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Application of Wavelet-based ECG Data Compression For a Wireless telecardiology System

R. S. H. Istepanian* A. Petrosian and S. Chen*****

* Department of Electrical and Computer Engineering
Ryerson Polytechnic University, 350 Victoria Street, M5B 2K3,Toronto, Canada
E-mail: ristepan@ee.ryerson.ca
** Health Sciences Center, Texas Technical University, Lubbock TX 79430, USA
*** Department of Electrical and Electronic Engineering
University of Portsmouth, PO1 3DJ, UK

Abstract: This paper presents a new wavelet based ECG compression algorithm compatible for mobile telecardioloy applications. The compression results on three standard segments of clinical ECG data using different wavelet transforms complemented with scalar quantization and Huffman coding procedures suitable for GSM cellular design are presented. The compression results show the compatibility of the compression method for ECG monitoring especially for emergency scenarios and mobile telemedical application.

Index: Telecradiology, Telemedicine, Wavelet, ECG

It is well known that the main purpose of the medical compression is to significantly reduce bit-rate while keeping signal distortion at clinically acceptable levels. In recent years the design and modeling issues of ECG data through a 900MHz GSM channel is addressed [1]. However, little attention has been paid thus far to identifying the best-suited wavelets for various types of ECG signals especially for telemedical applications. This paper presents the hybrid design and interactive modeling concepts of wavelet compression integrated with GSM-based mobile telemedical system. The ECG clinical data was selected from three 4-sec. standard segments from the MIT-BIH Arrhythmia database a) record 100; b) Creighton University Venticular Tachyarrhythmia database record CU01; and c) MIT-BIH Noise Stress Test database record 118e00) using different wavelet transforms (Haar, daublets, coiflets, and symmlets) complemented with scalar quantization and Huffman coding procedure used for the standard GSM communication design.

The wavelet based algorithmic and telecommunication design procedures are described elsewhere [1,2]. Table (1) shows the comparative results of the reduction in mobile transmission time with and without using the optimal wavelet compression approach within the mobile telemedical system.

[1] R. H. Istepanian, B. Woodward, P. Balos, S. Chen and B.Luk, "The comparative performance of mobile telemedicine systems using GSM and IS-54 cellular standards", *J. Telemedicine and Telecare*, Vol.5, No.2, 1999 (To Appear).

[2] A. Petrosian, "Optimal Zone Encoding of Digital Signals with Transform" *Problemi Peredachi Informatsii,* Vol. 27, N. 2, 1991, Moscow, Nauka, pp. 46-58 (in Russian. Translated into English in: *Problems of Information Transmission*, 27-2, October 1991, New York, Plenum Publishing Corp., pp. 128-140).

ECG Record	Transmitted ECG signals without OZWC	Transmitted ECG signals with OZWC	% Reduction Transmission time
record 100	300 seconds	82 seconds	72.7 %
cu01	300 seconds	82 seconds	72.7 %
record 118e00	300 seconds	82 seconds	72.7 %

Table (1)