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Some Practicable Applications of Quadtree Data Structures/Representation in Astronomy

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Development of quadtree as hierarchical data structuring technique for representing spatial data (like points, regions, surfaces, lines, curves, volumes etc.) has been motivated to a large extent by storage requirements of images, maps and other multidimensional (spatially structured) data. For many spatial algorithms time-efficiency of quadtrees in terms of execution may be as important as their space-efficiency concerning storage conditions.

Briefly, the quadtree is a class of hierarchical data structures which is based on the recursive partition of a square region into quadrants and subquadrants until a predefined limit.

Beyond the wide applicability of quadtrees in image processing, spatial information analysis and building digital databases (processes becoming ordinary for the astronomical community) there may be numerous further applications in astronomy. Some of these practicable applications based on quadtree representation of astronomical data are presented and suggested for further considerations.

Examples are shown for use of point as well as region quadtrees. Statistics of different leaf and nonleaf nodes (homogeneous and heterogeneous sub-quadrants respectively) at different levels may provide useful information on spatial structure of astronomical data in question. By altering the principle guiding the decomposition process, different type of spatial data may be focused on. Finally, a sampling method based on quadtree representation of an image is proposed which may prove to be efficient in the elaboration of sampling strategy in a region where observations were carried out previously either with different resolution or/and in different bands.