Correlation dimension of Magnetoencephalographic signals as a marker for brain pathogeny.
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Non linear signal analysis is a powerful technique that reveals qualitative and quantitative differentiations between different dynamical systems (biological or otherwise). Specifically the correlation dimension of a signal time series can be considered as a direct measure of the underlying dynamical system’s complexity. There are indications that the healthy brain, due to the statistical nature of neuronal discharges, is a very high, theoretically infinite complexity system. Thus low dimensionality discovered in the Magnetoencephalographic signals can be construed as a sign of pathogeny.

Presented here is part of an ongoing effort to quantitatively investigate the differentiation of the correlation dimension of Magnetoencephalograms (MEG) received from persons having clinically diagnosed brain pathogeny and normal healthy volunteers. We present MEG recordings from patients with different diseases of the central nervous system. Specifically we present MEG recordings of patients with malignant CNS lesions, a highly localized and anatomical pathology, and MEG recordings of patients diagnosed with idiopathic generalized epilepsy, a disease without localized lesion. Moreover we studied the MEG signals from healthy volunteers.

A 122-channel SQUID biomagnetometer in an electromagnetically shielded room was used to record the MEG signals and the Grassberger-Procaccia method for the estimation of the correlation dimension was applied on the phase space reconstruction of the recorded signal from each subject.

The results of this study support the hypothesis that low dimensionality, low complexity, of the signal’s dynamic is a sign of high organization in the underlying dynamical system, that is, in our case, the brain.

Keywords: Chaos in the Brain, Magnetoencephalography, Non-linear signal processing, Biomedical signals, Correlation dimension.