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Research Article

Information compression using a system of deferential equations

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Summary:
The author replaces the linear equation in n-dimensional space with a system of differential equations with constant coefficient.

1. Introduction

The data compression problem remains the topical issue in the aspect of the constant
Increase in the number of information with fixed bandwidth. P. Wróblewski [1] distinguishes the following compression methods:
1. RLE method
2. Hoffman's method
3. Coding, by the way, LZW (GIF form)
4. Mathematical modeling

Encoding [1] is an algorithm in which many of the same characters repeated in a row. Hoffmana compression [1] belongs to the prefix algorithm.
LZW coding [1] based on the use of a dictionary in which frequently repeated pattern is stored. GIF graphic format based on the coding of LZW [1].
Compression using mathematical modeling involves [1] replacing the data string with the parameters of a mathematical model that approximates this model.
All these methods currently used to simplify calculation.
In this work, the mathematical modeling method used, which consists of constructing a linear equation in multidimensional space, using a system of differential equation with constant coefficients [2].
Such a system solved by an analogue machine or computer program may be used [3]. Also, the sparse matrix method recently reported in the literature [4], [5], [6] in the form of Y=FX (where Y-measures, F-transformation matrix, X-input). Matrix F has many zero elements here, which simplifies calculations [6].
Instead of matrix F, my work based on the principle of data transformation through a system of differential equations.

2. Line and systems of differential equation

Let's assume we have a line in n-dimensional space in the parametric form it means:
$(x_1(t), x_2(t), \ldots, x_n(t))$ **where t is a parameter. Such a line can be solution differential equations on form:**

$$x_i'(t) = a_{i,i}x_i(t) + \sum_{j=1,j\neq i}^{n} a_{i,j}x_j(t) + \sum_{j=1,j\neq i}^{n} e^{\alpha_j(t-t_0)}, i = 1, ..., n \tag{1}$$

The form of such a line is

$$x_i(t) = C_i e^{\alpha_i(t-t_0)} \tag{2}$$

With the initial condition $x_i(t_0) = x_{i,0}$. Hence we will receive $C_i = x_{i,0}$. Inserting equation (2) into the system of differential equations (1) we will receive the following condition:

$$\alpha_i = a_{i,i}, i = 1, 2, ..., n \tag{3}$$

and

$$a_{i,j}C_j = -1, i = 1, 2, ..., n, j = 1, 2, ..., n, j \neq i \tag{4}$$

From the above line equation in multidimensional space is clear that it is a possibility of modelling systems of differential equations. Thanks to that the amount of information reduced.

3. Algorithm and its complexity

The above algorithm for converting the line equation into a system of differential equation is as follows:
1. we replace given lines with exponential curves.
2. Knowing α_i **for $i = 1, 2, \dots, n$ we set coefficients $a_{i,i}$**
3.knowing the zero conditions from formula (4), we determine the coefficient $a_{i,j}$
4.we repeat the above procedure for the next zero places. The complexity of the above algorithm is small. Equations (3) and (4) are primary.

4. Conclusion

This paper presents a new method of information compression using a simple algorithm.
This algorithm belongs to the group of mathematical modelling and based on the conversion of line equations into a system of differential equations with constant coefficients.

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