APPLICATION OF ATOMIC FUNCTIONS TO IMAGE COMPRESSION

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The function is called atomic if it is a solution of the linear functional differential equation with constant coefficients and linear transformations of the argument [1]. In [1 - 4], approximation properties of the atomic functions $\mathrm{up}(x)$, $\mathrm{up}_s(x)$ and their generalizations were studied. In terms of Kolmogorov width, it was shown that these functions are just as perfect constructive tools as classic trigonometric polynomials. Hence, their practical applications are promising.

Discrete atomic transform (DAT), which is based on application of atomic functions, was presented in [5]. Also, advantages of the DAT procedure over the discrete cosine transform were given. Further DAT was used as a core step of discrete atomic compression (DAC) [6].

DAC is an algorithm for compression of full color 24-bit images using atomic functions. This algorithm is an effective tool for compression of digital photos, aerial and satellite images, screenshots and all other types of photorealistic images.

DAC is a lossy compression algorithm. By varying the parameters of this compressor you can get results of different size and quality.

DAC is much more efficient than JPEG compression algorithm. The figure 1 presents the results of comparison of the high quality modes of DAC and JPEG.

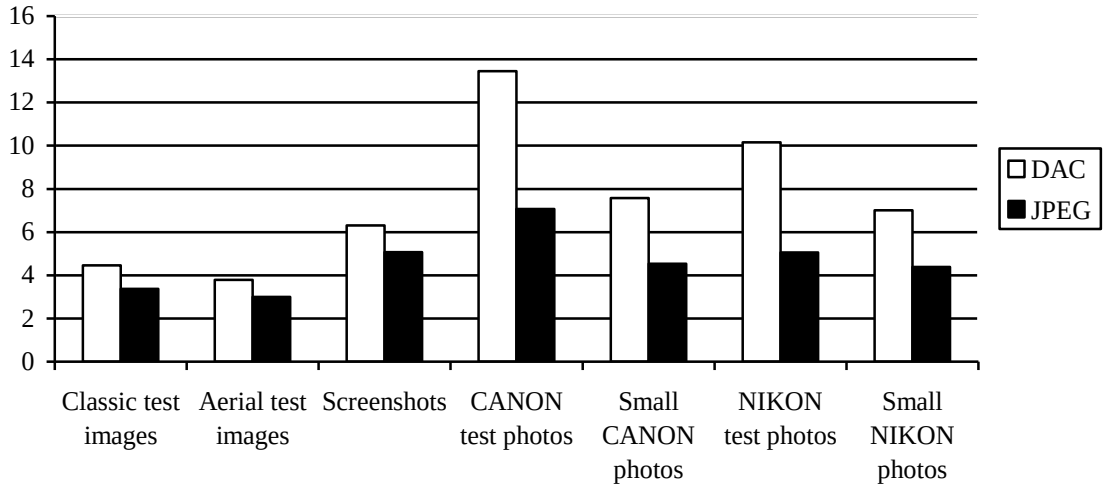

Fig. 1. Compression ratio

It should be mentioned that DAC and JPEG have almost the same loss of quality in terms of the uniform, root mean square and peak signal to noise ratio metrics.

Comparison of these algorithms, which was carried out on several groups of different test images, shows that DAC can save significantly more memory than JPEG with the same quality of results. For instance, the size of DAC-file is smaller than the size of the corresponding JPEG-file by 12 to 48 percent (actually, it depends on the type of the image and the settings of quality).

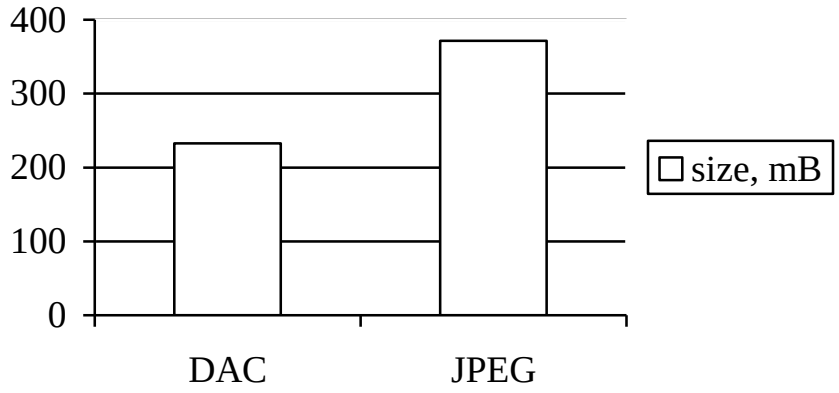

Fig. 2. Total size of compressed test images.
The total size of the original data is 1.9 gB.

It is also important that ZIP algorithm is effective for compression of DAC-files. Using ZIP compression, we can reduce memory costs by 6 to 13 percent. At the same time, ZIP compression of the corresponding JPEG-file does not exceed 5 percent.

Therefore, further development and wide use of DAC is promising.

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