A Branched Deep Neural Network for End-to-end Classification from ECGs with Varying Dimensions

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Objective: Computerized electrocardiogram (ECG) interpretation plays a critical role in the clinical ECG workflow. Widely available digital ECG data and the algorithmic paradigm of deep learning present an opportunity to substantially improve the accuracy and scalability of automated ECG classification. For 12-lead ECGs, deep neural networks (DNNs) could match state-of-the-art algorithms when trained in openly available datasets (e.g. 2020 PhysioNet/CinC Challenge data). However, there is limited evidence to demonstrate the utility of reduced-lead ECGs for capturing a wide range of diagnostic information. Thus, in this work, we aimed to develop a deep learning-based algorithm to identify clinical diagnoses from twelve-lead, six-lead, three-lead, and two-lead ECG recordings.

Methods: We have employed a branched DNN that utilizes two CNNs (similar to the residual network, but adapted to signals with varying dimensions) with different filter sizes. This architecture allows DNNs to be efficiently trained by introducing double branch and skip connections. Moreover, the Squeeze-and-Excitation block is added to every branch of the architecture, which allows the DNNs to learn more effective features from input signals.

Results: Our (CQUPT_Dontwant) method is evaluated using the twelve-lead, six-lead, three-lead, and two-lead of the Challenge validation datasets, and we received a Challenge metric score of 0.519, 0.404, 0.501, and 0.498, respectively.

Conclusion: The results demonstrate the effectiveness of the proposed method in achieving robustness towards the classification of ECGs with varying dimensions.