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METHODOLOGICAL BASE FOR TRANSFORMANTS REPRESENTATION IN NONEQUILIBRIUM POSITIONAL UNEVEN-DIAGONAL SPACE

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Показано актуальність розвитку технологій зниження інтенсивності відеопотоку і кодового представлення базового кадру як його ключова складова. Викладено базові аспекти створення методу формування нерівноважного позиційного нерівномірно-діагонального базису основи на підставі виявлення динамічних діапазонів для окремих нерівномірних діагоналей залежно від їх порядкового номера і напрямку зигзаг обходу. Розроблено модель оцінки інформативності трансформанти з урахуванням того, що трансформанта дискретного косинусного перетворення, розглядається по нерівномірній діагональній структурі, і є комбінаторним об'єктом, а саме перестановку з повтореннями, на динамічні діапазони елементів яких накладені обмеження. Обґрунтовано, що в умовах наявності тенденції в зміні властивостей трансформанти в діагональному напрямку для нерівномірно-діагонального методу виявлення динамічних діапазонів забезпечується потенціал відносно додаткового усунення структурної надмірності у базових кадрах.

Ключові слова: безпровідна; технологія; трансформанта; метод; нерівномірно-діагональний.

It is shown the relevance of development of technologies of lowering of intensity of a video stream and code representation of a basic frame as its key component. It is explained the basic aspects of creation of a method of formation of nonequilibrium positional uneven-diagonal basis that based on detection of dynamic ranges for separate uneven diagonals depending on their index number and the zigzag direction. It is developed the model of an assessment of informtiveness of a transformant taking into account that the transformant of discrete cosine transformation, is considered on uneven diagonal structure, and represents combinatorial object, namely reversion with reiteration on which dynamic ranges of elements restrictions are imposed. It is grounded that in the conditions of existence of a tendency in change of properties of a transformants in the diagonal direction for a eneven-diagonal method of detection of dynamic ranges is providing the potential of rather additional elimination of structural redundance in basic frames.

Keywords: wireless; technologies; transformant; method; eneven-diagonal.

Introduction

At the moment development of wireless infocommunication technologies is connected to creation of technologies of communication of fourth generation. Standards of generation 4G shall provide speeds of the entering data in 1 Gbit\s for stationary and 100 Mbit\s for mobile stations. They use new effective diagrams of multiplexing, namely multiple access with orthogonal frequency differentiation of channels. On the other hand such tendency inevitably leads to growth of intensity of a video traffic, and as a result increase of load on infocommunication systems [1–3]. Therefore a question of creation of methods of lowering of a video stream intensity starts to be actual. The carried-out assessment of values of video stream intensity revealed that there is an imbalance between intensity and network transmission speed that grows. The contribution of code representation intensity of a basic frame to total video stream intensity has significant impact.

Grounding of direction of the technologies of basic frames processing enhancement

As the direction of enhancement of technologies of a compression of a video stream for lowering of its intensity it is offered to upgrade methods of processing of basic frames. Basic technologies of basic frames processing generally use a stage of preliminary transformation. It is caused by existence in transformants of a complex of regularities, including such which allow to remove combinatorial redundance.

Existence of combinatorial redundance in transformants of two-dimensional cosine transformation has a statistical and psychovisual conditionality, namely [4–6].

For abbreviation of redundance it is necessary to carry out distribution of discharges on code constructions. In case of bit-by-bit distribution of discharges there are difficulties caused by need or to use separators for alignment of code words or to transfer information about values of dynamic range. Besides, formation of code words for separate elements is less effective concerning formation of codes for sequence of elements.

From here it is **preferentially** to use the approach concerning distribution of discharges which is based on possibility of the description of sequence of components of a transformants in the form of nonequilibrium positional number. In this time the received level of basic frames intensity is insufficient for delivery of a video stream in the conditions of support of the given quality of visual acceptability. It means that the purpose of article is the creation of methodological basis for representation of a transformant in enhanced nonequilibrium positional space.

