Non-linear dynamical analysis has emerged as a novel method for the study of complex systems in the past few decades. At present, almost all methods of time-domain and frequency-domain EEG analysis are based on implicit assumptions regarding the statistical characteristics of the underlying random process, particularly with respect to the extent of stationarity and Gaussianity of the process. The non-linear analysis method is effectively applied to ElectroEncephaloGram (EEG) to study the dynamics of the complex underlying behavior. The growth of this method as a tool for mental health evaluation mainly rests on the non-invasive nature of EEG. In addition, a better understanding of some of the nonlinear properties of different EEG ensembles might eventually result in a better understanding of the neurophysiological mechanism of spontaneous EEG generation, a mechanism which is still not well understood.

Analysis of nonlinear EEG is a very important research branch of medicine, because of its clinical applications and in brain dynamics research. During the past few years there has been an increasing interest in applying higher – order statistics to a wide range of signal processing and system theory problems. These statistics are very useful in problems where non-Gaussianity, nonminimum phase, colored noise, or nonlinearities are important and must be accounted for. Higher-order Statistics are applicable when we
are dealing with non-Gaussian (or, possibly, nonlinear) processes and many real world applications are truly non-Gaussian.

This thesis presents a novel method to detect the nonlinearities in EEG signal using higher order statistics and spectra. Here our statistical threshold, based on the normality assumption, was verified using Chi-square goodness of fit test.