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Big Data GPU-Driven Parallel Processing Spatial and Spatio-Temporal Clustering Algorithms

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Advances in graphics processing units' technology towards encompassing parallel architectures [1], comprised of thousands of cores and multiples of parallel threads, provide the foundation in terms of hardware for the rapid processing of various parallel applications regarding seismic big data analysis. Seismic data are normally stored as collections of vectors in massive matrices, growing rapidly in size as wider areas are covered, denser recording networks are being established and decades of data are being compiled together [2]. Yet, many processes regarding seismic data analysis are performed on each seismic event independently or as distinct tiles [3] of specific grouped seismic events within a much larger data set. Such processes, independent of one another can be performed in parallel narrowing down processing times drastically [1,3]. This research work presents the development and implementation of three parallel processing algorithms using Cuda C [4] for the investigation of potentially distinct seismic regions [5,6] present in the vicinity of the southern Hellenic seismic arc. The algorithms, programmed and executed in parallel comparatively, are the: fuzzy k-means clustering with expert knowledge [7] in assigning overall clusters' number; density-based clustering [8]; and a selves-developed spatio-temporal clustering algorithm encompassing expert [9] and empirical knowledge [10] for the specific area under investigation.

Indexing terms: GPU parallel programming, Cuda C, heterogeneous processing, distinct seismic regions, parallel clustering algorithms, spatio-temporal clustering

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