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MADALGO seminars by Thomas Mølhave, Duke University

From Point Clouds to 2D and 3D Grids: A Natural Neighbor Interpolation Algorithm using the GPU

Abstract:

With modern LiDAR technology the amount of topographic data, in the form of massive point clouds, has increased dramatically. One of the most fundamental GIS tasks is to construct a grid digital elevation model (DEM) from these point clouds. We present a simple yet very fast natural neighbor interpolation algorithm for constructing a grid DEM from massive point clouds. We use the graphics processing unit (GPU) to significantly speed up the computation. To handle the large data sets and to deal with graphics hardware limitations clever blocking schemes are used to partition the point cloud. This algorithm is about an order of magnitude faster than the much simpler linear interpolation, which produces a much less smooth surface. We also show how to extend our algorithm to higher dimensions, which is useful for constructing 3D grids, such as from spatial-temporal topographic data. We describe different algorithms to attain speed and memory trade-offs.

Joint work with Alex Beutel and Pankaj K. Agarwal