MULTIDIMENSIONAL SIGNAL PROCESSING METHOD USING WAVELET TRANSFORMS

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Due to the rapid development of computer technology, the Internet and closely related multimedia applications, digital images have become particularly popular. Storing images in digital form requires significant amounts of electronic memory. In this regard, various compression technologies have been developed. The goal of image compression is to minimize the number of bits required to represent an image [1].

Wavelets have significant advantages over the Fourier transform, namely, the wavelet transform allows you to draw conclusions not only about the frequency spectrum of the signal, but also about the time at which a particular harmonic appeared. With their help, you can easily analyze discrete signals or signals with sharp bursts. In addition, wavelets allow you to analyze data according to scale, at one of the given levels (small or large) [2].

The practical use of wavelet transforms is mainly associated with discrete wavelets, both due to the widespread use of digital data processing methods and due to a number of differences between discrete and orthogonal wavelet transforms. Discrete wavelet transforms are usually used for signal coding, while orthogonal transforms are used for signal analysis. That is why discrete transforms are used in engineering and computer science, and orthogonal transforms are used in scientific research of physical processes.

The issues of choosing a wavelet algorithm were considered, the criteria for assessing image quality were given, and the choice of the optimal wavelet algorithm for image processing was also considered.

The use of compression algorithms based on wavelet transforms gives a better ratio of the quality indicators of the restored image and the compression ratio than when using algorithms based on DCT, due to the absence of a block structure in the restored image, and also makes it possible to transmit the image progressively over the network.

During the study, it was found that when using the Daubech wavelet 7/9 and the depth of image decomposition to the third level, depending on the intensity of the image color palette, it is possible to obtain up to 98% of zero coefficients and a value of recovered energy of 94% with a small deviation of the visual quality of the resulting image from the original. Using this algorithm allows you to obtain an image compression ratio of up to 50 times.

To compare the results obtained in the Matlab environment, a software product was developed in the Delphi environment, which confirms the results obtained.

References:

1. Aamir, M., & Khan, M. A. (2021). A comprehensive review on image compression techniques. *Multimedia Tools and Applications*, 80(1), 947–982.

2. Zain, J. M., & Subari, K. S. (2022). Wavelet-based image compression techniques: A performance comparison. *Journal of Imaging*, 8(3), 80.