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# Seismocardiogram Signal Compression using DCT and DWT

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**Abstract**

Growing desires of healthcare tele-monitoring forces the research community to work for bio-medical signal compression. In this work, tunable compression approach has been implemented for Seismocardiography (SCG) signal using Discrete Cosine Transform (DCT) and Discrete Wavelet Transform (DWT). The overall performance of DWT is higher in comparison to DCT for SCG signals in phrases compression ratio (CR).

**Keywords:** Compression, Cardiovascular, Huffman Coding, Arithmetic Coding, Transform

## 1. Introduction

Sismocardiography (SCG) is a non-invasive system that quantifies the acceleration created by the mechanical cardiovascular exercises on the chest wall. It basically does the cadenced compression and relaxation of the heart [1]. Be that as it may, so as to use SCG in a wide of scope of utilization situations, including malady identification and real-time checking, huge amounts of information signals should be obtained and prepared. This builds the transfer speed and memory prerequisites of the framework. Proposed work depends on quality controlled SCG signal compression.

Researcher [2] utilized only DCT for compacted SCG signals and proposed significant decline in bandwidth while maintaining precise signal recovery Researchers [3-6] examined on quality-controlled compression on different biomedical signals by comparing DWT and DCT. However, such information is lacking for SCG signals. Keeping this in mind, the present study was planned to compare DWT and DCT for SCG signal.

## 2. Methodology

To develop the database, 20 assumed fit volunteers were examined. For the experiment, the subjects were approached to be extremely still in prostrate situation on an agreeable regular single bed and wakeful. After connection of sensors, equipment records the basal condition of the subjects by examining for 5 minutes (records b001 to b020). After that, subjects began to listening classical music for roughly 50 minutes (records m001 to m020). Finally, all subjects were observed for 5 minutes progressively after the music finished (records p001 to p020) [7]. For this work, randomly selected fifteen records have been considered for compression.

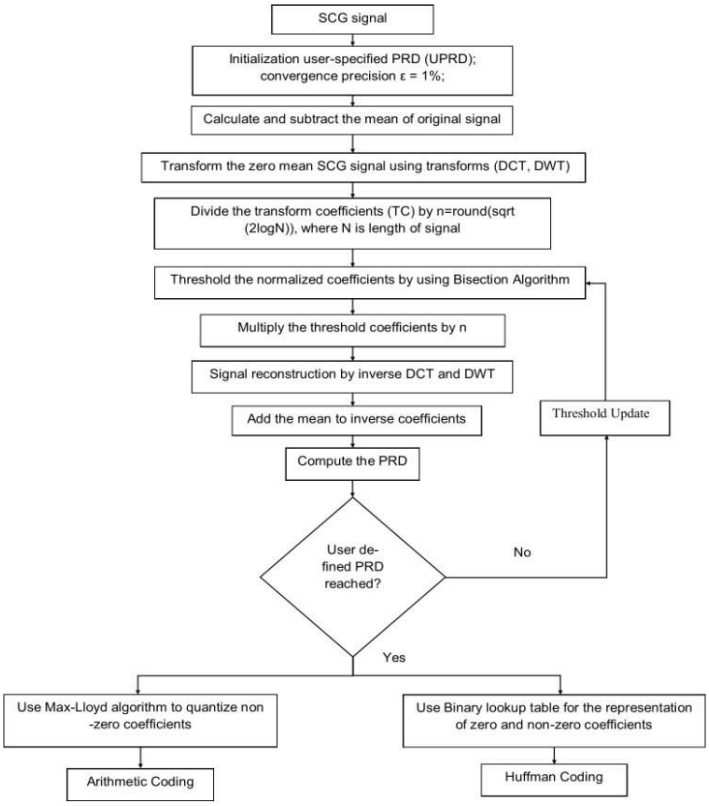


**Figure 1 Flow diagram of SCG signals compression technique.**

A schematic flow diagram of the proposed method is given in Fig.1 [8] for the better understanding. Performance analysis was based on two parameters viz. CR and percentage root mean square difference (PRD) as described in [6]. The visual comparison of SCG signal (b010m) at UPRD 0.5 and 2.0 is shown in figures 2-5.

