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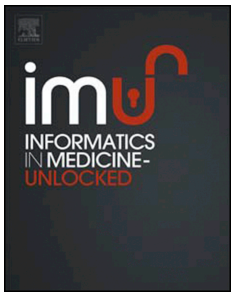

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Multiclass classification of myocardial infarction with convolutional and recurrent neural networks for portable ECG devices

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Abstract

Myocardial infarction (MI) is a medical emergency for which the early detection of symptoms is desirable. The prevalence of portable electrocardiogram (ECG) devices makes frequent screening for MI possible. In this study, we develop an MI classifier that combines both convolutional and recurrent neural networks, and is suitable for wearable ECG devices with only a single lead recording. It performs multiclass classification to discriminate the ECG records of MI from those of healthy individuals and patients with existing chronic heart conditions, as well as ECG records contaminated with noise. The method was tested on a database with MI ECG records and compared with a pure convolutional neural network and classifier with hand-crafted features. It was found that the addition of a recurrent layer improved the classification sensitivity by 28.0% compared to the convolutional neural network alone. Overall, it achieved 92.4% sensitivity, 97.7% specificity, a 97.2% positive predictive value, and a 94.6% F1 score.

Keywords: Myocardial infarction, Electrocardiogram, Deep learning, Convolutional neural network, Recurrent neural network, Classification

1. Introduction

Myocardial infarction (MI), more commonly known as a heart attack, is a medical emergency requiring immediate attention [1]. During an MI episode, blood flow to the heart tissues is disrupted owing to full or partial blockage of the coronary arteries. Without a full supply of oxygen and nutrients (ischemia), the heart tissues

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