

## SEPARATION OF FETAL-ECG FROM SINGLE CHANNEL ABDOMINAL ECG USING ACTIVATION SCALED NON-NEGATIVE MATRIX FACTORIZATION

### ABSTRACT

Performing a fetal electrocardiogram (ECG) analysis which contains important information about the status of a fetus, can help to detect fetus health even before birth. Since the fetal ECG extracted from the ECG signal recorded from the mother's abdomen, this extraction problem can be seen as a source separation problem, of recovering source signals from signal mixtures. In this project, a method for separation of fetal ECG from abdominal ECG using activation scaled non-negative matrix factorization (NMF) is proposed. The performance of the proposed method is also compared with independent component analysis (ICA). The proposed method is tested under three different scenarios when (i) the original abdominal ECG signal is used for fetal separation (ii) the recovered abdominal ECG after compression is used for separation (iii) the fetal ECG is extracted from the compressed domain of the abdominal ECG. We applied scaling on the activation matrix obtained using NMF for emphasizing the fetal ECG present in abdominal ECG. The improved regularized least square ( $l_p$  - RLS) algorithm is used for signal reconstruction, which provides better reconstruction quality and less processing time in comparison with other existing methods. The proposed algorithm is evaluated and tested on real abdominal recordings obtained from two different datasets from Physionet. The first dataset used for this study is Silesia dataset for abdominal and direct f-ECG, and the second dataset we considered is Set-A of the Physionet challenge dataset. The obtained outcomes reveal that it is possible to separate fetal ECG from single channel abdominal ECG signal which can help us to achieve energy efficient transmission, and cost effective fetal ECG remote monitoring for Internet of Things applications where device battery and



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computational capacity are limited. This project is implemented with MATLAB software.

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