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LOSSLESS COMPRESSION OF ECG SIGNALS

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Abstract

In this paper we study the compression techniques for electrocardiogram (ECG) signals based on *Block Sorting* Techniques. We introduce a new and faster block transformation than the Burrows and Wheeler Transformation (BWT), and later compare them for ECG data compression. We show that our algorithm yields better compression gain than the Burrows and Wheeler's algorithm (BWA), Gzip and the *Shorten* waveform coder for lossless ECG data compression.

Keywords: Block Sorting, ECG data, Lossless and Near-Lossless Compression

Various researchers [3,4,5] have investigated transform based compression techniques for ECG data. However, to the best of our knowledge nobody has investigated the compression of ECG data utilizing Block Sorting Techniques.

One of the recent developments in the data compression area is the *Block Sorting Lossless Data Compression Algorithm* (BWA) introduced by Burrows and Wheeler[2]. The BWA algorithm is composed of Lexical Sorting Transformation followed by MTF and Run-Length coding. When applied to text or image data, BWA achieves better compression rates than Ziv-Lempel techniques with comparable speed, while its compression performance is close to context based methods, such as PPM. The lexical sorting transformation utilized in BWA is called Burrows-Wheeler Transformation (BWT).

In this work, by expanding the theoretical foundations of *Lexical Permutation Sorting Algorithm* [1] we introduce a new, context-level one blocks-sorting technique, *Linear Order Transformation*, and show that LOT is faster than the BWT transformation which is context-level n (where n is the size of data). The compression algorithm, which utilizes Linear Order Transformation, MTF and Run-Length coding, is called Linear *Transformation Algorithm* (LTA).

Experimental results on twenty-two different ECG data files of sizes 12000 bytes each, have shown that LTA yields the best compression gain out of the three techniques, BWA, Gzip and Shorten, when the files are compressed without any loss. While LTA algorithm outperforms Gzip and Shorthen schemes, it yields 3-5% gain over BWA.

Our future work will involve with extending this work to compare the results of all the transformed-based coding schemes, such as the ones reported in [3,4,5]. However, considering the results of Gzip as a base for judgment, we believe that Block Sorting Transforms yields better compression gain than the other transform based coders for ECG data.

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