Development of methodological basis for enhancement of coding of basic frames technology in nonequilibrium space

For lowering of intensity of code representation of a basic frame it is necessary to provide potential for an additional exception of structural redundance without introduction of additional distortions. We will consider the direction for additional elimination of structural redundance in the conditions of representation of a column of a transformant as a code value of nonequilibrium positional number. According to expression:

$$Q_{l,n} = \left[\log_2 \left(\prod_{k=1}^{n} d_{k,l} \right) - 1 \right] + 1,$$

reduction of quantity $Q_{l,n}$ discharges on representation of a code $E'_{l,n}$ possible due to lowering of values of the bases $d_{k,l}$ [5]. Values $d_{k,l}$ are created as values of dynamic range on intersection k-th line и l-th column. Therefore abbreviation of dynamic range can be reached due to reduction of dynamic ranges by the additional accounting of characteristic structural features of a transform of DCT.

For the organization of this approach it **is offered** to consider the following features of transforms in addition.

First, it that for transforms of DCT there is a tendency of change of structural characteristics in the **diagonal** direction. For reviewing of this structural regularity we will enter such designations:

1. We will designate a diagonal a with sequence number ξ as $\overline{Y}^{(\xi)}$. Thus quantity of ν_d diagonals depends on the sizes $(n \times n)$ of transformant and determined by a formula $\nu_d = n + (n-1) = 2n-1$. Respectively value of sequence number of a diagonal will change in repartitions $\xi = \overline{1, \nu_d}$.

2. We will enter concept of an initial element of a diagonal as which we will understand an element:

- $y_{1,l}$ with coordinates $(1; l)$ if conditions are correct: $k = 1$ & $l \le n$;
- $y_{k,n}$ with coordinates $(k; n)$ in a case, when $k \ge 2$ & $l = n$.

Then sequence number of a diagonal $\overline{Y}^{(\xi)}$ will depend on coordinates of an initial diagonal element as follows:

$$\xi = l \text{, if } k = 1 \text{ \& } l \le n;$$

$$\xi = n + k - 1 \text{, if } k \ge 2 \text{ \& } l = n.$$

There k-coordinate of components by the lines; l-coordinate of components by transformant columns.

3. Under a diagonal $\overline{Y}^{(\xi)}$ transforms with sequence number ξ we will understand the sequences of components created according to the following expressions:

$$\overline{Y}^{(\xi)} = \{ y_{1,\xi}; \dots y_{1+\tau,\xi-\tau}; \dots y_{\xi,1} \} \text{, where}$$

$$\tau = \overline{0, \xi-1} \text{, for } \xi \le n;$$

$$\overline{Y}^{(\xi)} = \overline{Y}^{(n+k-1)} = \{ y_{k,n}; \dots y_{k+\tau,n-\tau}; \dots y_{n,k} \},$$

where $\tau = \overline{0, 2n-\xi-1}$ for $\xi \ge n+1$.

There τ -the auxiliary variable used for listing of the elements belonging diagonals.

4. According to the principle of formation of a diagonal $\overline{Y}^{(\xi)}$ have uneven lengths n_ξ, equal:

$$n_\xi = \xi \text{, if } \xi \le n; \quad (1)$$

$$n_\xi = 2n - \xi = n - k \text{ if } \xi \ge n+1. \quad (2)$$

There k-coordinate of components by the lines, l-coordinate of components by transformant columns.

5. The terminal element of a diagonal will be the element with coordinates:

$$y_{1+\tau,\xi-\tau} \text{ for } \tau = n_\xi - 1 \text{, if } \xi \le n;$$

$$y_{k+\tau,n-\tau} \text{ for } \tau = n_\xi - 1 \text{, if } \xi \ge n+1.$$

In same time taking into account expressions (1) and (2) for length n_ξ diagonals we will receive that the terminal element will have the following coordinates:

$$1 + \tau = 1 + n_\xi = \xi \text{ ; } \xi - \tau = \xi - n_\xi = 1 \text{, if } \xi \le n;$$

$$k + \tau = k + n_\xi = n \text{ ; } n - \tau = n - n_\xi = k \text{, if } \xi \ge n+1.$$

It means that for ξ-th diagonals its initial and finite elements will have the symmetric coordinates, i.e. $y_{1,\xi}$ and $y_{\xi,1}$ or $y_{k,n}$ and $y_{n,k}$.

