A DIGITAL DATABASE TEXT COMPRESSION SCHEME

SUSHIL KUMAR[*]

SARITA S. BHADAURIA[**]

ROOPAM GUPTA[***]

ABSTRACT

In this paper we investigate that for experimental result shows the proposed scheme provides significant improvement in compression efficiencies. The main proposal of this paper is to reduce the memory space and the transmission time. We will also produce an experimental result which shows that our technique achieves good compression ratios. Reduction of compression ratio collection of large amount of data in almost all application is very important. In today's era without computer application one can never thinks of database. Whenever database comes compression plays very important role. Application may be stock exchange, banking, reservations in almost every field compression becomes primary things. With the help of compression one can make very big data in very less memory space. Disc input and output performance has bottleneck for very large databases. Database compression can be used to reduce disk input output bandwidth requirements for very big amount of data transfers. The authors explores and propose techniques managing the compressed database such that standard operations like retrievals, inserts, deletes and modifications are supported.

Kewords: Compression, Compression Ratio, Delta code, Differential Method, Fixed Length Coding (FLC), Huffman after using Fixed Length Code (HFLC), Lossy Compression, Nonlossy Compression, RLE (Run Length Encoding), Temporal Database, LZW (Lampel Ziv Welch).

[*] Professor & Head, Department of Computer Science and Engineering, Lakshmi Narayan College of Technology, Kalchuri nagar, Raysen Road, Bhopal (M.P.), India

[**] Professor & Head, Department of Electronics & Communication Engg., MITS, Gwalior (M.P.), India

[***] Professor & Head, Department of Information Technology, UIT, RGPV, Bhopal (M.P.), India

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1. INTRODUCTION

DATA Compression can be viewed as a means for efficient representation of a digital source of data such as text, image, sound or any combination of all these types such as video. The final goal of data compression is to represent a source in digital form with as few bits as possible while getting the minimum requirement of reconstruction of the original.
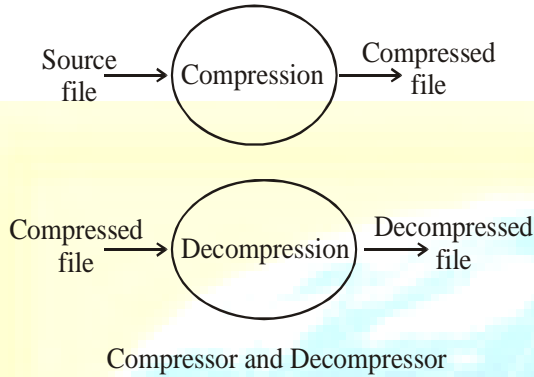

Compressor and Decompressor

Fig. (1)

Any compression will not work unless a means of decompression is also provided due to the nature of data compression.
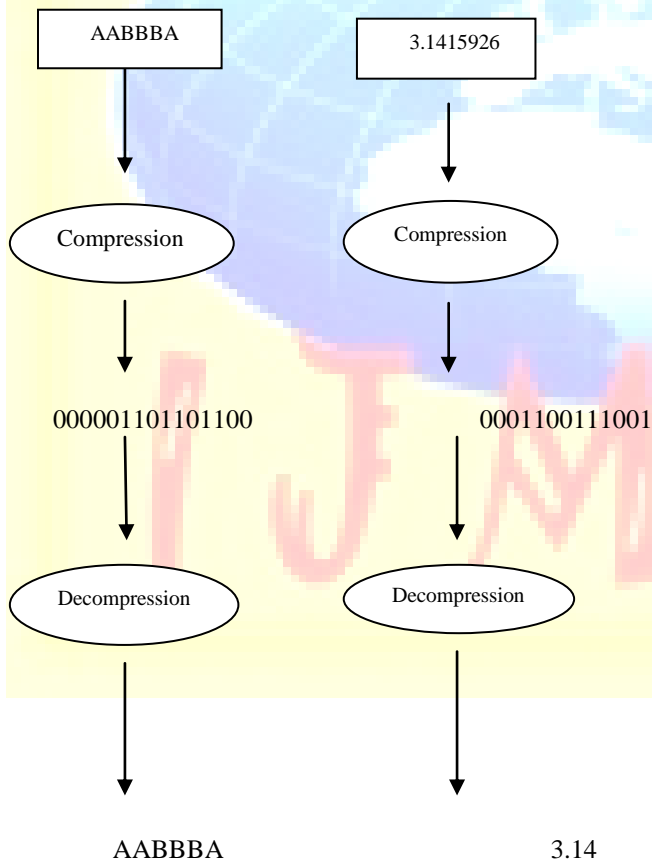

Decoded message
Coder and Decoder

Fig. (2)

A compression algorithm is often called compressor and the decompression algorithm is called de-compressor. The compressor and de-compressor can be located at two ends of a communication channel, [1] at the source and at the destination respectively as shown in fig.(1) also known as coder and decompression as decoder as shown in fig.(2).

