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THE METHOD OF THE PERFORATED NON-EQUILIBRIUM NUMBERS COMPOSITION

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Висловлено обґрунтування та основні етапи розробки методу композиційної збірки нерівноважних перфорованих позиційних чисел на основі масивів нижнього діапазонного і верхнього диференційованого діапазонного рівнів. Побудовано диференціальний опис масивів верхнього перфораційного рівня, який враховує наявність однорідної структури динамічних діапазонів перепадів на межі контуру і основного фону зображення. Показано, що композиційні перфоровані числа на відміну від нерівноважних позиційних чисел володіють властивостями для потенційного підвищення ступеня стискування.

Ключові слова: перфоровані позиційні числа, диференціальний опис, ступень стискування, нерівноважні позиційні числа.

A ground and basic design of the composition assembling times method is expounded non-equilibrium perforation of position numbers on the basis of arrays lower range and overhead the differentiated range levels. Differential description of arrays is built overhead of level perforation, taking into account the presence of dynamic ranges homogeneous structure of overfalls on the scopes of contour and basic background of image. Shown, that composition perforation of number in a difference from non-equilibrium position numbers possesses properties for the potential increase of compression degree.

Key words: perforation of position numbers, differential description, compression degree, non-equilibrium position numbers.

In accordance with the modern necessities of society **the** actual **purpose of the researches scientifically-applied subject** in the process of development and perfection of the informative systems consists in providing reduction of videoinformation stream volumes in the conditions of the limited temporal resource [1; 2].

The necessity of perforated non-equilibrium positions numbers forming is in-process grounded for differential presentation of images. It will allow: to expose conformities to the law of perforated dynamic ranges of saturated differential presentation by shallow output primitives; to provide possibilities for additional reduction of the differentially-represented images surplus in cases of structural properties unstationaryness. Essence of perforated non-equilibrium number forming consists in that for the arrays of differential presentation, examined as non-equilibrium positions numbers, there are such elements, the delete of which results in considerable reduction of dynamic range remaining elements. Then two arrays are formed $H \rightarrow \{H^{(0)};\ H^{(1)}\}$. The first array $H^{(1)}$ contains the elements of top perforation level. A lower perforation level answers according to second array $H^{(0)}$ cells.

For realization of potential possibilities in relation to the increase of compression degree without the loss of images quality it is necessary to develop of the compression method. It is necessary to take into account the structural features of images, namely presence: correlations between neighboring display elements; coherentness of elements in the columns of image fragments; limited amount of sharp overfalls for the images fragments; limited value and unevenness of overfall dynamic ranges between neighboring display elements; limited amount of overfalls of having high dynamic ranges.

Means, the compression method must be complex; I.e. the process of treatment will contain a few stages. The important stage of the differentiated images processing consists in construction of arrays composition presentation of perforated levels. From here **a scientific task** is the ground and development of composition description method of the perforated non-equilibrium positions numbers for the increase of encoding process efficiency.

The basic material

The development of technological process of structurally - differential representations specification construction

Construction of non-equilibrium positions numbers. This stage includes forming of dynamic ranges for the arrays cells of differential presentation(ADP) $d_{k\ell} = \min(d_k, d_\ell)$; $k = \overline{1,m}$; $\ell = \overline{1,n}$, $h'_{k\ell} \le d_{k\ell} - 1$. A non-equilibrium position number (NPN) for the elements which there are limitations on a dynamic range appears as a result $\{d_{1\ell}, \ldots, d_{k\ell}, \ldots, d_{m\ell}\}$. A stage is preliminary for organization of the perforated numbers construction.

Creation of the perforated non-equilibrium position presentation is carried out on the base of

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differential presentation arrays. Distributing of NPN elements on the arrays of perforated levels is carried out for the known threshold value $K(h')_{th}$ on the basis of the following rule:

— if for the dynamic range of NPN element inequality is executed:

$$d_{k\ell} \le K(h')_{th}, \qquad (1)$$

an element $h'_{k\ell}$ behaves to the region of lower perforated level $h'_{k\ell} \in H^{(0)}$;

— if inequality $d_{k\ell} \le K(h')_{th}$ is executed, then an element $h'_{k\ell}$ belongs to the array of top perforated level $h'_{k\ell} \in H^{(1)}$.

The arrays cells of lower $h^{(1)}_{k\ell}$ and overhead $h^{(2)}_{k\ell}$ perforated level can be on different positions in the array of differential presentation. Therefore on the next stage of treatment is needed from the selected elements to form the most complete arrays for simplification of encoding process. It is suggested to conduct forming of lower cells arrays and overhead perforated levels taking to account that: arrays are filled in the direction of lines, and in the case of incomplete line filling by an element from other line, having a greater range, it is necessary to count ranges for the elements of all line.

Formation of perforated levels arrays is conducted on the basis of procedures:

1) the elements of lower level, which correspond to the condition, are taken away (1). Failing elements are filled by the zeroing values. On position proper to the selected element the zeroing value is put.

2) construction of the second level array consists in replacement of zeroing values by neighboring elements or elements of neighboring lines.

If inequality (1) is executed, $h'_{k\ell}$ element standing on position with coordinates $h'_{k\ell}$ $(k;\ell)$ in an array *H* behaves to the array $H^{(0)}$.

Filling of array $H^{(0)}$ is carried out on lines. Length of line coincides with long the lines of array *H* and is evened n.

