

# Perforated with Technology of Description Massives Differential Representation in Delivery Compressed Images Systems

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**Abstract** – The analysis of the minimum time to transmit video information. As a result, we show that for current and future aerospace monitoring systems using on-board telecommunications video delivery time up to several tens of minutes. This leads to the obsolescence of the information obtained, and the belated adoption of wrong decisions. It is proved that for solving this problem, we propose to use video compression technology. We justify the fact that the representation of an array of the perforation upper level elements in the differential polyadic space provides an additional reduction of combinatorial redundancy. It is shown that to avoid the disadvantages associated with a decrease in the lower limit of the differential polyadic space required for perforating technology further consider the binary mask wavelet elements of the upper and lower levels. Outlines the development of differentiated image compression method for increasing the availability of video data, which is based on the following technology solutions: derivation of images fragments on a combined scheme, the organization perforation arrays in a two-dimensional representation of the differential polyadic space, mask-dimensional block coding scheme.

## I. INTRODUCTION

The effectiveness of the strategic sectors depends on the security of information. Security of information is defined by three categories, namely: availability, integrity and confidentiality. The special value of the first two categories of particularly critical in the case of a decision on the timeliness and accuracy of the information. Special problems arise when the quality and accuracy of the solution depends on national issues. One such area is the prevention and elimination of emergency situations (ES). In this case, decisions must be made in real time and the delay before starting operation, emergency response should not exceed 10 minutes. This imposes strict requirements on availability of information. On the other hand the greatest complexities appear when want to use the sources of video

information. In such a situation, when the bandwidth of wireless communication channels are limited, unavoidable delays in delivery of information [1]. To solve the problem using existing image compression technology [2, 3]. At the same time, existing compression technologies typical drawbacks. Image compression is achieved by delaying the processing time and making distortion. Which in turn increases the risk of loss of data integrity. Therefore, research topics related to the advancement of technology compact representation of video data is relevant.

As shown in [4, 5] direction of solving this problem is the combined use of a preliminary step the various mechanisms image conversion including differential representation. Effective option for further treatment approach is based on perforations of differential representation arrays (DRA) in polyadic space. Then, to further reduce the amount of compressed image by identifying the elements of the DRA, which have a high dynamic range is provided as a result of perforation. The point is that the perforations in the original array differential representation  $H = \{h'_{k\ell}\}$  is divided into two components, depending on the value  $d_{k\ell}$  belonging to one of two levels and the dynamic range of the DR array,  $H \xrightarrow{K(h')_{nop}} \{H^{(0)}; H^{(1)}\}$ , wherein  $H = \{h'_{k\ell}\}$ ,  $H^{(1)}$  - the array of discrete elements comprise converting the upper and lower perforated layers. Then a further decline in the compressed image by identifying the elements of the DRA, which have a high dynamic range is achieved as a result of perforation ( $K(h')_{nop}$ ). Building a perforation of the differential representation of arrays are combined approach. This results to the formation of at least a binary representation of the structure of the differential dynamic range of the array. Consequently polyadic code structure formed without perforation dynamic range possess structural redundancy. Hence, the aim is to improve the image compression technology based on the space transforms a polyadic coding.

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## II. THE MAIN PART OF INVESTIGATION

In [4, 5] proposed to increase the compression array is divided into two components, depending on one of two levels of the dynamic range, i.e. proposed to carry out the perforation of the differential representation of arrays (DRA). Then, to eliminate the lack of a large dynamic range of individual elements of the DRA is recommended to consider the properties constituting  $H^{(1)}$  the perforation of the upper level, consisting in the fact that:

- an array of top range of perforated presentation contains elements that are equal in value to an element contour images or the value of the basic background;
- the dynamic range of contour values and the values of the basic background images have a uniform structure.

Given these features you can go to the description of the differential representation of top-level perforation component [3, 4]. Where code-array number  $H^{(1)}$  will be determined by how the code array of polyadic numbers corresponding to the minimum level  $M^{(2)}$  of the differential space (fig. 1).

