Reconstruction Quality Of Ppg Signal Based On Singular Values And Ascii Character Encoding

Thasleema Latheef[1], Meekha Hanna Sam[2], Hari S[3]
[1]Dept of ECE
[2, 3]Assistant Professor , Dept of ECE
[1, 2, 3] Mount Zion College Of Engineering

Abstract- *In this paper, PPG signal represents the relative change in the blood- volume in the blood vessels. It presents high performing, robust, reliable and highly-efficient singular value decomposition and lossless ASCII character encoding (LL-ACE)-based quality PPG compression signal. It can not only be used to compress PPG signals but also do so for steganographed PPG signals that include the patient information. Signal compression particularly quality-guaranteed compression and steganography of patient's secret information is still lagging behind. It worth mentioning that such an algorithm is being proposed for the first time to compress steganographed PPG signals. This algorithm is tested on PPG signals collected from four different databases, and its performance is assessed using both quantitative and qualitative measures.*

Keywords- PPG signal-ASCII character- Patient information-Compressed data-Truncation of singular values.

I. INTRODUCTION

PHOTOPLETHYSMOGRAM (PPG) signal represents the relative change in the blood-volume in the blood vessels. The acquisition module for a PPG signal usually consists of a light emitting diode to send light into the tissue and a photo-detector to measure the amount of reflected or transmitted. From a diagnostic point of view, PPG is considered as the second most important biosignal (electrocardiogram being the prime and most important Computerized monitoring, analysis and detection of various clinical and physiological parameters of the PPG signal are important challenges faced by researchers in the recent times.

Pulse-oximetry is a very common clinical parameter often monitored during surgery, patient transport, emergency, delivery of a baby, etc[1][2]. Oximetric parameter is calculated utilizing a number of features extracted from the PPG signal to measure the oxygen saturation level in the arterial blood (SpO2).The Visual similarities between PPG and blood pressure (BP) signals have attracted researchers to hypothecate, investigate and design cuff-less BP estimation techniques from the PPG signal[4].

II. RELATED WORKS

The BLOOD PRESSURE is an important and commonly used index for health management. Generally, to be able to measure BP, cuffs are required for applying pressure to the brachial arteries[1]. Because of problems such as the BP machine being too large to carry around, BP measurement is time- and effort-consuming, and continuous measurements cannot be perform[3]. Therefore, cuffless estimation methods for Considerable research efforts have been devoted to developing cuffless BP estimation methods that utilize the pulse arrival times[2] . Because the PAT depends on the condition of the blood vessels, it is obvious that will reduce with the progress of arteriosclerosis . The PAT, estimated as the delay between an electrocardiogram (ECG) signal[10] and a photoplethysmogram (PPG) signal, can be used to estimate BP approach is not very straightforward, because it requires the use of both electrocardiography and photoplethysmography. The objectives of this study as follows: 1) to evaluate the maximum value of a differential PPG signal, such as an APG signal and a velocity PPG (hereafter "VPG") signal,[5][6] for estimating SBP and 2) to evaluate the proposed feature selection method of multiple to regression analysis to that method.

Photoplethysmography is low cost and convenient physiology measurement technique from the point of view of patient comfort. It is optoelectronic method for measuring and recording changes the volume of body parts such as finger,ear lobes caused by the changes in volume of the arterial oxygenated blood, associated with cardiac contraction . When light travels the biological tissue (earlobe or finger), it is absorbed by different absorbing substances . Primary absorbers of the skin pigmentation, bones and the arterial and venous blood. The characteristics of photoplethysmogram (PPG) pulses are influenced by arterial ageing and arterial disease. The PPG probe consists of a light emitting diode (LED) and a photo-detector. The LED transmits light with usually constant intensity[7], which is adjusted to the amplitude of the signal collected. Photo-detector is usually a silicon photodiode that produces a current proportional to the incident light. Improved technology in photodiode and LED

allow the LED and photodiode to be small enough to fit in small fingertip probes using transmission or reflection probes. It has been established that the characteristic of the PPG signals is body site specific, with pulses from the various peripheral sites showing difference in pulse transit time, amplitude, shape and variation of each over the time . PPG signals may provide physiologically to important information from these observed differences, especially related to cardiovascular related performance.

