Murmur Detection from Phonocardiogram Recordings using Spectral Features

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We propose our method for heart murmur detection from Phonocardiogram recordings. Our method puts focus on the spectral features of the recording's audio signal. We make and test the assumption that murmur sound can occur under specific frequencies. First, for each auscultation locations (if exists), we extract N Mel-frequency Cepstrum Coefficients MFCCs. For each MFCC, we compute simple statistics (mean, variance, and skew). In addition, we take into consideration, the change/difference in the signal over time (DMFCC); that is, for each coefficient $\mathbf{MFCC}_i$ we calculate:

$$\mathbf{DMFCC}_i(t) = \frac{d}{dt}\mathbf{MFCC}_i(t) \qquad i = 1, 2, ..., N$$

Random Forest classifier is used for predicting the existence of heart murmur given the patient demographic and audio features. We perform an ablation study on the training set of the CirCor DigiScope Dataset provided for the PhysioNet Challenge. We compare our results of different configurations that make use of demographic patient features, raw audio signal statistics (mean, variance, and skew), as well as MFCC and DMFCC statistics. Our results are shown in Table 1.

Features	AUROC	AUPRC	Accuracy	F-measure	Challenge
Baseline	0.984	0.960	0.914	0.839	911.297
Baseline + MFCC-5	0.997	0.988	0.950	0.917	667.667
Baseline + MFCC-5 + DMFCC	0.997	0.992	0.962	0.928	555.406
Baseline + MFCC-10 + DMFCC	**0.999**	**0.995**	**0.968**	**0.944**	**516.127**

Table 1. Preliminary results on the training data. Baseline uses demographic features audio signal statistics. MFCC-N indicates using N MFCCs.

Adding MFCC cepstral features provides significant improvement in classification accuracy, compared to temporal only features. Using larger number of MFCC features further improves results. DMFCC further improves the accuracy and provides a best score of 516.13. Ongoing work focuses on improving the performance using additional features and time-series segmentation algorithms .