

# **An Automatic Tool for Pediatric Heart Sound Segmentation**

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A large number of children referred for echocardiography have normal hearts; this number could be noticeably decreased by using a computer-assisted screening system. A big obstacle for development of such an automatic screening system comes from the fact that children's heart murmurs are typically more intensive than those of adults, which decreases the robustness of the heart sound segmentation step.

In this paper, we present an original segmentation tool, based on our previous work [Amir Sepehri et al, 2010, A Novel Method for Pediatric Heart Sound Segmentation without Using the ECG, Computer Method and Programs in Biomedicine, Elsevier, in print]. The method works in two steps. We first extract cardiac cycles using wavelet transform. Then we segment first and second heart sounds within the cycle by taking their spectral properties into account. We enhance the robustness of our original algorithm by coupling ECGs and PCGs.

In order to assess the method, we prepared 120 heart sound signals, each containing 10 seconds of phonocardiogram and electrocardiogram with various abnormalities, recorded under the supervision of pediatric cardiologists using echocardiography and complementary tests in the Children Heart Center of Tehran. The abnormalities include mild to severe systolic murmurs, third and fourth heart sounds. We used 60 samples as a training data-bank and the remaining 60 samples as a test data-bank. Results showed that in more than 93% of the test data-bank, the system correctly identifies first and second heart sounds while in 100% of them, cardiac cycles are correctly extracted. The algorithm, as well as a subset of the data, are incorporated into a freely available tutorial software (with a user-friendly GUI), which could be demonstrated at the conference.