VISUAL SEARCHING AND COMPRESSION

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Резюме: В статията се разглежда модификация на компресиращия алгоритъм RLE, който се използва за сравнение при търсенето на подобни изображения. Резултатите от него са сравнени с приблизителното търсене в Google, а също и с мнения на хора.
Ключови думи: RLE, визуално търсене, компресиране

Abstract: An interesting modification of the Run-length encoding algorithm is used in the current article. The experiments using the algorithm, the Google's CBIR and people's oppinion of similarities are being done.
Keywords: RLE, VIR, visual search, compression, HCI

Резюме: Интересная модификация Run-length encoding алгоритма используется в данной работе. Делаются эксперименты на сходство, используя алгоритм, CBIR Google и мнения людей.
Ключевые слова: RLE, визуальный поиск, сжатие

There are a number of productive ways to connect DNA and visualization. A lot of coding schemes based on number four exist, for example Quaternary[1] (four-based method for counting), the CMYK color model used in printing, or the four-color problem. An interesting scheme of representing DNA sequences as

[1] http://mathworld.wolfram.com/Quaternary.html.

sequence logos[2] and also some graphical representations of proofs exists (Meyer 1982). According to Cross, in the area of design research there are four components called “four stages in the evolution of design process”: prescription of an ideal design process; description of the intristic nature of design problems; observation of the reality of design activity and reflection on the fundamental concepts of design (Cross, 1983).

Lew mentions some major research challenges of particular importance to the MIR research community. They are:

- Semantic search with emphasis on the detection of concepts in media with complex backgrounds;
- Multi-modal analysis and retrieval algorithms especially towards exploiting the synergy between the various media including text and context information;
- Experiential multimedia exploration systems toward allowing users to gain insight and explore media collections;
- Interactive search, emergent semantics, or relevance feedback systems;
- Evaluation with emphasis on representative test sets and usage patterns.

Nowadays is quite important the area of Visual image retrieval research. A lot of tools have been developed. Some of them are using content-based image retrieval (CBIR), also known as query by image content (QBIC) and content-based visual information retrieval (CBVIR). This is the application of computer vision

[2] http://weblogo.berkeley.edu/.

techniques to the image retrieval problem, that is, the problem of searching for digital images in large databases (Lew, 2006).

A lot of algorithms for compression also exists. Some of them like Pigpen Cipher is a geometric simple substitution cipher which exchanges letters for symbols which are fragments of a grid. Another one that is in close relationships with our study is the RLE (Run-length encoding).

Run-length encoding is a data compression algorithm that is supported by most bitmap file formats such as TIFF, BMP, and PCX. RLE is suited for compressing any type of data regardless of its information content, but the content of the data will affect the compression ratio achieved by RLE. Although most RLE algorithms cannot achieve the high compression ratios of the more advanced compression methods, RLE is both easy to implement and quick to execute, making it a good alternative to either using a complex compression algorithm or leaving your image data uncompressed (Murray, 1996).

RLE works by reducing the physical size of a repeating string of characters. This repeating string, called a run, is typically encoded into two bytes. The first byte represents the number of characters in the run and is called run count. In practice, an encoded run may contain 1 to 128 or 256 characters; the run count usually contains as the number of characters minus one (a value in the range of 0 to 127 or 255). The second byte is the value of the character in the run, which is in the range of 0 to 255, and is called the run value.

Uncompressed, a character run of 15 A characters would normally require 15 bytes to store: AAAAAAAAAAAAAAA. The same string after RLE encoding would require only two bytes: 15A.

An interesting modification of the Run-length encoding (RLE) algorithm is used in the current paper. For example, when encoding a sequence containing exactly two different values, e.g. ‘AAABBBBA’, it will not be encoded as ‘3A 4B 1A’ (which would mean ‘*three times A, four times B, once A’*), but as ‘3 4 1’ *(‘three times the first value, four times the second value, once the first value’*). Note that BBBA would be encoded as ‘0 3 1’, because there are zero As before Bs. Thus, the compression size is reduced even more, as the result contains only numbers.

There are three RLE-based methods used in the paper. The naïve method compares the two images pixel by pixel. The Lightness-based RLE method first defines every pixel as a light or dark one by the HSL (Hue-Saturation-Lightness) standard and then compares the images. The Brightness-based RLE method defines every pixel as a bright or pale by the Rec. 601 standard and then compares the two images.

The images for the study are from the South California University standard image dataset. They are searched with the Search by image option of Google images and the top 5 results are taken into account. Then, all the images are turned into 8-bit .bmp images.

The task of the current study is to arrange the five top-result images in order from the most to the least alike image. The results from the three RLE-based methods are compared to one another and to a CBIR search engine. The opinion of 24 people is considered as well.

Two types of matches are considered – exact matches (for two methods, the same image is at the same position) and approximate (the two positions of the image differ by one).

Table 1 First experiment

	1st	2nd	3rd	4th	5th
Google Images					
LISH					
Naïve					
Lightness-based					
Brightness-based					

The naïve method is the best one, with two exact and three approximate matches. This is mainly because of the various colors in the images leading to difficulties in compression-based similarity measurement.

Table 2 Second experiment

	1st	2nd	3rd	4th	5th
Google Images					
LISH					
Naïve					
Lightness-based					
Brightness-based					

The Google images and people's opinion match exactly. Although the naïve method gives the best results in the first experiment, it gives the worst results in the second one. Thus, it is considered as an unstable method. The Lightness-based RLE method has 5 exact matches, which makes it good for recognizing similarity in images with plain background. The Brightness-based method gives more approximate than exact matches in both cases.

Table 3

	Google Images				**LISH**			
	exact		approximate		exact		approximate	
Naïve	3	0	2	1	0	0	2	1
Lightness- based	0	5	1	0	0	5	1	0
Brightness-based	0	1	1	2	0	1	3	2

The experiments suchlike are considered quite important in the area of Visual information retrieval (VIR) and Human computer interactions (HCI) in order to find tools helping to fill the semantic gap at the area of VIR research.

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