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Real time QRS complex detection using DFA and regular grammar

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Abstract

Background: The acquisition of Q, R, and S peaks (QRS) complex detection is a crucial procedure in electrocardiogram (ECG) processing and analysis. We propose a novel algorithm for QRS complex detection based on the dynamic time warping (DTW) algorithm with the addition of some constraints. This paper considers that signals can be used for detecting QRS complex and representing normalised ECG signals. A QRS is considered to be a pair of adjacent peaks which meet the four criteria of standard deviation and duration.

Results: The proposed method was applied on several trials of ECG signals sourced from the standard MIT-BIH arrhythmia database. A total of 40 signals were used. For an input signal, several parameters were determined such as QRS duration, RR distance, and the peak amplitude. RR and rQRS parameters were added to quantify the regularity of RR distance and QRS duration, respectively. The sensitivity of the suggested method was 99.74% and the specificity was 99.94%. Moreover, the sensitivity and the specificity rates according to the topographic maps were very promising.

Conclusions: Regular grammar with the addition of some constraints and additional rules summarise a novel algorithm for ECG signal processing. Compared to traditional methods, the use of grammar provides satisfactory and competitive results and it could be more comparable to or more better than those used in the literature.

Keywords: ECG signal, QRS complex, RR distance, DFA, Regular grammar

Background

The acquisition of Q, R, and S peaks complex detection is one of the most frequently addressed tasks in ECG signal processing and analysis. A wide range of methods allowing high detection rates have been proposed and used [1–4]. Nevertheless, the problem remains open since the variety of ECG signals and the noise that might impact them. These methods include the Spline Vector Machine (SVM) [5–10], the fuzzy neural networks [11–14] and the wavelets [1, 17–24]. Saha *et al.* [15, 16] utilised the first-order derivatives of the Gaussian function as a window for the characterisation of ECG beats. The authors used the dyadic wavelet transform to detect and measure the different parts of a signal, especially the duration of the beginning and the end of the QRS complex. Subsequently, it showed the robustness of the algorithm in the presence of a high-frequency noise added to the signal. In [11], a dyadic wavelet transform was used to extract

Real Time Qrs Complex Detection Using Dfa And Regular Grammar

Wolfgang Guggemos



Real Time Qrs Complex Detection Using Dfa And Regular Grammar:

This book delves into Real Time Qrs Complex Detection Using Dfa And Regular Grammar. Real Time Qrs Complex Detection Using Dfa And Regular Grammar is a vital topic that needs to be grasped by everyone, ranging from students and scholars to the general public. This book will furnish comprehensive and in-depth insights into Real Time Qrs Complex Detection Using Dfa And Regular Grammar, encompassing both the fundamentals and more intricate discussions.

1. The book is structured into several chapters, namely:
 - Chapter 1: Introduction to Real Time Qrs Complex Detection Using Dfa And Regular Grammar
 - Chapter 2: Essential Elements of Real Time Qrs Complex Detection Using Dfa And Regular Grammar
 - Chapter 3: Real Time Qrs Complex Detection Using Dfa And Regular Grammar in Everyday Life
 - Chapter 4: Real Time Qrs Complex Detection Using Dfa And Regular Grammar in Specific Contexts
 - Chapter 5: Conclusion
2. In chapter 1, the author will provide an overview of Real Time Qrs Complex Detection Using Dfa And Regular Grammar. The first chapter will explore what Real Time Qrs Complex Detection Using Dfa And Regular Grammar is, why Real Time Qrs Complex Detection Using Dfa And Regular Grammar is vital, and how to effectively learn about Real Time Qrs Complex Detection Using Dfa And Regular Grammar.
3. In chapter 2, the author will delve into the foundational concepts of Real Time Qrs Complex Detection Using Dfa And Regular Grammar. The second chapter will elucidate the essential principles that need to be understood to grasp Real Time Qrs Complex Detection Using Dfa And Regular Grammar in its entirety.
4. In chapter 3, this book will examine the practical applications of Real Time Qrs Complex Detection Using Dfa And Regular Grammar in daily life. The third chapter will showcase real-world examples of how Real Time Qrs Complex Detection Using Dfa And Regular Grammar can be effectively utilized in everyday scenarios.
5. In chapter 4, this book will scrutinize the relevance of Real Time Qrs Complex Detection Using Dfa And Regular Grammar in specific contexts. The fourth chapter will explore how Real Time Qrs Complex Detection Using Dfa And Regular Grammar is applied in specialized fields, such as education, business, and technology.
6. In chapter 5, this book will draw a conclusion about Real Time Qrs Complex Detection Using Dfa And Regular Grammar. The final chapter will summarize the key points that have been discussed throughout the book.

This book is crafted in an easy-to-understand language and is complemented by engaging illustrations. This book is highly recommended for anyone seeking to gain a comprehensive understanding of Real Time Qrs Complex Detection Using Dfa And Regular Grammar.

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