

Assessing ECG Signal Quality Using a Pre-trained Audio Network

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Background and Aim. Novel ECG wearable systems offer the possibility for continuous cardiac monitoring acquiring long periods of ECG signal uninterrupted. Thus, ECG signals obtained from wearable often suffer from severe noise, necessitating automated quality assessment. Recent advancements have demonstrated the effectiveness convolutional neural networks (CNNs) in this domain. The transfer learning approach has been widely used in vision and natural language processing domains, however its application to an ECG signal directly as audio data remains relatively unexplored. Therefore, the aim of this study is explore the applicability of this technique in the assessment of ECG signal quality.

Methodology. To utilize a pre-trained audio network with ECG signals, it was necessary a previous preprocessing. Usually, ECG signals are sampled up to a maximum frequency of 1000 Hz, whereas in audio signals the sampling frequency is notably higher. The ECG signals were normalized and resampled to 16 KHz. The pretrained model is called YAMNet, short for “Yet Another Audio Mobilenet Network,” and is a deep neural network pre-trained on the AudioSet corpus. It predicts 521 audio event classes, making it suitable for various audio-related tasks. The network was fine-tuned to bridge this gap by adapting YAMNet, originally designed for audio event classification, to ECG quality assessment.

Results. After ten iterations of training using a proprietary dataset composed of 20,000 5 second-length ECG intervals (50% clean and 50% noisy), the model was tested by using a publicly available database with a different morphology. Results show a slight unbalance between sensitivity and specificity, obtaining rates of about 82% and 74% respectively.

Significance. The utilization of ECG signals as audio data to be inputted in a pre-trained audio network demonstrates the feasibility of using YAMNet for ECG quality evaluation, opening new avenues for audio-based transfer learning in healthcare applications.