Values of coordinates $(\xi;\gamma)$ taking into account the known amount of elements $\nu(H^{(0)}_{k\ell})$ belonging to the array $H^{(0)}$ in the moment of distributing beginning of $(k;\ell)$ array cell *H*, are on the basis of the following expressions:

— when the amount of elements $\nu(H^{(0)}_{k\ell})$ is less, than amount n of elements in the line of array $H^{(0)}$, I.e. $\nu(H^{(0)}_{k\ell})<n$, $\xi=1$ and $\gamma=\nu(H^{(0)}_{k\ell})+1$;

— in the case when equality is executed,, and $\nu(H^{(0)}_{k\ell})=n$, $\xi=2$, $\gamma=1$;

— if length of array line $H^{(0)}$ exceeds the amount of array cells $H^{(0)}$, I.e. $\nu(H^{(0)}_{k\ell})>n$;

$$\xi=\left[\frac{\nu(H^{(0)}_{k\ell})}{n}\right]+1;\ \gamma=\nu(H^{(0)}_{k\ell})-\left(\left[\frac{\nu(H^{(0)}_{k\ell})}{n}\right]n\right)+1.$$

Construction of array $H^{(1)}$ from elements $h'_{k\ell}$ for the dynamic ranges which a condition (1) is not executed gets organized on the basis of remaining array cells *H*. The array $H^{(1)}$ of top perforated level appears by filling of array position *H*, which an element belonging to the array takes place on $H^{(0)}$. In this case for the count of array coordinates *H* cells a rule is used in the coordinates of array $H^{(1)}$ cells.

If the dynamic range $d_{k\ell}$ of element with coordinates $(k;\ell)$ satisfies to inequality (1), the coordinates of next element $h_{k,\ell+1}$ (if $\ell+1 \le \mathrm{n}$) or $h_{k+1,1}$ (if $\ell+1>n$) array H will be equal $\xi=k$; $\gamma=\ell$. Format of array H, after a selection from him elements in an array $H^{(0)}$ is maintenance of array $H^{(1)}$.

As a result of this stage implementation is provided:

— distributing of positions in a non-equilibrium position number *H* on arrays $H^{(0)}$ and $H^{(1)}$ accordingly values of lower elements and overhead perforated levels;

— breaking up of array $D(h')$ consisting of limitations values on a dynamic range $\mathrm{d}_{\xi\gamma}$, accordingly on arrays $D(h')^{(0)}$ and $D(h')^{(1)}$.

Assembling of perforation number on the basis of two arrays composition

Further treatment of perforations levels arrays can be carried out on the basis of two approaches, namely:

1) forming of code-number for every array individually;

2) calculation of code-number for the composition array got as a result of arrays assembling of perforations levels in one array.

The first direction allows shortening the amount of the calculable expenses taken in the case of composition perforation number forming. However in this case is not taken into account, that the dynamic range of perforated levels arrays cells can be brief so, that the formed codes combinations will contain plenty of unmeaning binary digits. It will result in the decline of compression degree.

The second approach of perforations numbers treatment allows eliminating the similar failings. This approach allows to take into account that most aspect ratios at forming of code-number to the non-equilibrium positions numbers is arrived at in cases then when code word capacity not less than 32 bit. It is special shows up at treatment of NP numbers the elements which have large dynamic ranges. In also time in order to fill code words of such length by meaningful digits it is necessary to form codes-numbers mattering large proper. For this purpose it is required to multiply the amount of elements in NPN. In addition, possibility is provided:

— to process plenty of elements, I.e. potential possibilities are multiplied in relation to the amount of the abbreviated surplus;

— choice of elements mattering minimum grounds. It will allow reducing code length, as the minimum values will be on positions of senior elements.

Dignities of such approach consist in: absence of calculation necessity of array minimum value of differential presentation, that forming of additional service information allows avoiding; calculation of perforation threshold on the basis of the self-weighted account of ADP elements dynamic ranges, that allows promoting the sensitiveness of perforated to structural maintenance.

Conclusions

1. The method of the composition assembling of the non-equilibrium perforated positions numbers is developed on the basis of lower range arrays and overhead differentiated range levels.

2. Differential arrays of top perforation level declaration taking into account such feature as presence of homogeneous structure of overfalls dynamic ranges on the scopes of contour and basic background of image is built. In this case the arrays of top range level are examined as double positions numbers in difference non-equilibrium space. Lengths of distances are the elements of differential non-equilibrium position number from him to the double NP number mattering minimum elements, i.e. proper to the lower level of difference non-equilibrium space.

3. Grounded, that the composition perforated numbers in a difference from non-equilibrium positions numbers possess the following properties for the potential increase of compression degree:

1) brief dynamic range for the elements of top perforated level, describing meaningful overfalls in the images;

2) additional service information content about the minimum values concerns only for the lines of top perforated level array, and can in a limit to equal to one size;

3) for determination of perforated threshold additional service information is not used.

The scientific novelty of the got results consists of that, got further development method of the non-equilibrium position encoding (polyadyc encoding), consisting of that is carried out exposure of the perforated dynamic ranges on the basis of self-weighted middle of initial dynamic ranges.

It allows additionally shortening the amount of combination surplus without the use of additional service information.

REFERENCES

1. *Gonzalez R.* Digital Image Processing / R. Gonzalez, R. Woods. — M. : Technosphere, 2005. — 1073 p.

2. *Barannik V.* The structurally — combinatory presentation of information in the automated control systems / V. V. Barannik, Y. V. Ctasev, N. A. Koroleva. Monograph, Kharkov: Khups, 2009. — 252 p.

3. *Wallace G. K.* The JPEG Still Picture Compression Standard // Communication in ACM / G. K. Wallace. — 1991. — V. 34. — № 4. — P. 31—34.

4. *Shynkarev V. V.* The methodology of compression technology forming of the differentiated images: Modern special technique / V. V. Shynkarev. — 2009. — № 4. — P. 45—54.

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