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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 rejecting non-QRS 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 received 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 classes, RR distances, and the peak amplitudes. RR and rQRS parameters were added to quantify the regularity of RR distances and QRS detection, 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 top-100 Miss and False were 99.99%.

**Conclusions:** Regular grammar with the addition of some constraints and additional rules summarizes a novel algorithm for ECG signal analysis. 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 Support Vector Machine (SVM) [5–10], the fuzzy neural networks [11–14] and the wavelets [1, 17–24]. Saha et al. [15, 16] utilized the first-order derivatives of the Gaussian function as a window for the discrimination of ECG beats. The authors used the dyadic wavelet transform to detect and measure the different parts of a signal, especially the baseline at 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 [1], a dyadic wavelet transform was used to extract

# Real Time Qrs Complex Detection Using Dfa And Regular Grammar

**Tao Wei**



## **Real Time Qrs Complex Detection Using Dfa And Regular Grammar:**

## Unveiling the Energy of Verbal Art: An Emotional Sojourn through **Real Time Qrs Complex Detection Using Dfa And Regular Grammar**

In some sort of inundated with displays and the cacophony of fast conversation, the profound energy and emotional resonance of verbal beauty often fade into obscurity, eclipsed by the continuous barrage of noise and distractions. Yet, nestled within the musical pages of **Real Time Qrs Complex Detection Using Dfa And Regular Grammar**, a fascinating perform of fictional elegance that impulses with organic thoughts, lies an unique trip waiting to be embarked upon. Published by a virtuoso wordsmith, this enchanting opus courses readers on an emotional odyssey, lightly revealing the latent possible and profound influence stuck within the delicate internet of language. Within the heart-wrenching expanse of this evocative analysis, we can embark upon an introspective exploration of the book is key styles, dissect their captivating writing type, and immerse ourselves in the indelible effect it leaves upon the depths of readers souls.

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