This results show that pulse timing, amplitude and shape of high frequency components of PPG waveforms between right and left sides of bodies in three different sites of fingers, toes and earlobes are expected to be similar since the anatomical structure are similar .Pulsetiming is characterized by the PWTT (Pulse Wave Transit Time), the time for a pulse to travel between two arteries sites. Any difference in vessel properties can affect the time and shape of the rising edge (anacrotic) and falling edge (catacrotic) of the PPG signal leading to important clues about pathological changes. Cardiovascular diseases (CVDs) still remain the leading killer all over the world. The World Health Organization's (WHO) estimation, in 2008, millions people died from CVDs, representing 30% of all global deaths. It is alarming that, by the year 2030, millions people will die from CVDs, and the effect will be terrible in South-East Asia . The Proper medicine or cardiac surgery may save some of these lives if precautionary measures can be taken at an earlier stage of the cardiac abnormality. The electrocardiogram (ECG) is a diagnostic means that is often used to judge the electrical and muscular functions of the heart[8][9]. This ECG is described by waves, segments and intervals. The letters of P, QRS, T and U are used to mark different ECG waves. This alphabets were chosen in the early days of ECG history and were chosen arbitrarily . The U wave may not be visible always. Shapes, sizes and durations of these P-QRS-T waves, intra-wave and also interwave intervals have their own clinical morphology .In the present work, at first, standard deviation (SD) of a section of the ECG signal is computed[9][10]. If the calculated SD exceeds an empirically determined threshold, then that portion of the this ECG signal (probable QRS regions) is compressed in a lossless manner, otherwise in a lossy manner with negligible.

III. PROPOSED SYSTEM

In this project we mainly focus , to improve the PPG signal compression ratio and reconstructing signal quality.This proposed steganographed PPG compression algorithm provides a compression ratio that is much higher than provided by other algorithms that are designed to compress the PPG signals .Add more data encryption and data security. To Change the grouping system with another extended grouping system so compression ratio will be increased. To change the singular value decomposition (SVD) to another SVD to improve the signal compression ratio. To better the signal values .So Increasing the efficiency of the system. It consist the lighit emiting diode they occurs the light enters in to the body and detecting the diagnostic point. Detect the patient details and solve the problems.

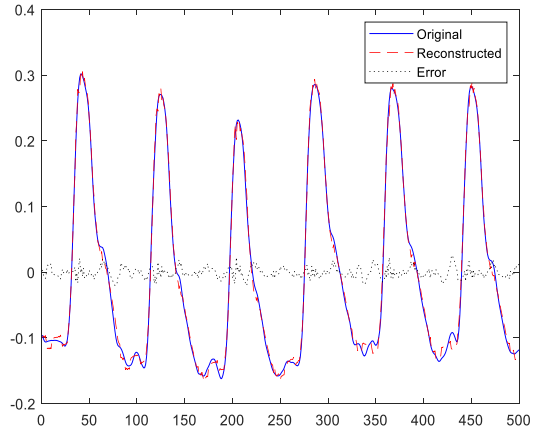

Fig-1: Before compression of PPG signal

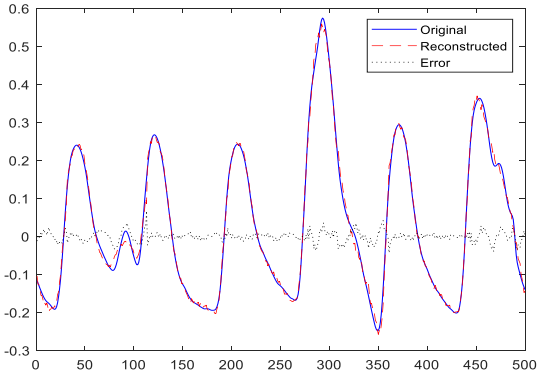

Fig-2: After compression of PPG signal

A. Preprocessing

The clinical bandwidth of PPG signal ranges from 0.05 to 15 Hz. In this research, the PPG signal is de-noised through a 4th order zero-phase Butterworth bandpass filter having lower and upper cutoff frequencies of 0.05 Hz and 25 Hz, respectively, and hence, the signal must be sampled at a rate higher than 50 Hz. Next, the amplitude of the de-noised PPG signal is normalized to keep it within the range (-1, 1). The amplitude-normalized PPG signal is then down-sampled in such a way that the sampling frequency (SF) of the down-sampled signal would not fall below 100 Hz.The maximum

amplitude is found from the first- difference data, and the indices ofthe samples having amplitude within 30%.

