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### Identification of epileptic seizures from the EEG signals through phase space analysis and machine learning technique

#### Abstract:

Epilepsy is an abnormal brain condition characterized by the excessive synchronous firing of cortical neurons. An electroencephalogram (EEG) serves as a diagnostic tool to identify the underlying brain dynamics responsible for seizures. Neurologists must continuously evaluate EEG recordings from the background activity during preoperative stages to detect seizures, a process that can be tedious and susceptible to errors. Therefore, automatic identification of seizure and seizure-free EEG signals is crucial for effective treatment and diagnosis. This study introduces a novel method for classifying seizure-free (interictal and preictal) and seizure (ictal) EEG signals, utilizing features extracted from phase space reconstruction (PSR). The dynamic characteristics of brain signals manifest as elliptical patterns in phase space due to their oscillatory nature. Consequently, the proposed method calculates the elliptical area and the interquartile range of the Euclidean distances within the PSR as distinguishing features. These features are then fed into a k-nearest neighbour machine learning algorithm to identify seizure and seizure-free EEG signals. The results demonstrate that the proposed features perform superior classification in distinguishing between various seizure stages with minimum computational time compared to existing methods. Thus, phase space features embedded with the machine learning algorithm can serve as a reliable and robust technique for discriminating and identifying seizure signals.

#### Biography

**Sreelatha K.S.** is an Associate Professor of Physics at Government College Kottayam, Kerala, India. She holds an M.Sc. in Physics from Mahatma Gandhi University, an M.Phil and a Ph.D. from the Cochin University of Science and Technology, Kerala. With 24 years of teaching and research experience, she has guided Ph.D., M.Phil. and Postdoctoral students and supervised a large number of M.Sc. projects. Her research interests include nonlinear dynamics, brain dynamics, chaos, optical solitons, and nanomaterials. She has published 42 refereed research papers, edited two books, and delivered over 30 invited talks.