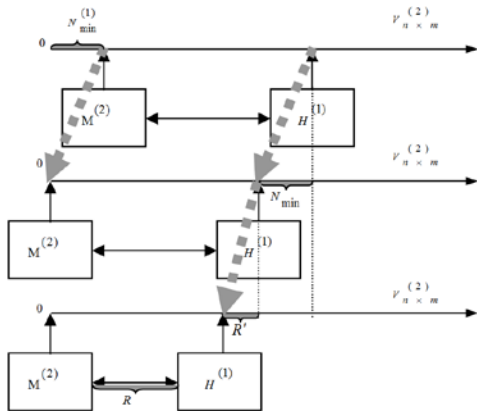


Fig. 1. Schematic of the formation of two-dimensional elements of the differential non-equilibrium position number

The minimum value of the vector formed in rows  $M = \{\mu_1, \dots, \mu_m\}$ . Where the value  $\mu_i$  is determined as a minimum value in the  $i$ -th row of the array  $H^{(1)}$ , i.e.  $\mu_i = \min_{1 \leq j \leq n} \{h_{ij}^{(1)}\}$ ,  $i = \overline{1, m}$ .

This allows you to move from the original of dynamic range of the array  $H^{(1)}$  to reduced dynamic range described by vector  $S$  constraints, i.e.  $S = \{s_{1j}, \dots, s_{nj}\}$ . Here  $s_{ij}$  – the difference between the maximum  $d_{ij}^{(1)}$  and minimal  $\mu_i$  value in  $i$ -th row of an array  $H^{(1)}$  the perforating of the upper level, i.e.

$$s_{ij} = d_{ij}^{(1)} - \mu_i. \quad (1)$$

In view of (1) we obtain the following range the perforating of the upper level

$$\mu_i \leq h_{ij}^{(1)} \leq d_{ij}^{(1)} - 1, \quad i = \overline{1, m}, \quad j = \overline{1, n^{(1)}}, \quad (2)$$

where  $n^{(1)}$  – the number of columns in the array  $H^{(1)}$ .

The lower level  $M^{(2)}$  the differential two-dimensional space is determined based on the values of the vector  $M = \{\mu_1, \dots, \mu_m\}$  and is polyadic number, the elements of which satisfy the constraints on dynamic range of the upper level of the perforating.

Given the constraints (1) and (2) the value of the code-number as the length of the distance  $R$  between the current array  $H^{(1)}$  and the lower level  $M^{(2)}$  two-dimensional polyadic of the number is determined by the formula

$$R = \sum_{i=1}^m \sum_{j=1}^{n^{(1)}} (h_{ij}^{(1)} - \mu_i) \prod_{\xi=j+1}^{n^{(1)}} s_{i\xi} \prod_{\gamma=i+1}^m \prod_{\xi=1}^{n^{(1)}} s_{\gamma\xi}. \quad (3)$$

Let us show that the consideration of the array  $H^{(1)}$  the two-dimensional differential polyadic the space of allows to reduce the interpretation thereof code-number relative to the original case. For that us justify that between the code-number  $R$  as length distance in the differential polyadic space and source code-number of  $N^{(1)}$  the inequality

$$R \leq N^{(1)}. \quad (4)$$

The value of the code-number  $N^{(1)}$  in the source polyadic space is equal to

$N^{(1)} = \sum_{i=1}^m \sum_{j=1}^{n^{(1)}} h_{ij}^{(1)} \prod_{\xi=j+1}^{n^{(1)}} d_{i\xi}^{(1)} \prod_{\gamma=i+1}^m \prod_{\xi=1}^{n^{(1)}} d_{\gamma\xi}^{(1)}$ . We write the equation (3) taking into account formula (1), and we obtain

$$R = \sum_{i=1}^m \sum_{j=1}^{n^{(1)}} (h_{ij}^{(1)} - \mu_i) \prod_{\xi=j+1}^{n^{(1)}} (d_{i\xi}^{(1)} - \mu_i) \prod_{\gamma=i+1}^m \prod_{\xi=1}^{n^{(1)}} (d_{\gamma\xi}^{(1)} - \mu_\gamma), \quad (5)$$

In view then obtain the inequality (4).

