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CPS Paper

Big-data Feature Analysis in a Cyclostationary Model Framework

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CPS0075_FrancoisMarshall

Brief Description

When a harmonic signal appears in noise and the residual noise is red, this may be evidence for residual periodicity, and a simple model for this is to assume the presence of normal modes in the power spectrum.

As long as spectral power does not diverge too rapidly approaching zero frequency, it may also be true that the noise finite-dimensional distribution (FDD) exhibits normality.

Here, two novel visualization diagnostics are introduced that make use only of the power spectrum to characterize the noise FDD.

The first diagnostic reveals the quality of the harmonic periodicity in both the mean and spectral-power signals, while the second reveals the extent to which the joint distribution of the multitaper Fourier-transform processes exhibits spherical, proper, Gaussian behaviour.
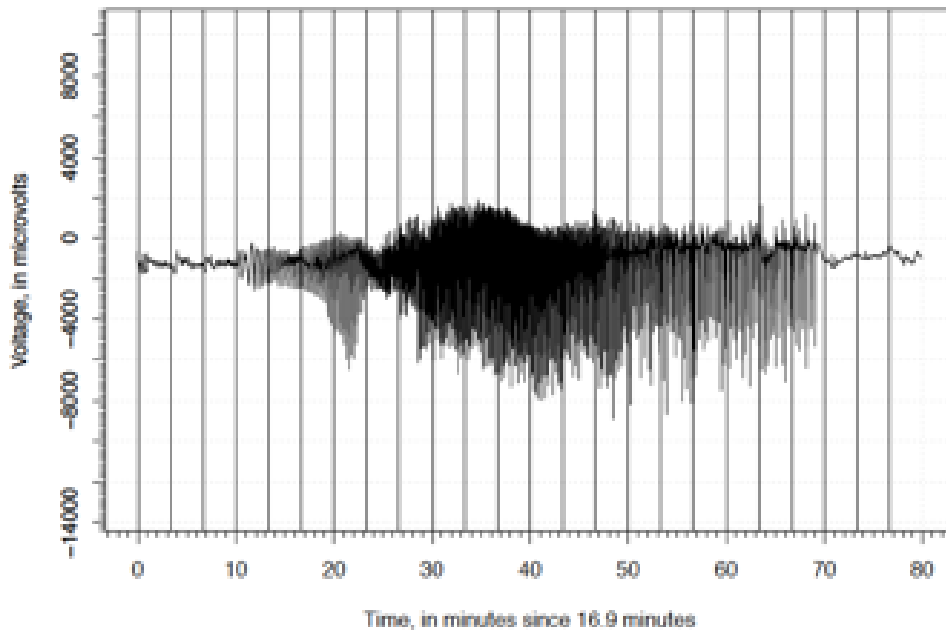
It is shown for a two-sample survey of epileptic-seizure, microelectrode-voltage time series how these visualization techniques explain time-evolutionary periodicity for long records in a manner more efficient than a spectrogram due to invariance of the diagnostic metrics to linear filtering.
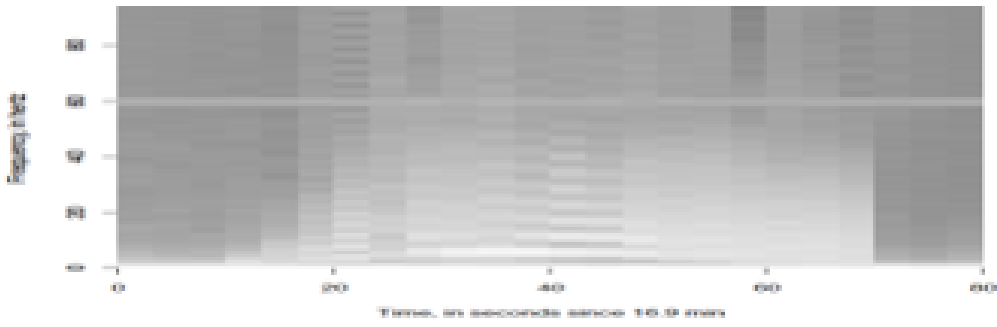
Abstract

When a harmonic signal appears in noise and the residual noise is red, this may be evidence for residual periodicity, and a simple model for this is to assume the presence of normal modes in the power spectrum. As long as spectral power does not diverge too rapidly approaching zero frequency, it may also be true that the finite-dimensional distribution (FDD) exhibits normality. Here, two visual diagnostics are introduced that make use only of the power spectrum to characterize the FDD. The first diagnostic specifies the quality of harmonic periodicity in both the mean and spectral-power signals, while the second reveals the extent to which the joint FDD of the multitaper Fourier-transform processes exhibits spherical, proper, Gaussian behaviour. It is shown for a two-sample survey of epileptic-seizure, microelectrode-voltage time series how these visualization techniques explain time-evolutionary periodicity for long records in a manner more efficient than a typical spectrogram.

Figures/Tables

Picture1_PNG

Time, in minutes since 16.9 minutes

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Time, in seconds since 16.9 min

F–statistic, in relative decibel value from 3.64 (p=5%, left) to 5004.19 (p=0%, right)