

Parallel Computation of 2D Morse-Smale Complexes

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Abstract: The Morse-Smale complex is a useful topological data structure for the analysis and visualization of scalar data. This paper describes an algorithm that processes all mesh elements of the domain in parallel to compute the Morse-Smale complex of large two-dimensional data sets at interactive speeds. We employ a reformulation of the Morse-Smale complex using Forman's Discrete Morse Theory and achieve scalability by computing the discrete gradient using local accesses only. We also introduce a novel approach to merge gradient paths that ensures accurate geometry of the computed complex. We demonstrate that our algorithm performs well on both multicore environments and on massively parallel architectures such as the GPU.

Index Terms: Visualization techniques and methodologies, Region growing, partitioning

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