



Synchronization of EEG: Bivariate and Multivariate Measures

Sujithra Jenifer.M¹, Antony Gnana Anusiya.S², Nancy Lydia.T³

Department of Information Technology, Francis Xavier Engineering College, Tirunelveli, India¹

Department of Information Technology, Francis Xavier Engineering College, Tirunelveli, India²

Assistant Professor, Department of Information Technology, Francis Xavier Engineering College, Tirunelveli, India³

Abstract: Electroencephalographic (EEG) signals is important for decoding information processing in the human brain, synchronization in pairs of EEG signals to whole brain synchronization maps. Then it can be based on bivariate measures averaging over pair wise values or, alternatively, on multivariate measures, which directly ascribe a single value to the synchronization in a group. In order to compare BM and MM, we applied nine different estimators to simulated multivariate time series with known parameters and to real EEGs. We found widespread correlations between BM and MM, which were almost frequency independent for all the measures except coherence. The analysis of the behavior of synchronization measures in simulated settings with variable coupling strength, connection probability, and parameter mismatch showed that some of them, including S-estimator, S-Renyi, omega, and coherence, are more sensitive to linear interdependences, like mutual information and phase locking value, are more responsive to nonlinear effects. One must consider these properties together with the fact that MM are computationally less expensive and, more efficient for the large scale data sets than BM while choosing a synchronization measure for EEG analysis.

Keywords: Bivariate Measures (BM), Coupled Oscillators, ElectroEncephaloGram (EEG), Multivariate Measures (MM), Synchronization.