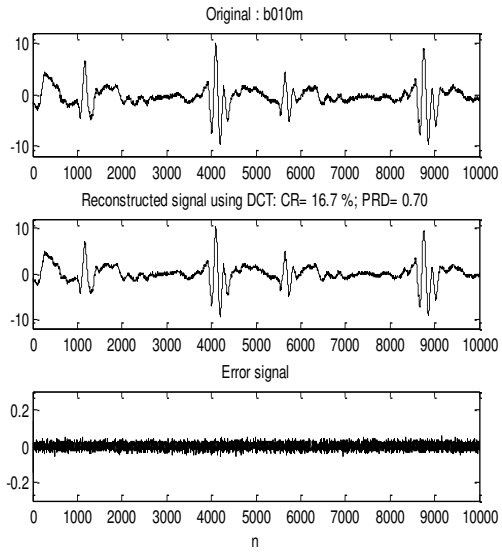


**Figure 2 Compression waveform of record b010m using DCT at UPRD = 0.5.**

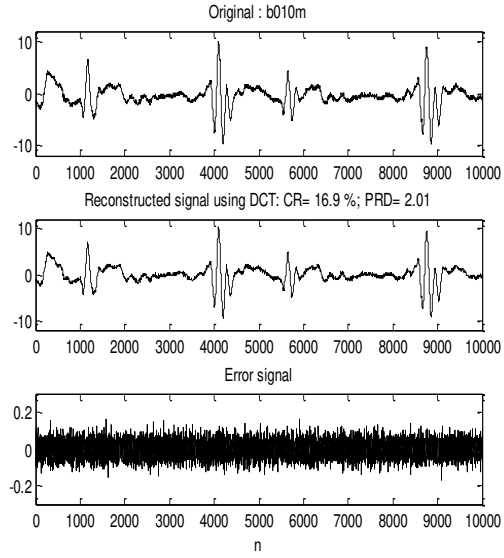


**Figure 3 Compression waveform of record b010m using DCT at UPRD = 2.**

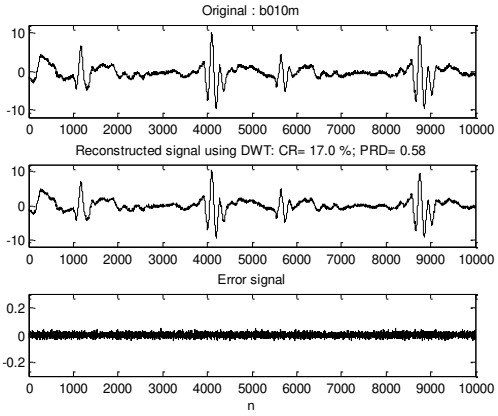


**Figure 4 Compression waveform of record b010m using DWT at UPRD = 0.5.**

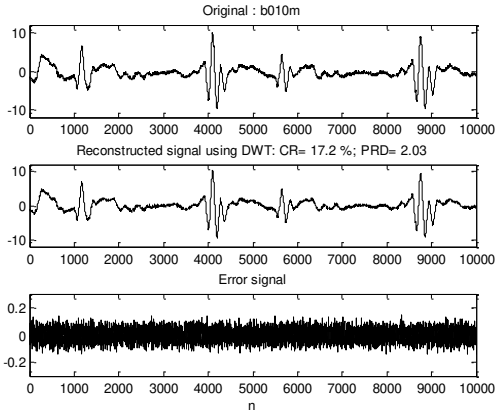


**Figure 5 Compression waveform of record b010m using DWT at UPRD = 2.**

## 3. Result and Discussion

Average value of CR and PRD for DCT and DWT are shown in Table 1. The corresponding test dataset for this work is: b010m, b012m, b015m, b018m, b020m, m010m, m012m, m015m, m018m, m020m, p010m, p012m, p015m, p018m, and p020m.

