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Recurrence Method in the Analysis of Electroencephalographic Signals in Healthy Adults under Light-Dark Conditions.

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Electroencephalography is one of the non-invasive techniques used for analyzing brain activity. Its signals are recorded from several electrodes placed on the scalp. Recorded signals reflect the functional state of the brain, which is allied to the person's mental condition.

We analyze electroencephalographic signals (EEG signals) using recurrence methods. These signals were collected during an experiment where each person was exposed to light of two different colors (blue and red) in contrast to the dark. In addition to linear signal filtering methods and independent component analysis applied to EEG signals, we used a non-linear method, recurrence plot, to characterize the system that produces them.

Using Takens theorem, we obtain a set of vectors that were built from the value of the EEG signals. Then we analyze the distance matrix between vectors obtained from the one chosen EEG signal. Based on these matrices we perform recurrence quantification analysis, and calculate: percent determinism, Shannon entropy and average line length. They gives information about changes in the dynamics of the sources producing the EEG signal under light-dark conditions. We demonstrate that light selectively affects EEG signal sources. Their effects are also diversed by changes in the dynamic properties of these sources.