PROGRAMS FOR PROCESSING AUDIO INFORMATION

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In the world to improve the quality of digital television images, methods of modeling filtering processes and highly effective control systems in a number of priority areas, scientific research is carried out, including: on the formation of mathematical models of filtration processes to improve the methods of wavelet, Fourier, Haar, Walsh-Hadamard, Karkhunen- Loeva in increasing the clarity and brightness of images based on linear and nonlinear differential equations; Creation of methods for eliminating additive, impulse and adaptive-Gaussian types of noise in images using additive and adaptive filtering; Methods of algorithms and software for intra-frame and inter-frame image transformation; Methods of the adaptive method of controlling the brightness system using the Chebyshev matrix series; Methods of gradient, static and Laplace methods for segmenting the image and dividing it into contours; The formation of criteria and conditions for assessing the quality of images.

The main objective of sharpening is to emphasize the small parts of the image or improve those details because of errors or imperfections of the shooting method. Image sharpening is used quite broadly — from e-printing and medical imaging to technical control of industrial and automatic pointing systems in the military sphere.

Consider the grid system equations

$$-a_{ij}z_{i-1,j} - b_{ij}z_{i,j-1} - c_{ij}z_{i+1,j} - d_{ij}z_{i,j+1} + e_{ij}z_{ij} = f_{ij} \quad (1)$$

approximating two-dimensional boundary value problems on rectangular grids (or topologically equivalent rectangular). The equations are considered in internal nodes of the computational domain indexes

$$i = 1, 2, \ldots, I, \qquad j = 1, 2, \ldots J_i,$$

where J_i — the number of Interior nodes in the i - grid lines. It is expected that sites odds and right parts of equations (1) determined by the boundary conditions (e.g., if the nodes $(i-1, j)$ and $(i, j-1)$

external, $a_{ij} = b_{ij} = 0$). All coefficients in (1) we assume non-negative and possessing property of diagonal dominance. In other words, the matrix A the system is written in vector form as

$$Az = f \quad (2)$$

where $z = fz = \{z_{ij}\}, f = \{f_{ij}\},$ is $M -$ matrix.

Entering under vectors z_i dimension J_i represent values of the grid functions on i grid lines, the system of equations can be represented as

$$-L_i z_{i-1} + D_i z_i - U_i z_{i+1} = f_i, \; i = 1,2,...,I, \quad L_1 = U_1 = 0 \quad (3)$$

There $D_i = \{-b_{ij}, e_{ij}, -d_{ij}\} -$ square three diagonal $M -$ matrix order J_i, L_i and $U_i -$ in general, rectangular matrices, with its rows of one nonzero element a_{ij} or c_{ij} respectively.

The system matrix can be written in the form.

$$A = D - L - U = \begin{Vmatrix} D_1 - U_1 & \\ -L_i \;\; D_i - U_i & \\ & \end{Vmatrix}$$

where $D = \{D_i\}, L$ and $U -$ accordingly, block-diagonal, lower and upper triangular matrices. We will also assume symmetry matrix A, $D = D^1, L = U^1,$ where the bar denotes the transpose.

To solve the system of equations (1)-(3) consider an iterative Conjugate gradient method

$$r^n = f - Az^n, \;\; \bar{z}^n = K^{-1} r^n, \;\; p^0 = \bar{z}^0,$$

$$z^{n+1} = z^n + a_n p^n, \;\; a_n = \frac{(r^n, \bar{z}^n)}{(Ap^n, p^n)},$$

$$p^{n+1} = \bar{z}^{n+1} + \beta_n, p^n, \; \beta_n = \frac{(r^{n+1}, \bar{z}^{n+1})}{(r^n, \bar{z}^n)}, \quad (4)$$

with the downsizing of the matrix

$$K = (G - L) G^{-1} (G - U) \quad (5)$$

There $G = \{G_i\} -$ block-diagonal matrix whose blocks G_i the essence of band matrices and are determined from recurrences

$$G_1 = D_1, \; G_i = D_i - L_i (G_{i-1}^{-1})^{(p)} U_{i-1} - \theta S_i, \; i = 2,3,...,I, \quad (6)$$

where $p = 0,1,3,...$ — an odd number, $0 \le \theta \le 1$ — iterative "compensating" option $(G_{i-1}^{-1})^{(p)}$ — "band part" of the matrix with a width of strip p, S_i — diagonal matrix, calculated by using the equality

$$S_{ie} = L_i \left[G_{i-1}^{-1} - (G_{i-1}^{-1})^{(p)} \right] e \quad (7)$$

where e denotes the vector with single components.

Note that if $p = 0$ (this implies $(G_{i-1}^{-1})^{(p)} = 0$), then $G_i = D_i - \theta S_i$ and the resulting algorithm can be viewed as a generalization of the method of block symmetric consistent top relaxation with "compensation" or close to him to implement alternately-triangular method and explicit methods of variable directions.

Implementation methods (4) —(7), call implicit because matrix G_i no longer are the diagonal contains at least two notable algorithmic aspects. its solution is easily carried out using the oncoming amount. In the end, to find each of the matrices G_i the required number of operations is proportional to the $p^2 J_i$, These calculations must be performed only once before beginning the iterations.

The second point is the finding in (4) of vector z^n. By definition K and block structure matrices G, L and U, calculation under vectors z_i^n when known G_i and r_i^n is based on the following formulas:

$$G_i v_i^n = r_i^n + L_i v_{i-1}, \quad i = 1, 2, \ldots, I, \quad (8) \qquad G_i w_i^n = U_i z_{i+1}^n, \; z_i^n = v_i^n + w_i^n, \; i = I, I-1, \ldots, 2, 1. \quad (9)$$

Here the decision support systems with three diagonal (p -diagonal when $p \geq 5$) matrices G_i is executed in turn, using the amount.

Programs for working with audio information (sound). These programs allow you to record live sound and transform it, changing the timbre, improving the sound quality, adding effects, etc. The previous section has already been told that modern sequencer programs have the ability to record not only MIDI, but also sound tracks. However, for serious work with sound information, as a rule, it is required to call an external audio editor, that is, just a program for working with sound. Unlike MIDI sequencers, here the quality of the program is determined not only by the convenience and functionality of the interface, not only by the presence of additional utilities, but also by the processing algorithms themselves. Under the same conditions and parameters on the same sound material, different programs can give completely different results. Generally speaking, sound information is an “elusive” thing: sometimes a slight change in one of the many processing parameters can produce a completely new hearing result. So, getting good sound results, do not be too lazy to once again write the resulting file to disk.

The prospects for the development and use of digital audio are seen by the authors of the article as very broad. It would seem that everything that could be done in this area has already been done. However, it is not. There remains a lot of problems that are still completely unaffected.

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