6. For formalization of positioning and a level of closeness of diagonals to the upper left corner of a transformant we will set the appropriate principle of their numbering. In this case it is offered to number diagonals since the diagonal located in the upper left corner and finishing with a diagonal in the lower right corner of a transform.

Now we will consider properties of diagonals of transforms of discrete cosine transform, namely:

1) the first property. Values of components decrease in case of bypass of a diagonal zigzag in the direction at the left — to the right. In this case component $y_{\alpha,\beta}$ belonging to diagonal $\overline{Y}^{(\omega)}$, located closer to the upper left corner of the transformant (i.e. having smaller sequence number), will have potentially smaller value, than an element $y_{\gamma,\phi}$, belonging to diagonal $\overline{Y}^{(\eta)}$, positioned at more remote distance from the upper left corner of the transformant. Such tendency can be described as follows:

$$y_{\alpha,\beta} < y_{\gamma,\phi}\text{, if } y_{\alpha,\beta} \in \overline{Y}^{(\omega)} \text{ and } y_{\gamma,\phi} \in \overline{Y}^{(\eta)},\ \omega < \eta;$$

2) the second property sets a tendency between values of components of one diagonal. For two elements $y_{\alpha,\beta}$ and $y_{\gamma,\phi}$, inhering to one diagonal, i.e $y_{\alpha,\beta} \in \overline{Y}^{(\omega)}$ and $y_{\gamma,\phi} \in \overline{Y}^{(\omega)}$, the inequality is executed:

$$y_{\alpha,\beta} < y_{\gamma,\phi}, \tag{3}$$

if conditions between coordinates of elements are satisfied $y_{\alpha,\beta}$ and $y_{\gamma,\phi}$:

- $u < \upsilon$, where $\alpha = 1+u$, $\beta=\xi-u$, $\gamma=1+\upsilon$, $\phi=\xi-\phi$ and $k = 1$ & $\xi \le n$;
- $u < \upsilon$, where $\alpha = \xi+u$, $\beta=n-u$, $\gamma=\xi+\upsilon$, $\phi=n-\phi$ and $\xi \ge 2$ & $\ell = n$.

3) the third property. For zigzag bypass in the diagonal direction in the field of high-frequency components appearance of the longest chains of components with null values is watched.

We will designate a chain of elements ξ-th diagonal, having null values as $\overline{Y}(0)^{(\xi)}$, and its length respectively — $n_0^{(\xi)}$.

Then the third property can be provided so:

Opportunity to watch existence of the diagonals which are completely consisting of elements with null values grows in a case of increase in its sequence number, i.e. in case of positioning of a diagonal is closer to the lower right corner of a transform.

It is set by the following ratio: $n_0^{(\xi)} \to n_\xi$ when $\xi \to \nu_d$ for $\xi \ge n+1$, where n_ξ — length ξ-th diagonal transformants; ν_d — maximum value of a transformant diagonal; n — the linear transformant size.

The revealed structural properties of diagonals of a transformant DCT allow to claim about existence of tendencies of relative change of values of dynamic ranges of their elements. For detection of such features **it is offered** to define dynamic ranges d'_ξ transformant diagonals as value range of its elements. It is set as follows:

$$d'_\xi = \max_{0 \le \tau \le \xi-1} \{y_{1+\tau,\xi-\tau}\}\text{, for } \xi \le n;$$

$$d'_\xi = \max_{0 \le \tau \le 2n-\xi-1} \{y_{k+\tau,n-\tau}\}\text{, for } k \ge 2 \text{ and } \xi \ge n+1.$$

