Comparison between Sample Entropy and AR-models for Heart Sound-based Detection of Coronary Artery Disease

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The first reported observations of rare diastolic murmurs in patients with coronary artery disease (CAD) dates back to the late sixties. Several studies have subsequently examined various signal processing methods for identification of weak heart murmurs. Two such methods are autoregressive (AR) modeling and sample entropy. The aim of the current study is to analyze the relationship between features from an AR-model and features describing signal entropy. Sample entropy and the poles of a 6th order AR model were calculated from diastolic intervals in heart sound recordings randomly selected from a database of high quality stethoscope recordings. In total 100 recordings were analyzed (50 patients with two recordings each). The patients were referred for coronary angiography and the percentages of artery occlusions were collected from the angiography. The stethoscope recordings were made from the left 4th intercostal space on the chest of patients. The recordings were sampled at 4000 Hz and band-pass filtered with a 6 order Chebyshev filter with pass-band edge frequencies at 50 Hz and 500 Hz. The parameters for Sample entropy was m=2 and r=0.5 x STD. The angle of the first AR pole was the best AR feature for discriminating CAD patients from non CAD patients. CAD patients (N=23) were defined as patients having at least one coronary stenosis with a minimum of 50% diameter reduction. The area under the receiver operating characteristic curve was 0.765 (95% CI: $\pm$0.09) for the AR pole and 0.762 (95% CI: $\pm$0.09) for Sample entropy. The spearman correlation between the two measures was 0.92.