We now prove that the code of number in the differential polyadic the space of will be less than the difference between the code-number polyadic of the number and the code-number of the lower level in the source perforated space, i.e.

$$R \leq N^{(1)} - N_{\min}^{(1)}. \quad (6)$$

where  $N_{\min}^{(1)}$  – value of the code-number PPN  $M^{(2)}$ , which is the the lower level of the two-dimensional the differential polyadic space.

Really. We write the left side of (6) and we obtain

$$N^{(1)} - N_{\min}^{(1)} = \sum_{i=1}^m \sum_{j=1}^{n^{(1)}} h_{ij}^{(1)} \prod_{\xi=j+1}^{n^{(1)}} d_{i\xi}^{(1)} \prod_{\gamma=i+1}^m \prod_{\xi=1}^{n^{(1)}} d_{\gamma\xi}^{(1)} - \sum_{i=1}^m \sum_{j=1}^{n^{(1)}} \mu_i \prod_{\xi=j+1}^{n^{(1)}} d_{i\xi}^{(1)} \prod_{\gamma=i+1}^m \prod_{\xi=1}^{n^{(1)}} d_{\gamma\xi}^{(1)} = \sum_{i=1}^m \sum_{j=1}^{n^{(1)}} (h_{ij}^{(1)} - \mu_i) \prod_{\xi=j+1}^{n^{(1)}} d_{i\xi}^{(1)} \prod_{\gamma=i+1}^m \prod_{\xi=1}^{n^{(1)}} d_{\gamma\xi}^{(1)}. \quad (7)$$

Whence comparing the right-hand side of (5) and (7) obtain the inequality (6).

Fulfillment of inequality (6) leads to a conclusion as to what to of elements of the array representation of the upper level of the perforating in the differential polyadic the space of provides an additional reduction of combinatorial redundancy.

The total number of  $R^{(2)}$  positional number admissible in the differential nonequilibrium the space of defined by the formula

$$R^{(2)} = \prod_{i=1}^m \prod_{j=1}^{n^{(1)}} (d_{ij}^{(1)} - \mu_i). \quad (8)$$

Equation (8) determines the number of combinatorial redundancy, which could potentially be reduced by the perforating of the upper representation level array differential polyadic space.

For the separation of two constituting the DRA is used threshold perforation. In [4, 5] to estimate the threshold of perforation are encouraged to use

$$K(h')_{nop} = \left( \sum_{k=1}^m \sum_{\ell=1}^n d_{k\ell} \right) / mn, \quad (9)$$

where  $d^{(u)}$  – importance of the foundation of number polyadic to  $u$ -th a level of dynamic range;  $v_u$  – number of bases polyadic of number, owned  $u$ -th level of dynamic range;  $U$  – the number of levels of dynamic range.

At the same time a perforation array option of a differential representation leads to the existence of the following drawbacks. Cases are possible when the dynamic range of the element  $h'_{k\ell}$  an array of the differential representation will be above the threshold perforation  $K(h')_{nop}$ , i.e.  $d_{k\ell} > K(h')_{nop}$ . But, on the other side the value itself will be the element below the threshold value, i.e.  $h'_{k\ell} < K(h')_{nop}$ . This situation is possible when

maximum values at the intersection of string  $d_k$  and columns  $d_\ell$  have significantly higher values relative to the value  $h'_{k\ell}$ , i.e.  $h'_{k\ell} \lll \max_{1 \leq \xi \leq n} \{h'_{k\xi}\} = d_k - 1$  or  $h'_{k\ell} \lll \max_{1 \leq u \leq m} \{h'_{u\ell}\} = d_\ell - 1$ . Such a situation leads to

the fact that a minimal boundary in the upper perforation array level will decline down to zero level. This leads the fact that the potential number of combinatorial reduced redundancy.

