Extracting Fetal ECG from a Single Maternal Abdominal Record

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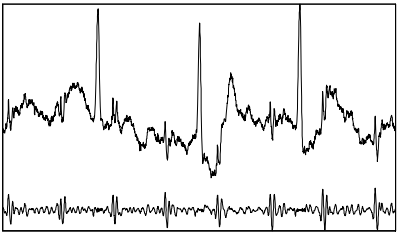
Fetal ECG (FECG) is the electrical activity of fetal heart muscles and it can reveal vital information of fetal heart status. This signal can be recorded non-invasively during pregnancy from the abdomen of a pregnant woman. However, such a recording of the FECG would be useless since it is largely overwhelmed by the maternal ECG and other sources of noise. Nonetheless, if the abdominal recording is properly processed then a useful FECG can be extracted and it can provide a very good and simple means for detecting and diagnosing fetal heart diseases.



Upper plot shows real abdominal record, Lower one shows extracted FECG with proposed method.

Many methods have been proposed for FECG extraction from abdominal signals. They usually need multi-channel input; hence, they require complex lead structure.

In this work, we introduce a novel two-tier technique for extracting fetal ECG from a single abdominal record. The proposed method in its first tier extracts an estimate of the maternal ECG by processing the abdominal signal through a Savitzky-Golay smoothing filter. The estimated maternal ECG is then nonlinearly aligned with the abdominal signal using polynomial networks to extract the fetal ECG signal. Results on synthetic and real abdominal ECG data show that the proposed method can extract fetal ECG with signal quality comparable or better than that extracted by multi-channel based methods.