FRATSAN: A New Software for Fractal Analysis of Signals

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Abstract : Fractal analysis is assessing fractal characteristics of data. It consists of several methods to assign fractal characteristics to a dataset which may be a theoretical dataset or a pattern or signal extracted from phenomena including natural geometric objects, sound, market fluctuations, heart rates, digital images, molecular motion, networks, etc. Fractal analysis is now widely used in all areas of science. An important limitation of fractal analysis is that arriving at an empirically determined fractal dimension does not necessarily prove that a pattern is fractal; rather, other essential characteristics have to be considered. For this purpose a Visual C++ based software called FRATSAN (FRActal Time Series ANalyser) was developed which extract information from signals through three measures. These measures are Fractal Dimensions, Jeffrey's Measure and Hurst Exponent. After computing these measures, the software plots the graphs for each measure. Besides computing three measures the software can classify whether the signal is fractal or no. In fact, the software uses a dynamic method of analysis for all the measures. A sliding window is selected with a value equal to 10% of the total number of data entries. This sliding window is moved one data entry at a time to obtain all the measures. This makes the computation very sensitive to slight changes in data, thereby giving the user an acute analysis of the data. In order to test the performance of this software a set of EEG signals was given as input and the results were computed and plotted. This software is useful not only for fundamental fractal analysis of signals but can be used for other purposes. For instance by analyzing the Hurst exponent plot of a given EEG signal in patients with epilepsy the onset of seizure can be predicted by noticing the sudden changes in the plot.

Keywords : EEG signals, fractal analysis, fractal dimension, hurst exponent, Jeffrey's measure

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