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MADALGO seminar by Jonathan Richard Shewchuk, University of California at Berkeley

Streaming Computation of Delaunay Triangulations

We show how to compute Delaunay triangulations of utterly huge, well-distributed point sets in 2D and 3D on an ordinary computer by exploiting the natural spatial coherence in a stream of points. We achieve large performance gains by introducing "spatial finalization" into point streams: we partition space into regions, and augment a stream of input points with finalization tags that indicate when a point is the last in its region. By extending an incremental algorithm for Delaunay triangulation to use finalization tags and produce streaming mesh output, we compute a billion-triangle terrain representation for the Neuse River system from 11.2 GB of LIDAR data in 48 minutes using only 70 MB of memory on a laptop with two hard drives. This is a factor of twelve faster than the previous fastest out-of-core Delaunay triangulation software.