The NInFEA dataset for non-invasive fetal electrocardiography research

The fetal ECG extraction from non-invasive recordings is still an open research issue. The lack of open, large, standard datasets including both electrophysiological signals and an appropriate gold standard hampers the progress of the research in the field.

This work presents a new open dataset, that will be made available on Physionet by September 2018, acquired, maintained and continuously improved in the framework of the Non-Invasive Fetal ECG Analysis (NInFEA) project. The dataset includes electrophysiological recordings performed with the TMSi Porti7 at 2048 Hz, a maternal respiration signal acquired by the same device through a thoracic resistive belt, and video/images of fetal pulsed-wave Doppler (PWD) ultrasound recording obtained by a Philips iE33 at 60 frames per second, through which it is possible to assess the fetal heart activity from a mechanical perspective. The chosen electrode configuration includes up to 22 unipolar abdominal electrodes, 2 further channels on the maternal back, and 3 thoracic bipolar channels to record the maternal ECG components, enabling the evaluation of algorithms requiring maternal reference signals. Furthermore, the chosen positioning allows reproducing up to 10 different positioning choices presented in the scientific literature. The PWD is recorded on a 5-chamber apical window, and synchronized with the other signals by means of a trigger. All the relevant information about the pregnancy, presentation and health status of the fetus are registered.

At the time of writing, the dataset includes 36 high-quality homogeneous traces obtained from 22 pregnant women (21st to 27th gestational week). The simultaneous recordings are 10s to more than 1min long. Compared to currently available datasets, the proposed one allows the non-invasive fetal ECG analysis even in early pregnancies and with algorithms requiring multiple channels, eventually including maternal references, with hitherto unavailable information, and could represent a valuable open tool in the field.