2D dan 3D set partitioning in hierarchical trees spiht untuk kompresi data electrocardiogram multi-lead = 2D and 3D set partitioning in hierarchical trees spiht for multi-lead electrocardiogram data compression / Sani Muhamad Isa

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Abstrak

[ABSTRAK
penelitian ini diusulkan implementasi 2D dan 3D Set Partitioning In Hierarchical Trees (SPIHT) coding pada kompresi data ECG multi-lead. Implementasi SPIHT mereduksi tiga jenis redundansi yang umumnya terdapat pada sinyal electrocardiogram (ECG), yaitu redundansi intra-beat, inter-beat, dan inter-lead. Kami juga mengusulkan tiga teknik optimisasi untuk meningkatkan kinerja kompresi lebih lanjut dengan mengelompokkan sinyal ECG yang berasal dari beberapa lead, menyusun kembali posisi ECG cycle pada 2D ECG array (beat reordering), dan menormalisasikan amplitudo dari 2D ECG array dengan residual calculation. Beat reordering menyusun posisi beat pada 2D ECG array berdasarkan kemiripannya dengan beat terdekat. Penyusunan ini mengurangi variasi antar beat-beat yang berdekatan sehingga 2D ECG array mengandung lebih sedikit komponen frekuensi tinggi. Residual calculation mengoptimalkan penggunaan ruang penyimpanan lebih lanjut dengan meminimalkan variasi amplitudo dari 2D ECG array.

Hasil eksperimen terhadap sejumlah record pada St Petersburg INCART 12-lead Arrhythmia Database menunjukkan bahwa metode yang diusulkan menghasilkan distorsi rendah pada rasio kompresi 8 dan 16. Hasil eksperimen juga memperlihatkan bahwa pendekatan 3D SPIHT memiliki kinerja kompresi yang lebih baik dibanding 2D SPIHT. Untuk mengevaluasi kualitas sinyal hasil rekonstruksi pada permasalahan klasifikasi, pada penelitian ini kinerja dari metode kompresi sinyal ECG dianalisis dengan cara membandingkan sinyal asli dengan sinyal hasil rekonstruksi pada dua permasalahan; pertama, klasifikasi sleep stage berdasarkan sinyal ECG; kedua, klasifikasi arrhythmia. Hasil eksperimen menunjukkan bahwa akurasi dari klasifikasi sleep stage dan klasifikasi arrhythmia menggunakan sinyal hasil rekonstruksi sebanding dengan menggunakan sinyal input. Metode yang diusulkan dapat mempertahankan karakteristik sinyal pada kedua permasalahan klasifikasi tersebut.;
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ABSTRACT
In this study we proposed the implementation of 2D and 3D Set Partitioning In Hierarchical Trees (SPIHT) coding to a multi-lead ECG signal compression. The implementation of SPIHT coding decorrelates three types of redundancy that typically found on a multi-lead electrocardiogram (ECG) signal i.e. intra-beat, inter-beat, and inter-lead redundancies. We also proposed three optimization techniques to improve the compression performance further by grouping the ECG signal from precordial and limb leads, reordering the ECG cycles position in the 2D ECG array, and normalizing the amplitude of 2D ECG array by residual calculation. Beat reordering rearranged beat order in 2D ECG array based on the similarity between adjacent beats. This rearrangement reduces variances between adjacent beats so that the 2D ECG array contains less high frequency component. The residual calculation optimizes required storage usage further by minimizing

amplitude variance of 2D ECG array.

Our experiments on selected records from St Petersburg INCART 12-lead Arrhythmia Database show that proposed method gives relatively low distortion at compression rate 8 and 16. The experimental results shows that 3D SPIHT approach gives better compression performance than 2D SPIHT. To evaluate the quality of reconstructed signal for classification task, we analyzed the performance of electrocardiogram (ECG) signal compression by comparing original and reconstructed signal on two problems. First, automatic sleep stage classification based on ECG signal; second, arrhythmia classification. Our experimental results showed that the accuracy of sleep stage classification and arrhythmia classification using reconstructed ECG signal from the proposed method is comparable to the original signal. The proposed method preserved signal characteristics for the automatic sleep stage and arrhythmia classification problems.;In this study we proposed the implementation of 2D and 3D Set Partitioning In Hierarchical Trees (SPIHT) coding to a multi-lead ECG signal compression. The implementation of SPIHT coding decorrelates three types of redundancy that typically found on a multi-lead electrocardiogram (ECG) signal i.e. intra-beat, inter-beat, and inter-lead redundancies. We also proposed three optimization techniques to improve the compression performance further by grouping the ECG signal from precordial and limb leads, reordering the ECG cycles position in the 2D ECG array, and normalizing the amplitude of 2D ECG array by residual calculation. Beat reordering rearranged beat order in 2D ECG array based on the similarity between adjacent beats. This rearrangement reduces variances between adjacent beats so that the 2D ECG array contains less high frequency component. The residual calculation optimizes required storage usage further by minimizing amplitude variance of 2D ECG array. Our experiments on selected records from St Petersburg INCART 12-lead Arrhythmia Database show that proposed method gives relatively low distortion at compression rate 8 and 16. The experimental results shows that 3D SPIHT approach gives better compression performance than 2D SPIHT. To evaluate the quality of reconstructed signal for classification task, we analyzed the performance of electrocardiogram (ECG) signal compression by comparing original and reconstructed signal on two problems. First, automatic sleep stage classification based on ECG signal; second, arrhythmia classification. Our experimental results showed that the accuracy of sleep stage classification and arrhythmia classification using reconstructed ECG signal from the proposed method is comparable to the original signal. The proposed method preserved signal characteristics for the automatic sleep stage and arrhythmia classification problems., In this study we proposed the implementation of 2D and 3D Set Partitioning In Hierarchical Trees (SPIHT) coding to a multi-lead ECG signal compression. The implementation of SPIHT coding decorrelates three types of redundancy that typically found on a multi-lead electrocardiogram (ECG) signal i.e. intra-beat, inter-beat, and inter-lead redundancies. We also proposed three optimization techniques to improve the compression performance further by grouping the ECG signal from precordial and limb leads, reordering the ECG cycles position in the 2D ECG array, and normalizing the amplitude of 2D ECG array by residual calculation. Beat reordering rearranged beat order in 2D ECG array based on the similarity between adjacent beats. This rearrangement reduces variances between adjacent beats so that the 2D ECG array contains less high frequency component. The residual calculation optimizes required storage usage further by minimizing amplitude variance of 2D ECG array. Our experiments on selected records from St Petersburg INCART 12-lead Arrhythmia Database show that proposed method gives relatively low distortion at compression rate 8 and 16. The experimental results shows that 3D SPIHT approach gives better compression performance than 2D SPIHT. To evaluate the quality of reconstructed signal for

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