Separation Of The Valvular Contribution To Heart Sounds Through Blind Source Separation In Multi-Channel Phonocardiography

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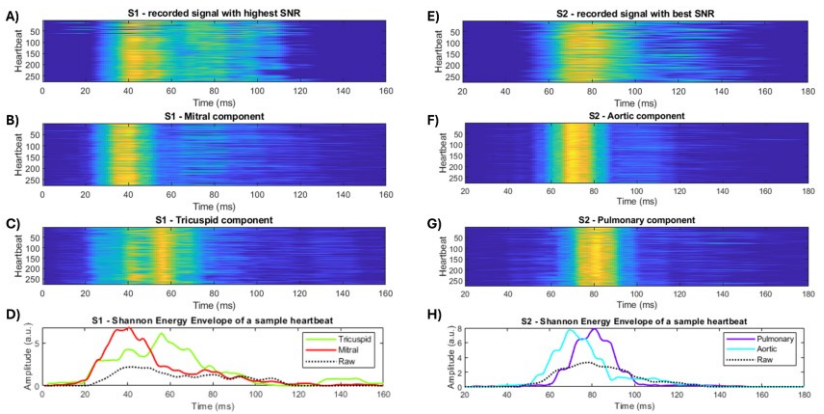
Introduction: The separation of the contribution of the left and right cardiac valves to heart sounds is an open challenge in the field of phonocardiography. Yet, reliably measuring their time of closure in a noninvasive fashion would open to novel monitoring possibilities. **Materials and Methods**: We explored the potentiality of Blind Source Separation (BSS) applied to multi-channel recordings at high spatial resolution to separate the components of the two main heart sounds. Our pipeline involves a pre-processing stage to isolate the segments of interest, a dimensionality reduction stage performed via clustering, and the use of Independent Component Analysis to perform BSS. **Results**: We applied our method to a sample population of 52 healthy volunteers and obtained a successful separation of the components. The estimated time of closure proved consistent with the physiology of the heart sounds. Moreover, the time of closure of the mitral and tricuspid valves from S1 proved significantly different, as well as the time of closure of the aortic and pulmonary valves from S2, proving that the separation was effective. **Conclusions**: We believe that this work makes a step further towards the clinical use of heart sound components and lays the foundation to novel possibilities of the analysis of heart sounds.



Outcome of the separation of the mitral and tricuspid components of S1 and the aortic and pulmonary components in S2 on the Shannon Energy envelope.