We will generalize these ratios in one system taking into account expression for transformant diagonal length. As a result we will receive:

$$d'_\xi = \begin{cases} \max\limits_{0 \le \tau \le n_\xi - 1} \{y_{1+\tau,\xi-\tau}\}+1, & \to \xi \le n; \\ \max\limits_{0 \le \tau \le n_\xi - 1} \{y_{\xi-n+1+\tau,n-\tau}\}+1, & \to \xi \ge n+1. \end{cases} \tag{4}$$

As for a transformant property (3) concerning existence of a tendency between elements in one diagonal is typically, depending on the direction of zigzag bypass of a transform the following options of determination of dynamic ranges of diagonals are possible, namely:

1) if direction of bypass ξ-th diagonal begins with its initial element, value d'_ξ dynamic range will be determined by system of formulas:

$$d'_\xi = \begin{cases} \max\limits_{0 \le \tau \le n_\xi - 1} \{y_{1+\tau,\xi-\tau}\}+1 = y_{1,\xi}+1, \\ \to \xi \le n; \\ \max\limits_{0 \le \tau \le n_\xi - 1} \{y_{\xi-n+1+\tau,n-\tau}\}+1 = y_{\xi-n+1,n}+1, \\ \to \xi \ge n+1. \end{cases}$$

There $y_{1,\xi}$, $y_{\xi-n+1,n}$ — initial elements for ξ-th diagonal accordingly for cases where $k = 1$ & $\xi \le n$ and $\xi \ge 2$ & $\ell = n$;

2) if direction of bypass ξ-th diagonal comes to an end in its initial element, value d'_ξ dynamic range could be found by the following system of expressions:

$$d'_\xi = \begin{cases} \max\limits_{0 \le \tau \le n_\xi - 1} \{y_{1+\tau,\xi-\tau}\}+1 = y_{\xi,1}+1, \\ \to \xi \le n; \\ \max\limits_{0 \le \tau \le n_\xi - 1} \{y_{\xi-n+1+\tau,n-\tau}\}+1 = y_{n,\xi-n+1}+1, \\ \to \xi \ge n+1. \end{cases}$$

There $y_{\xi,1}$, $y_{n,\xi-n+1}$ — values, with which the direction of bypass begins ξ-th diagonals accordingly for cases $k = 1$ & $\xi \le n$ and $\xi \ge 2$ & $l = n$.

From the analysis it isn't difficult to note that option of coincidence of an initial element of the ξ-th diagonal from the beginning of its bypass takes place then, when ξ-even. On the contrary, when sequence number ξ diagonal odd, bypass of a diagonal comes to an end in its initial element.

According to what, we will enter signs of parity and parity of sequence numbers of diagonals, using the following conditions: ξ-even, if $\xi \bmod(2)=0$; ξ-odd, if $\xi \bmod(2)=1$.

Taking into account what the system of ratios (4) will assume the following form:

$$d'_\xi = \begin{cases} \max\limits_{0 \le \tau \le n_\xi - 1} \{y_{1+\tau,\xi-\tau}\} + 1 = y_{\xi,1} + 1, \\ \to \xi \bmod(2)=1 \ \& \ \xi \le n; \\ \max\limits_{0 \le \tau \le n_\xi - 1} \{y_{1+\tau,\xi-\tau}\} + 1 = y_{1,\xi} + 1, \\ \to \xi \bmod(2)=0 \ \& \ \xi \le n; \\ \max\limits_{0 \le \tau \le n_\xi - 1} \{y_{\xi-n+1+\tau,n-\tau}\} + 1 = y_{n,\xi-n+1} + 1, \\ \to \xi \bmod(2)=1 \ \& \ \xi \ge n+1; \\ \max\limits_{0 \le \tau \le n_\xi - 1} \{y_{\xi-n+1+\tau,n-\tau}\} + 1 = y_{\xi-n+1,n} + 1, \\ \to \xi \bmod(2)=0 \ \& \ \xi \ge n+1. \end{cases} \quad (5)$$

Then for dynamic ranges of diagonals of a transform the following tendencies will be typical, namely:

