and the Bit rate method.

The proposed algorithm for EM image compression has been coded in C. The codes run on Pentium III, 1 GHz, by 2-10 seconds according to different bit rates used. As shown in Figure 1(a-d), the quality of the image in Figure 1(d) is almost the same as that of the original in Figure 1(a). The size of the compressed image file is 1/8 times the size of the original. With lower bit rates, the smaller compressed files could be obtained with degraded quality of the compressed images. The suitable bit rate should be judged against the required image quality.

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