Framework for Noise Cancellation (FraNC)

RWTH, ?

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1   Purpose

To provide implementations of noise mitigation techniques with a common interface and automated performance evaluations.

We aim to provide a modular framework containing flexible, multi-channel implementations of noise mitigation techniques with a common python interface. This includes classic signal processing techniques such as Wiener (WF) and Least-Mean-Squares (LMS) filters, as well as Deep Learning approaches utilizing, for example, classical and graph convolutional networks. Inputs are the witness and target sensor time series and the output is the predicted noise. Using the common interface, we aim to provide automated training/conditioning, and evaluations of the filter's noise cancellation performance and comparisons of their processing rate.

2   Components and Status

Most aspects have been developed separately but require consolidation into one coherent implementation:

- WF & adaptive filter implementations

- Deep Learning techniques

- Evaluation of cancellation performance and processing rates

- Generation of test datasets for developement and methodological validation

    - Simple white-noise based test-cases
    - Loading recorded waveforms and a numerical simulation of Newtonian noise from seismic waves in simplified geometries

Future work:

- Analysis of biases from Noise Mitigation

3   Underlying models

- Wiener Filter

- Adaptive filtering (e.g. LMS filter)

- Deep Learning: multi-layer perceptron, convolutional neural networks and graph neural networks in Tensorflow and/or PyTorch

4   Main Contact Person

TODO (name + mail-address)