There are two major families of compression technique; they are called lossless and lossy compression. A compression is lossless only if it is possible to get exactly original data from the compressed version. There is no loss of information during the compression process. Fig. (3) will give the exact idea about lossless compression. Lossless compression is used when the original data of a source are so important that one cannot afford to lose any data, for example medical images.

A compression technique is lossy if it is not possible to reconstruct the original exactly from the compressed version. Lossy compression is called irreversible compression since it is impossible to recover the original data exactly by decompression. Fig. (4) shows one of the major used examples of lossy compression.

```
   AABBBA                      3.1415926

      |                            |
      v                            v

  Compression                 Compression

      |                            |
      v                            v

000001101101100             0001100111001

      |                            |
      v                            v

 Decompression               Decompression

      |                            |
      v                            v

   AABBBA                        3.14


 Lossless Compression       Lossy Compression

      Fig. (3)                   Fig. (4)
```

DATA Compression is the science and art of representing information in a compact form [7]. The data may also classified as text, audio, image and video while the real digital data format consists of 0's and 1's in a binary format

- Text data are usually represented by 8-bit extended ASCII code or EBCDIC having extension .txt, .tex, .doc.
- Binary data include data base file spreadsheet data, excitable files and program codes having extension as .bin.
- Image data are represented often by a two dimensional array of pixels in which each pixel is associated with its color code having extension as .bmp and .psd.
- Graphics data are in the form of vectors or mathematical equations, for example data format is .png (portable network graphics).
- Sound data are represented by a wave function having extension as .wav [6].

2. BACKGROUND ON TEXT COMPRESSION TECHNIQUE

Lossy compression achieves better compression by losing some information. When compressed stream is decompressed, the result is not identical data stream. Such a method makes sense especially in compressing images movies or sounds. In contrast, text files, especially files containing computer programs, may become worthless if even one bit get modified. Such files should be compressed only by a lossless compression method.

A data compression method is called universal if the compressor and de-compressor or do not know the statistics of the input strain [12].

There are different compression techniques

2.1 RLE:

If a data item d occurs n consecutive times in the input stream, replace the n occurrences with the single pair nd. The n consecutive occurrences of a data item are called a run length of n, and this approach to data compression is called run length encoding or RLE.

The runs are replaced by a tuple (r, l, s) for (run-flag, run-length, run symbol) respectively, where s is a member of alphabet of symbols but r and l are not.

For example: String KKKKKKKKK, containing a run of 9 k's can be replaced by triple('r',9,'k'), or a sort unit r9k consisting of the symbol r, 9 and k where r represents the case of 'repeating symbol', 9 means '9 times of occurrence' and k indicates that this should be interpreted as 'symbol k' (repeating 9 times).

Another example

Input is GGG○○○ ○ ○ ○ BCDEFG ○5○GHJK ○M77777.

Output is $r_3Gr_6n_6BCDEFGr_2n_955○HJK$ LMr_57.

Solution is:

1. For first three G encoded as r_3G.

2. Next six space encoded r_6.
3. The non-repeating symbols BCDEFG encoded by n_6BCDEFG.
4. Next two spaces r_2.
5. Nine non repeated $n_9$55GHJK   LM.
6. Next five 7's are encoded by $r_5$7.

The mathematical model for Run-Length is so-called Markov Model [22].

  1. If two characters are repeated then there is increase in size, so in place of compression it becomes expansion in size.

  2. And for three repeated characters there is no compression.

  3. But four onwards there will be actual compression starts.

The method will be advantageous when repetition is more than three.

RLE compression data can be further compressed using 5-bits and 6-bits coding scheme.

2.2 LZW:

LZW is a general compression algorithm capable of working on almost any type of data. It is generally fast in both compressing and decompressing data and does not require the use of floating-point operations. Also LZW writes compressed data as bytes and not as words.

