Heart Murmur Detection from Phonocardiogram Recordings by Self-Operational Neural Networks

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***Abstract*—Objective:** Phonocardiogram (PCG) signals are used in ambulatory monitoring to assess the heart's hemodynamic status and detect cardiovascular disease. This study presents a method to detect the presence or absence of murmurs in heart sound recordings from multiple auscultatory areas. **Approach:** To this end, we proposed 1D Self-Organized Operational Neural Networks (Self-ONNs) architecture for PCG signals classification. We used 1D Self-ONN layers to automatically learn morphological representations from PCG cardiac cycles that are first converted into a nine-channel time-frequency representation using wavelet transform. We further inject time-frequency based hand features into the model. The classification layers can thus benefit from both hand-crafted and learned features for the final classification of PCG signals. The final decision rule to classify heart sounds is based on the mean prediction of PCG signals across all available auscultatory areas. When trained, the 1D Self-ONN algorithm can be used to classify PCG data segments in a fast and accurate manner. **Results:** In this study, the proposed methodology is evaluated by applying the scoring mechanism provided by the PhysioNet/Computing in Cardiology (CinC) Challenge 2022. The proposed algorithm (team SAMI) achieves an overall score of 1127 on the train dataset and 1330 on the unseen test dataset. **Conclusion:** An early evaluation of the proposed method indicates that it is capable of distinguishing between different rhythms. Hence, it opens the possibility of computer-assisted interpretation of PCG signals.