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United States Patent [19]

Williams

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[54] **METHOD FOR PARTITIONING A BLOCK OF DATA INTO SUBBLOCKS AND FOR STORING AND COMMUNCATING SUCH SUBBLOCKS**

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[30] **Foreign Application Priority Data**

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Apr. 12, 1995 [AU] Australia PN2392

[51] **Int. Cl.**[6] **H03M 7/00**
[52] **U.S. Cl.** **341/51**; 341/67
[58] **Field of Search** 341/51, 50, 67; 375/241; 704/203

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,698,628 10/1987 Herkert et al. 340/825.02
5,235,623 8/1993 Sugiyama et al. 341/67
5,479,654 12/1995 Squibb 395/600

OTHER PUBLICATIONS

Williams, Ross, "An algorithm for matching text (possibly original)", Newsgroup posting, comp.compression, Jan. 27, 1992.

Williams, Ross, "Parallel data compression", Newsgroup posting, comp.conmpression.research, Jun. 30, 1992.

Knuth, Donald E., "The Art of Computer Programming, vol. 3: Sorting and Searching", pp. 508–513, Addison–Wesley Publishing Company, 1973.

Williams, Ross N., "An Introduction to Digest Algorithms" Proceedings of the Digital Equipment Computer Users Society, pp. 9–18, Aug. 1994.

Williams, Ross N., "An Extremely Fast ZIV–Lempel Data Compression Algorithm", Proceedings of Data Compression Conference, pp. 362–371, Apr. 1991.

Knuth, Donald E., The Art of Computer Programming, vol. 1: Fundamental Algorithms, pp. 435–451, Addison Wesley Publishing Company, 1973.

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[57] **ABSTRACT**

This invention provides a method and apparatus for detecting common spans within one or more data blocks by partitioning the blocks (FIG. **4**) into subblocks and searching the group of subblocks (FIG. **12**) (or their corresponding hashes (FIG. **13**)) for duplicates. Blocks can be partitioned into subblocks using a variety of methods, including methods that place subblock boundaries at fixed positions (FIG. **3**), methods that place subblock boundaries at data-dependent positions (FIG. **3**), and methods that yield multiple overlapping subblocks (FIG. **6**). By comparing the hashes of subblocks, common spans of one or more blocks can be identified without ever having to compare the blocks or subblocks themselves (FIG. **13**). This leads to several applications including an incremental backup system that backs up changes rather than changed files (FIG. **25**), a utility that determines the similarities and differences between two files (FIG. **13**), a file system that stores each unique subblock at most once (FIG. **26**), and a communications system that eliminates the need to transmit subblocks already possessed by the receiver (FIG. **19**).

30 Claims, 26 Drawing Sheets

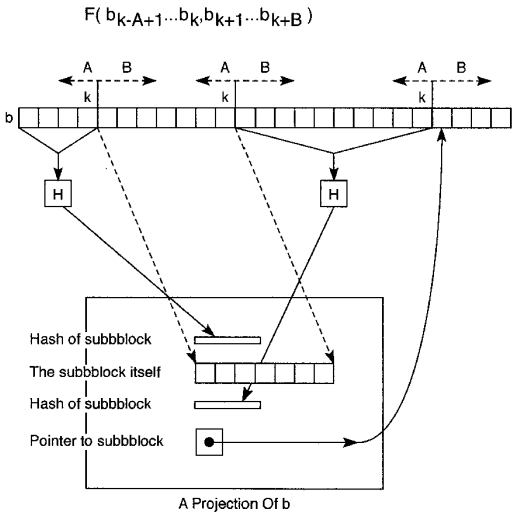

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Figure 1

| Fixed an | d variab | le width | partiti | oning.|
| Fixe | d an | d variable wid | th part | itioning.|

Figure 2

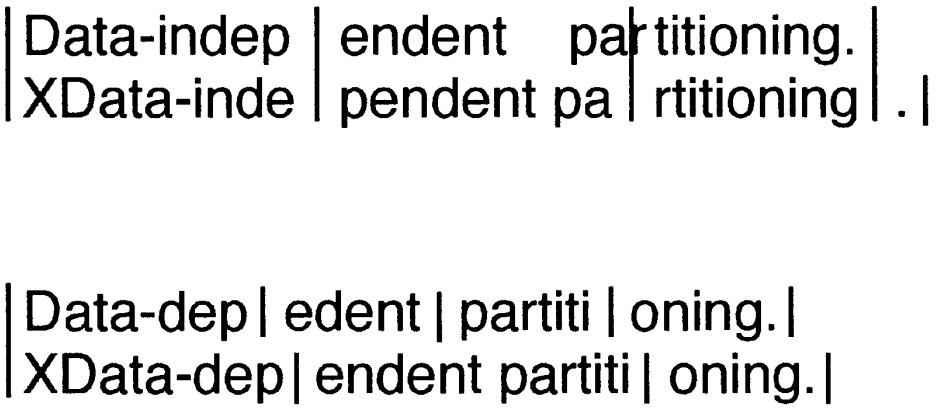

Figure 3

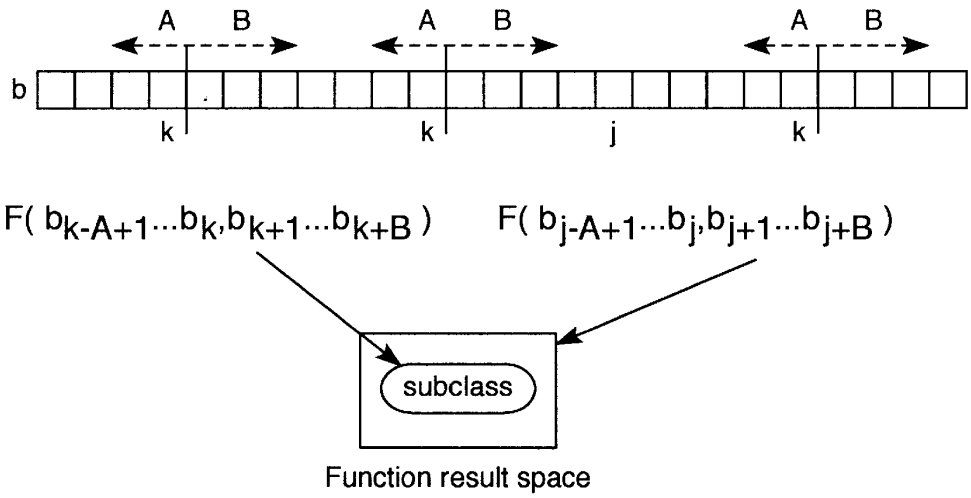

Figure 4

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