1) dynamic range d'_ω, appropriate to a diagonal $\overline{Y}^{(\omega)}$, having smaller sequence number, will have potentially bigger value, than dynamic range d'_η diagonal $\overline{Y}^{(\eta)}$, the transform positioned at more remote distance from the upper left corner, i.e.

$$d'_\omega > d'_\eta, \text{ if } \omega < \eta; \quad (6)$$

2) dynamic range d'_ξ потенциально in a bigger measure will be defined by values of elements $y_{\alpha,\beta}$ diagonal, coordinates $(\alpha;\beta)$ that meet conditions:

$$\alpha \to \xi,\ \beta \to 1, \text{ for } k = 1 \ \& \ \xi \le n; \quad (7)$$

$$\alpha \to n,\ \beta \to \xi, \text{ for } \xi \ge 2 \ \& \ l = n; \quad (8)$$

3) value of dynamic range d'_ξ appropriate to diagonals, in the field of high-frequency components of a transformants will aim potentially to 1, i.e.

$$d'_\xi \to 1, \text{ when } \xi \to \nu_d \text{ and } \xi \ge 2 \ \& \ l = n. \quad (9)$$

Definition. The approach concerning detection of dynamic ranges of a transformant in the direction of diagonals we will call ***a method of uneven-diagonal formation of dynamic ranges of transformants.***

If consider a transformant DCT as swap with reiterations with the specifications that given in a type of restrictions (6)–(9) on dynamic range, it is admissible to consider it as combinatorial object.

Definition. DCT transformant considered on uneven diagonal structure represents combinatorial object, namely swap with reiterations on dynamic ranges of elements restrictions according to formulas (6)–(9) — are imposed.

Quantity $\overline{V}^{(2)}_{n\times n}$ of such transformants is determined by a formula:

$$\overline{V}^{(2)}_{n\times n} = \begin{cases} \prod\limits_{\xi=1}^{\nu_d} (\max\limits_{0 \le \tau \le n_\xi - 1} \{y_{1+\tau,\xi-\tau}\} + 1)^{n_\xi}, \\ \to \xi \le n; \\ \prod\limits_{\xi=1}^{\nu_d} (\max\limits_{0 \le \tau \le n_\xi - 1} \{y_{\xi-n+1+\tau,n-\tau}\} + 1)^{n_\xi}, \\ \to \xi \ge n+1. \end{cases}$$

Accordingly quantity $\overline{Q}'^{(2)}_{n\times n}$ of information, on average containing in one element $y_{k,l}$, it is evaluated by a formula:

$$\overline{Q}'^{(2)}_{n\times n} = \left(\sum_{\xi=1}^{\nu_d} n_\xi \log_2 d'_\xi\right) / n \times n.$$

For comparing potentially of the reduced structural redundance on the basis of two approaches, namely the line and column method of detection of dynamic ranges of transformants and uneven-diagonal we will formulate and we will prove the following statement.

Statement (about comparing of dynamic ranges of the line and column and uneven-diagonal methods). For the condition (3) that setting a tendency of change of dynamic ranges $d'_{k,l}$ diagonals, the following inequality is executed:

$$d'_{k,l} < d_{k,l},$$

where $d'_{k,l}$, $d_{k,l}$ — values of dynamic ranges of a component $y_{k,\ell}$, calculated respectively for the line and column and uneven-diagonal methods..

Substantiation. According to that structural properties of a transformants tend to change in the direction of a diagonal zigzag, and considering property (3), we receive that dynamic ranges of diagonals will correspond to values of the components located either at the beginning of a diagonal, or in its end. This feature is set by system (5).

In such conditions dynamic ranges $d_{k,\ell}$ for the line and column diagram of their detection will correspond to the values of components of transformants that located or in its first line $Y^{(1)} = \{y_{1,1}, \ldots, y_{1,\ell}, \ldots, y_{1,n}\}$ or in its first column $Y^{(1)} = \{y_{1,1}, \ldots, y_{k,1}, \ldots, y_{n,1}\}$.

