A Dilated CNN with Temporal Feature Extraction for Atrial Fibrillation Detection

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Aims: This study aimed to boost the ability of detecting atrial fibrillation by integrating domain knowledge and deep feature representation. Current methods based on deep neural networks for atrial fibrillation detection tend to prefer raw signals as input, ignoring valuable clinical experience in ECG diagnosis.
Methods: We proposed a novel feature extraction method. By locating R peaks in the ECG signal, we developed a temporal mask that was further used to generate a pseudo QRS complex signal and a pseudo T, P wave signal, thereby separating different phases in an ECG cycle. A novel neural network was then trained on the decomposed signal, using dilated convolutional kernels with growing dilation rate and residual structure to provide large and flexible receptive fields.
Results: The performance of our method was examined on the Physionet/CinC 2017 Challenge dataset, achieving an average F1 score of 0.843, which is the SOTA result. The method was further tested on the MIT-BIH Atrial Fibrillation Database, where an average F1 score of 0.985 was obtained.
Conclusion: our proposed ECG signal decomposition technique introduces simple and reliable domain knowledge into deep neural networks. The dilated residual network is efficient in extracting important and generalized features of ECG signals, thereby improving performance in AF detection. The simplicity and versatility of our method show promise for other tasks involving ECG signals.

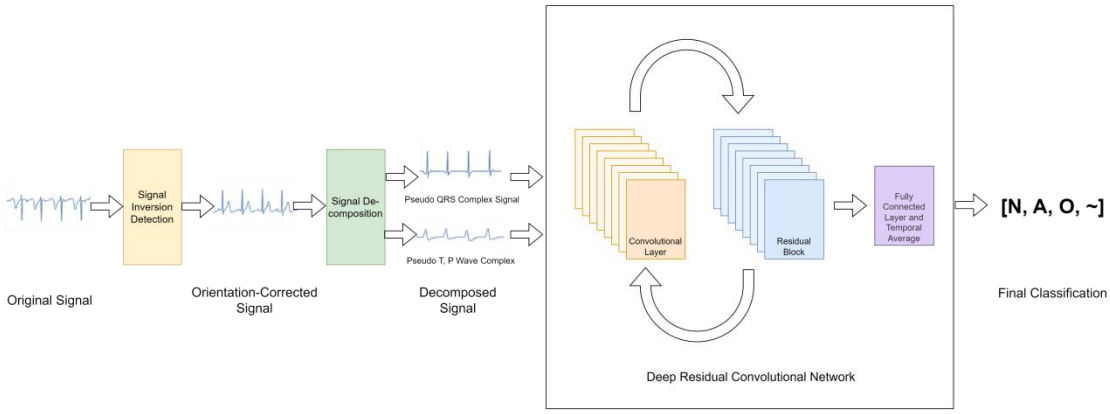

Figure 1. Overview of our proposed method