Grid Computing Technology and Recurrence Quantification Analysis to Predict Seizure Occurrence in Patients Affected by Drug-resistant Epilepsy

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Nowadays, a hot topic in the field of epilepsy research is the detection of any reliable marker embedded in the electroencephalograms (EEGs) which can be exploited to predict the incoming seizure with a sufficient anticipation. This would greatly improve the effectiveness of the administration of conventional anti-epileptic drugs as well as the investigation of novel therapeutic strategies. A useful analytical tool which may help epileptologists to unveil significant patterns of behaviour embedded in EEGs from epilepsy sufferers is recurrence quantification analysis (RQA).

This mathematical technique can be easily exploited by any researchers since RQA software applications and related source codes are freely available. Additionally, these programs can run on ordinary PCs and their usage is at the reach to any investigator with a little background in computing. Nevertheless, the analysis of extensive EEGs can be considerably CPU-time-consuming so researchers are often enforced to strongly reduce the amount of data which RQA is applied to. This computing-time constraint makes the investigators fully at risk of loss of important information that might be embedded anywhere in the time series of EEGs. High throughput computing, enabled Grid technology appears as the best solution to solve this problem. The ongoing research is focused on performing RQA of EEGs recorded from four epileptic patients who underwent pre-surgical evaluation for the resection of epileptic foci, being all these patients refractory to any conventional anti-epileptic drug treatments. EEGs were segmented in epochs of proper length, each one analysable independently from the others by the submission of parametric jobs to a Grid computing infrastructure. This research exploits the computing resources of the Italian Grid (www.italiangrid.org) for the Grid-it VO. In order to foster the uptake of the grid paradigm by non-expert users, the GENIUS Grid portal, powered by EnginFrame (www.enginframe.com), has been adopted as official
Web Server interface to allow epileptologists to conduct RQA in Grid Infrastructures. In the presentation, preliminary results of the study will be shown and future work will be outlined.