By determining the value $d_{k,l}$ the line and column method is as the minimum value from two maxima in k-th line d_k and l-th column d_l. In same time and among components k-th line and amoung components of l-th column with elements that belonging to diagonals with smaller sequence number, will be elements $y_{k,1} \in \overline{Y}^{(k)}$ and $y_{1,\ell} \in \overline{Y}^{(\ell)}$. In other words the smallest sequence number of a diagonal containing components *k*-th line equal $\xi = k$. Accordingly the smallest sequence number of the diagonals including components *l*-th column will be equal $\xi = l$. But then, according to properties of dynamic ranges of diagonals of value of elements $y_{k,1}$ and $y_{1,l}$ will be maximum among elements respectively in *k*-th line and in *l*-th column , i.e.

$$\max\{y_{k,1},...,y_{k,l},...,y_{k,n}\} + 1 = d'_k = y_{k,1} + 1 ;$$

$$\max\{y_{1,l},...,y_{k,l},...,y_{n,l}\} + 1 = d'_l = y_{1,l} + 1 .$$

Thus we note that these elements belong according to the first line and the first column of a transformant.

Now we will define dynamic range $d_{k,l}$ as minimum from two maxima d_k and d_l. Here it is required to find cases when $d_k > d_l$ and $d_k < d_l$. For this purpose it is necessary to define sequence number and the direction of the appropriate diagonals, i.e. the diagonals containing an element $y_{k,1}$ and $y_{1,l}$. Here it is required to analyze values of coordinate on *k*-th line and on *l*-th column. Then, if the inequality is executed $k \neq l$, that such cases are possible:

a) when $k > l$. For such option diagonal $\overline{Y}^{(k)}$, containing an element $y_{k,1}$ will have bigger sequence number, than a diagonal $\overline{Y}^{(l)}$, containing an element $y_{1,l}$. From here on property of dynamic ranges of diagonals, we will receive that $y_{k,1} < y_{1,l}$, and consequently, dynamic range $d_{k,l}$ element $y_{k,l}$ on line-column method it will be equal $d_{k,l} = y_{k,1} + 1$;

b) on the contrary when $k < l$, diagonal $\overline{Y}^{(k)}$, containing an element $y_{k,1}$ will have smaller sequence number, than a diagonal $\overline{Y}^{(\ell)}$, containing an element $y_{k,l}$. Therefore the inequality will be executed $y_{k,1} > y_{1,l}$, and dynamic range $d_{k,l}$ element $y_{k,l}$ by line-column method it will be equal $d_{k,l} = y_{1,l} + 1$.

In that case when the condition is satisfied $k = l$, components $y_{k,l}$ are the central components of a transformants. Then components $y_{k,1}$ и $y_{1,l}$ corresponding to the first column and the first line of a transform will have the symmetric coordinates. Therefore, on properties of diagonals of a component $y_{k,1}$ and $y_{1,l}$ are according to initial and finite elements of one diagonal.

For such option determination of dynamic range of a component $y_{k,l}$ is defined with the direction of bypass of the appropriate diagonal.

If value of coordinate l is even, the diagonal with sequence number equal l and initial element $y_{1,l}$ will have equal number.

Its beginning of bypass will match an initial element with coordinates $y_{1,l}$.

Then according to properties of dynamic ranges of diagonals the condition is satisfied $y_{1,l} > y_{k,1}$ and $d_{k,l} = y_{k,1} + 1$.

On the contrary, if value of coordinate l is odd, l-th the diagonal will have odd number. Then an element $y_{1,l}$ its bypass will come to the end. The condition will be satisfied then $y_{1,l} < y_{k,1}$ and $d_{k,l} = y_{1,l} + 1$.

By generalizing all conditions, we will receive the following system:

$$d_{k,l} = \begin{cases} y_{k,1} + 1, \rightarrow (k \neq l;\ k > l)\& \\ \&\ (k = l;\ l \bmod(2) = 0); \\ y_{1,l} + 1, \rightarrow (k \neq l;\ k < l)\& \\ \&\ (k = l;\ l \bmod(2) = 1). \end{cases} \qquad (10)$$

We will prove the second part of the statement concerning comparing with dynamic ranges of different methods of formation now.