B.Truncation of singular values

A non-zero real matrix of $NsxB$ dimension can be

$$PNs\times B = UNs\times NsSNs\times BVB\times BT$$

ma SVD of a matrix P consists of finding the eigenvalues and eigenvectors of PPT and PTP. The columns of $UNsxNs$=[$u1$ $u2$ $\cdots uNs$] and $VBxB$=[$v1$ $v2$ $\cdots vB$] trices are the eigenvectors of PPT and PTP, respectively. The singular values (μ) of $SNs\times B$ are the square roots of the eigenvalues from either PPT or PTP, and are arranged diagonally in the descending order. The values of μ are always real and positive.

C.Near –loseless compression

Uniform quantizer of 216 levels is used to quantize the coefficients of the truncated right singular matrix ($VB\times\gamma opt$), and the quantized values. Next, each 16-bit data stream is divided into 2-bytes (1-byte=8-bits), and each byte is converted into its corresponding ASCII character. Finally, the ASCII characters are stored in the output file. This has been experimentally observed that the quantization and the subsequent ASCII character encoding technique reduces the data-size .

D.Estimation of optimum numbers

The data loss, which occurs between the original and the reconstructed PPG signals, is mostly due to (1) down-sampling, (2) beat-length normalization and (3) singular value truncation operations, and the aggregate contribution of the data-loss due to these three operations can be estimated in advance; this makes it possible to control the quality of signal . Percent root mean square difference (PRD) is a widely-used and standard metric of measure of distortion between the original and reconstructed bio-signals including PPG and therefore, PRD is used in this research as the quality-controlling metric of the reconstructed PPG signal.

E.Regenerating the ppg signal

The actual lengths of all the PPG beats are fetched from the compressed data file, and then the length-normalized PPG-beats are restored to their original lengths using the FFT-based interpolation technique. The 1D PPG signal is regenerated by concatenating all these length-restored PPG-beats. Next, the 1D PPG signal is up-sampled using the linear interpolation technique to restore it to its original sampling rate and finally, the signal is amplified by the amplitude normalization.

F.Extracting the patient's information

From the compressed data file, the grouped, regrouped and non-grouped characters are fetched, and converted into their corresponding ASCII values. Grouped and regrouped ASCII values are separated properly using techniques that are reverse of the grouping techniques used in Section II C. One set of characters is taken at-a-time from the compressed data file and the corresponding decimal value is taken into consideration. If the number of integers (except for the sign-byte) in a set is one, it signifies that *Technique I* grouping has been performed and all the 8- integers are re-generated easily. If the number of integers (except for the sign-byte) is two, it signifies that *Technique III* grouping has been performed.

IV. RESULT

To improve the PPG signal compression ratio and reconstructing signal quality. The main advantages of the proposed StePPGcomp algorithm are (1) the clinical quality of the reconstructed PPG signal can be controlled precise (2) Patient's personal information is restored with no errors (3) high compression ratio and (4) the PPG signal reconstruction error is neither dependent on the steganographic operation nor on the size of the patient information. The compression performance of the algorithm highly depends on the peak detection performance. This results indicate that the reconstructed PPG signals do not lose any significiant clinical information, and the BER value shows faithful and loseless restoration of patient's information.

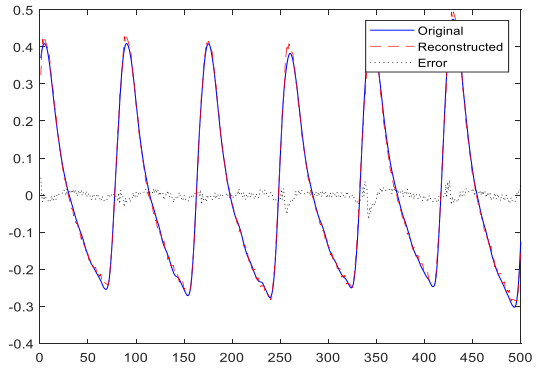

Fig-3: Final output of PPG signal

V. ADVANTAGES

1. It can be Simple and inexpensive method.

2. Easy to handle , small- sized devices.
3. Greater number of body locations.
4. Patient`s information will be stored with no errors.

VI. CONCLUSION

Quality of the reconstructed PPG signal can be controlled precisely. Patient information is restored with no errors .The signal reconstruction error is neither dependent on stenographic operation nor on the size of the patient information data. value shows faithful and lossless restoration of patient's information**.**

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