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## Classification of Normal, Ictal and Inter-ictal EEG via Direct Quadrature and Random Forest Tree

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**Abstract:** This paper presents an accurate nonlinear classification method that can help physicians diagnose seizure in electroencephalographic (EEG) signal characterized by a disturbance in temporal and spectral content. This is accomplished by applying four steps. First, different EEG signals containing healthy, ictal and seizure-free (inter-ictal) activities are decomposed by empirical mode decomposition method. The instantaneous amplitudes and frequencies of resulted bands (intrinsic mode functions, IMF) are then tracked by the direct quadrature method (DQ). In contrast to other approaches, DQ cancels the effect of amplitude modulation on frequency calculation. The dissociation between instantaneous amplitude and frequency information is therefore fully achieved to avoid features confusion. Afterwards, the Shannon entropy values of both sets of instantaneous values (amplitudes and frequencies) related to every IMF are calculated. Finally, the obtained entropy values are classified by random forest tree. The proposed procedure yields 100% accuracy for (healthy)/(ictal) and 98.3?99.7% for (healthy)/(ictal)/(interictal) classification problems. The suggested method is hence robust, accurate, fast, user-friendly, data driven with open access interpretability.