LZW is referred as a substitution or dictionary-based encoding algorithm. The algorithm builds a data dictionary (also called a translation table or string table) of data occurring in an uncompressed data stream. Patterns of data (substrings) are identified in the data stream and are matched to entries in the dictionary. If the substring is not present in the dictionary, a code phrase is created based on the data content of the substring, and it is stored in the dictionary. The phrase is then written to the compressed output stream.

Data Compression technique on text Files: A comparison study has been done by Haroon Altarawneh et. al., he has taken different methods of data compression English text files, LZW, Huffman, Fixed Length Coding (FLC) and Huffman after using Fixed Length Code (HFLC). He evaluated a test on these algorithms on different text files or different file sizes and taken a comparison in terms of comparison: Size, Ratio, Time (Speed) and entropy. And they found that LZW is the best algorithm in all the compression scales [25].

According to them LZW is a general compression algorithm capable of working on almost any type of data. It creates a table of strings commonly accruing in the data being compressed, and replaces original data with reference into the table. LZW Compression replaces strings of characters into a single code. Compression occurs when a single code is output instead of a string of characters. It starts with a dictionary of all the single character with indexes. It starts expanding the dictionary as information gets send through. Pretty soon, redundant strings will be coded as a single bit, and compression has occurred.

The drawback is, Compression usually does not begin until a sizable table has been built.

They have lastly concluded that LZW is the best in all compression scale, especially on the large files, than Huffman, HFLC and FLC respectively. FLC is a good technique if the source file

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contains little number of different symbols (less than 16). Huffman gives better than HFLC and the second one need more time and more calculations but it is better than FLC.

3. PROPOSED NEW TECHNIQUE

- Characters can be coded into 5-bits coding.
- Memo can be coded into 6-bits coding.
- Dates can be coded into 16-bits coding.
- Time can also be coded into 16-bits coding [17].

4. IMPLIMENTATION OF PROPOSED TECHNIQUE

We have proposed some new techniques that can be implemented as given below:

4.1 Character

In general 8-bit ASCII code have been used for representing character, but when one declare any attribute to be of character type they often interested only in alphabet character from A-Z or a-z. So it has redefined the coding in the following way.

Table 1. Modified Characters Code for Character Field

DECIMAL	CHARACTER	DECIMAL	CHARACTER
0	NOTHING	16	p
1	a	17	q
2	b	18	r
3	c	19	s
4	d	20	t
5	e	21	u
6	f	22	v
7	g	23	w
8	h	24	x
9	i	25	y
10	j	26	z
11	k	27	SPACE
12	l	28	END OF LINE
13	m	29	COMMA

| 14 | n | 30 | FULL STOP |
| 15 | o | 31 | ' ' |

So in this way a compact and complete representation of information is possible.

4.2 Memo

The memo field often includes character other than alphabets like number underscore plus minus etc. and it is found that at most 61 symbols are used in general so in this situation 6 bits are sufficient to represent them. Out of these 32 are the same as that in the previous case of character and the remaining 32 could be used for the following purposes.

Table 2. Modified Characters Code for Memo Field

DECIMAL	CHARACTER	DECIMAL	CHARACTER
32	" "	48.	&
33	0	49.	*
34	1	50.	(
35	2	51.	)
36	3	52.	-
37	4	53.	_
38	5	54.	=
39	6	55.	+
40	7	56.	<
41	8	57.	>
42	9	58.	?
43	!	59.	/
44	@	60.	:
45	#	61.	;
46	$	62.		
47	^	63.	\

So in this way complete information is possible.

5. RESULTS AND EVALUATION OF PROPOSED TECHNIQUE

We have evaluated our proposed compression techniques on existing RLE method. Below Table1 has taken some 21 of different files with their size in number of bits. Then compressed it with the help of RLE compression and then on that we applied our methods then one can see our

method is better. Below the table one can see that original size i.e. ASCII size in bits is 55094077. But the same file size has been increased to 58054222 bits. And when it comes to our methods it becomes only 22937800 bits. The same comparison is also can be seen graphically given below in last page of this paper. As in table one can see that almost all cases the size of file is increased when come to RLE compression. And this is true which we have discussed earlier in this paper. In the table some files have been taken on that experiment has been done. In modern database systems table structure is also stored together with the database file so that any application can make use of it. When we consider this compression scheme we will store this structure without any modification, it is only the data that will be stored according to this new scheme. The file also store some additional words like field separator, end of record to mark and distinguish separate attribute and record, and these will be there in proportion to the number of records in the file.