**Table 1 Performance of DCT and DWT for SCG signals**

| bits=100192 bytes, Qbits[a]=12, duration of signal=10 sec, Error=0.1%, | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | UPRD[b]=0.5 | | UPRD[b]=1 | | UPRD[b]=2 | | UPRD[b]=3 | |
| Transform | QPRD[c] | CR[d] | QPRD[c] | CR[d] | QPRD[c] | CR[d] | QPRD[c] | CR[d] |
| DCT | 0.66 | 12.8 | 1.05 | 12.9 | 2.01 | 13.4 | 3.01 | 13.3 |
| DWT | 0.57 | 14.0 | 1.03 | 14.1 | 2.01 | 14.3 | 3.00 | 14.5 |

*Qbits[a]= Quantization bits;*
*UPRD[b]=User defined percentage root mean square difference;*
*QPRD[c]=After quantization percentage root mean square difference;*
*CR[d]=Compression ratio.*

For DCT and DWT, CR increases by 3.97% and 3.77%, respectively, when UPRD increases from 0.5 to 3. There was an increase in the CR with an augmented of UPRD value for each DCT and DWT. The results show that CR increases by 9.4%, 9.25, 6.35 and 9.2% for UPRD value from 0.5, 1.0, 1.5 and 2.0, respectively, for DCT and DWT (Table 1).

The reproduced signals of DWT were well matched with original signals in comparison to the DCT (Figs. 2-5). This might be due to the reason of local time and frequency parameters in DWT ac compared to DCT.

## 4. Conclusion

This research is first known comparison using DWT and DCT for SCG signals. Our results reveal that DWT performs better than DCT for SCG signals. Further evaluation of SCG signals using different compression methods needed to untangle the storage capacity and bandwidth.

## References

[1] M.A. García-González, A. Argelagós-Palau, M. Fernández-Chimeno, J. Ramos-Castro, A Comparison of Heartbeat Detectors for the Seismocardiogram, Computing in Cardiology Conference (CinC), 2013, 40, 461-464.

[2] Z. Yu, F.M. Bui, P. Babyn, A. Dinh, Evaluation of Compressed Sensing in Seismocardiogram (SCG) Systems, 26th IEEE Canadian Conference of Electrical And Computer Engineering (CCECE), 2013. DOI: 10.1109/CCECE.2013.6567782.

[3] V. Aggarwal, S. Gupta, M.S. Patterh, L. Kaur, Quality Controlled EMG Signal Compression using Linear and Non Linear Transform, Inter. J. of Innovative Tec. and Exploring Engineering (IJITEE), 2019, 8, (12), 5885-5889.
[4] V. Aggarwal, M.S. Patterh, V.K. Singla, Comparative studies of discrete cosine transform and lifting wavelet transform techniques for compression of blood pressure signal in salt sensitive Dahl rat, Inter. J. Comput. Systems Engineering, 2018, 4, (2/3), 165-170.
[5] V. Aggarwal, M.S. Patterh, Performance Analysis of Non-Linear Transformational ECG Compression Method, Biomed. Engineering: Appl., Basis and Comm. (BME), 2009, 21, 245-251.
[6] V. Aggarwal, S. Gupta, M.S. Patterh, L. Kaur, Analysis of Compressed Foetal Phono-Cardio-Graphy (PCG) Signals with Discrete Cosine Transform and Discrete Wavelet Transform, IETE Journal of Research, 2020, 1-7.
[7] https://physionet.org/cgi-bin/atm/ATM
[8] V. Aggarwal, M.S. Patterh, Quality Controlled ECG Compression using Slantlet Transform and Lifting Wavelet transform with and without Normalization, Inter. J. of Electronics, 2013, 100, 626-636.