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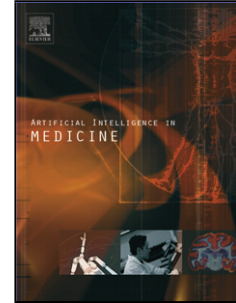
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Premature Ventricular Contraction Detection Combining Deep Neural Networks and Rules Inference

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Highlights

- We proposed a new approach combining deep neural networks and rule inference for PVC detection.
- We combined LCNN and LSTM for PVC detection.
- We used rules inference for detecting the recordings or beats that were classified into non-PVC class and PVC class by the method with the LCNN and LSTM.
- The results obtained by our method represented a performance improvement with respect to some published methods.

Abstract—Premature ventricular contraction (PVC), which is a common form of cardiac arrhythmia caused by ectopic heartbeat, can lead to life-threatening cardiac conditions. Computer-aided PVC detection is of considerable importance in medical centers or outpatient ECG rooms. In this paper, we proposed a new approach that combined deep neural networks and rules inference for PVC detection. The detection performance and generalization were studied using publicly available databases: the MIT-BIH arrhythmia database (MIT-BIH-AR) and the Chinese Cardiovascular Disease Database (CCDD). The PVC detection accuracy on the MIT-BIH-AR database was 99.41%, with a sensitivity and specificity of 97.59% and 99.54%, respectively, which were better than the results from other existing methods. To test the generalization capability, the detection performance was also evaluated on the CCDD. The effectiveness of the proposed method was confirmed by the accuracy (98.03%), sensitivity (96.42%) and specificity (98.06%) with the dataset over 140,000 ECG recordings of the CCDD.

Index Terms—Detection, Premature Ventricular Contraction (PVC), Deep Neural Networks, Rules Inference

1. Introduction

An electrocardiogram (ECG) reflects the heart's activity and provides a large amount of information about the state of the heart. Thus, an ECG is extremely useful as a diagnostic tool in clinical practice. A typical heartbeat in an ECG signal contains four basic waveforms: the P-wave, the QRS complex, the T-wave, and the U-wave^[1]. Physicians can correctly diagnose heart diseases based on some of the characteristic parameters, such as RR interval, ST segment, QRS complex duration, and QRS complex morphology, and so on.

Premature ventricular contraction (PVC) is a relatively common form of cardiac arrhythmia

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