Table 3.File Size before Compression and after Compression

File Name	ASCII size (bits)	RLE size (bits)	With proposed technique (bits)	Compression ratio between RLE and proposed techniques
Paper1.txt	482978	493899	188675.67	0.382013
Paper2.txt	103251	114142	44543.87	0.39025
Paper3.txt	25677	26067	10038.44	0.385101
Paper4.txt	697867	707952	278734.70	0.39372
Paper5.txt	985567	999755	399902.00	0.4
Paper6.txt	1067865	1853265	741306.00	0.4
Paper7.txt	118957	118859	46543.60	0.391587
Bib.txt	9876789	9987652	3894177.85	0.389899
Test1.txt	2738527	2927652	1082770.74	0.369843
Test2.txt	778965	776852	301740.80	0.388415
Test3.txt	479211	489923	195969.20	0.4
Test4.txt	117528	206431	81662.32	0.395591
Test5.txt	874321	911211	354464.39	0.389004
Test6.txt	9865421	9974322	3978934.79	0.398918
Test7.txt	879437	898344	349978.78	0.389582
Test8.txt	6778943	7001233	2800999.67	0.400072
News.txt	347954	391221	149976.47	0.383355
Book1.txt	5674312	6600311	2640007.66	0.399982
Book2.txt	248968	290142	110077.43	0.379392

Book3.txt	698437	607421	240997.40	0.396755
Book4.txt	746389	805072	321919.98	0.399865
Book5.txt	9778899	9983241	3982176.40	0.398886
Book6.txt	439567	491010	191303.01	0.389611
Book7.txt	543268	602477	239990.80	0.39834
Book8.txt	744979	795768	310908.20	0.390702
TOTAL	**55094077**	**58054222**	**22937800**	**0.39511**

6. CONCLUDING REMARK

In our paper we have taken original size of different files. On that applied RLE technique and then on RLE we applied our own technique. We have presented a very new compression technique for Text and Memo. Our technique will give better results, so that the proposed technique has better performance, compared to other techniques currently used in the Data-base. The CPU utilization will also increases due to compression. Also compression is beneficiate to Input and Output performance. Database compression is used to reduce the disc input output bandwidth requirements for bigger data transfer. The above technique will give 62.5% of compressions. Table 1 and table 2 will have modified chart according to our technique. Table 3 contains practical data on which our compression is giving better compression compare to RLE. Also the graph below can conclude that our compression is better than RLE technique.

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AUTHER PROFILES:

Sushil Kumar is a Professor & H.O.D. in the department of Computer Science & Engineering at NRI Institute of Research & Technology Bhopal, India. His research interests include computer, IT, EC. He is a member of Institution of Engineers from 1991, was also a member of Computer Society of India.

Holds HDSE from Aptech Ltd. (Chennai), BSc. (part-I, Maths honors) from Magadh University, Bodh Gaya (Bihar), A.M.I.E., A.I.E. from Institution of Engineers (India), M.Tech (IT), Ph.D (going to submit) from RGTU, Bhopal, India. Guided many project at U.G. & P.G. level. Also Published 10 International Journals, 22 International Conferences and 20 National level Conferences**.** Having 12 years of UG, 7 years of PG level teaching experiences also 5 years of other experiences.

Dr. Sarita Singh Bhadauria Professor & H.O.D., Electronics, Madhav Institute of Technology& Science, Gwalior-5 (M.P), B.E (Electronics), M. Tech (Computer Science), Ph.D (Digital Image Processing), 25 years of teaching UG, 17 years of teaching PG, Publicationshed Int Journals / National Journals 29, Int conf / National conf 65, Ph.D guided Awarded 05, Registered 08, Memberships of Professional Societies like CSI,IETE,ISTE,IEI.

Dr. Roopam Gupta is currently working as Professor & HOD in IT department, University Institute of Technology , RGPV,Bhopal,India. She received her Ph.D from Barkatullah University, Bhopal, India and M.Tech from MANIT, Bhopal, India. She has eighteen years of teaching experience. Her research interests are in the areas of Communication and Computer Networking. She is the recipient of MPCST, Young Scientist Award; 1999.She is Life Member of IETE and ISTE.

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Compression on ASCII to RLE to Our Method