For exclusion disadvantages of the proposed conduct perforating an array of the differential representation with an additional view of the binary mask  $P^{(2)}$ , singles out the items for which both of the following conditions):  $d_{k\ell} > K(h')_{nop}$  and  $h'_{k\ell} < K(h')_{nop}$ . Then the if for array element the differential representation the condition (9), at the corresponding position in the mask will be standing unit of. Conversely, if even one of the inequalities (8) is not satisfied, then the corresponding position in the mask will stand zero.

Consequently, the content of mask  $P^{(2)}$  is given as follows:

$$P_{k\ell} = \begin{cases} 0, & \rightarrow d_{k\ell} \leq K(h')_{nop} \vee h'_{k\ell} \geq K(h')_{nop}; \\ 1, & \rightarrow d_{k\ell} > K(h')_{nop} \ \& \ h'_{k\ell} < K(h')_{nop}, \end{cases}$$

where  $p_{k\ell}$  – mask element  $P^{(2)}$  at position  $(k; \ell)$ .

Availability such a mask enables array elements detect the upper perforating the level which results in decrease the degree of compression. Is suggested to elements of the array the differential representation, for which is equal to unity element of the mask, leave in an array of the lower level perforation with base  $K(h')_{nop}$ . Then the dynamic range  $d_{k\ell}^{(0)}$  the lower level array elements of perforating following system:

$$d_{k\ell}^{(0)} = \begin{cases} d_{k\ell}, & \rightarrow p_{k\ell} = 0; \\ K(h')_{nop}, & \rightarrow p_{k\ell} = 1. \end{cases}$$

Such transformations will: on the one hand increase the low the differential polyadic perforating the upper space of the array level, on the other side lower dynamic range of the masked the array elements of the lower level perforating. After all, the original value of dynamic range  $d_{k\ell}$  an array of the upper-level perforating of perforation condition exceeds the value a threshold, i.e.  $d_{k\ell} > K(h')_{nop}$ .

Amount  $V^{(0)}$  polyadic numbers for an of the lower level perforating array with the masked by elements is defined as

$$V^{(0)} = (K(h')_{nop})^v \prod_{i=1}^{m'} \prod_{j=1}^{n'} d_{ij}^{(0)}.$$

Here  $v$  – number of masked by elements,  $m'$ ,  $n'$  – perforating of the lower level array except for masked by elements.

From the analysis of the expression can be concluded that the number of valid polyadic numbers taking into account features dynamic range of camouflage of elements will be lower than without such accounting. Ultimately this will lead to an increase in the degree of compression the differential representation array.

### III. CONCLUSIONS

1. It is proved that the representation of the array elements of the top level perforating in the differential polyadic the space of provides an additional reduction of combinatorial redundancy caused by:

- reduction in of dynamic range perforating of the upper-level elements by identifying the minimum values;
- reduction of the number of polyadic numbers preceding the current number, but do not satisfy the condition the differential space.

2. To reduce the dynamic range of the differential representation arrays we demonstrate the use their perforating into two components, depending on the dynamic range of accessories one of the levels elements.

3. For exclusion limitations associated with lowering the lower bound the differential polyadic of the space substantiates and being developed an array of perforating technology with an additional the differential representation based binary mask. Such transformations will: on the one hand increase the low the differential polyadic perforating

the upper space of the array level, on the other side lower dynamic range of masked by the array elements of the lower level perforating.

4. It is proved that as a result of a one-dimensional polyadic coding block diagram shrinking a combinatorial redundancy caused on the one hand correlated areas of the images, on the other hand - the presence of a small objects limited number.

#### IV. REFERENCES

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