For this purpose it is necessary to compare dynamic ranges $d'_{k,l}$ and $d_{k,l}$.

Dynamic range of $d'_{k,l}$ component $y_{k,l}$, considered as a diagonal element, will be defined depending on sequence number of a diagonal and the direction of its bypass.

For this purpose we will define sequence number ξ for a diagonal which contains an element $y_{k,l}$ with coordinates $(k;l)$.

According to properties of coordinates of the elements belonging ξ-th diagonal we will receive $1+\tau = k$ and $\xi - \tau = l$.

From where after conversion we will receive such ratios: $\tau = k-1$; $\xi = l + \tau$.

Having described value ξ relativly τ, we will get $\xi = l + \tau = l + k - 1$.

It means that a component $y_{k,l}$ will belong diagonals with sequence number $(l+k-1)$, i.e. $y_{k,l} \in \overline{Y}^{(\xi)} = \overline{Y}^{(l+k-1)}$. In this case dynamic range $d'_{k,l}$, created by the uneven-diagonal principle will decide on the help of the following system of expressions:

$$d'_{k,\ell} = d'_{\xi} = d'_{k+l-1} = \begin{cases} y_{k+l-1,1}, \rightarrow (k+l-1)\,\mathrm{mod}(2) = \\ =1 \; \& \; \xi \le n; \\ y_{1,k+l-1}, \rightarrow (k+l-1)\,\mathrm{mod}(2) = \\ =0 \; \& \; \xi \le n; \\ y_{k+l-n,n}, \rightarrow (k+l-1)\,\mathrm{mod}(2) = \\ =0 \; \& \; \xi > n; \\ y_{n,k+l-n}, \rightarrow (k+l-1)\,\mathrm{mod}(2) = \\ =1 \; \& \; \xi > n. \end{cases} \quad (11)$$

From where (10) and (11) follows from comparing of systems of ratios that:

$$y_{k,1} + 1 > y_{k+l-1,1}; \; y_{k,1} + 1 > y_{1,k+l-1};$$

$$y_{k,1} + 1 > y_{k+l-n,n}; \; y_{k,1} + 1 > y_{n,k+l-n};$$

$$y_{1,l} + 1 > y_{k+l-1,1}; \; y_{1,l} + 1 > y_{1,k+l-1};$$

$$y_{1,l} + 1 > y_{k+l-n,n}; \; y_{1,l} + 1 > y_{n,k+l-n}.$$

It is caused by that diagonals with numbers k and l will have bigger dynamic range, than diagonals with big number $(k+l-1)$.

Conclusions

1. It is developed a method of ***nonequilibrium positional uneven-diagonal basis*** that based on on the basis of detection of dynamic ranges for separate non-uniform diagonals depending on their sequence number and the direction a zigzag bypass.

It allows to consider existence of tendencies of rather structural characteristics of a transformants of DCT in the diagonal direction, namely that: values of components decrease in case of bypass of a diagonal zigzag in the direction at the left — to the right; for zigzag bypass in the diagonal direction in the field of high-frequency components appearance of the longest chains of components with null values is watched.

2. The model of an assessment of informtiveness of a transform from the scientist of is created that DCT transformant, is considered by uneven-diagonal structure, and represents combinatorial object, namely swap with repetitions on which dynamic ranges of elements restrictions are imposed. It is justified that in the conditions of existence of a tendency in change of properties of a transform in the diagonal direction for a non-uniform and diagonal method of detection of dynamic ranges the potential of rather additional elimination of structural redundance in images is provided.

Scientific novelty. For the first time concerning a method of formation of base of the bases by uneven-diagonal principle. Difference that the bases for a transform come to light for diagonals on zigzag bypass taking into account existence of high-frequency spectrum components. It allows to reduce in addition amount of structural redundance of the transformed representation of a fragment of basic frames.

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