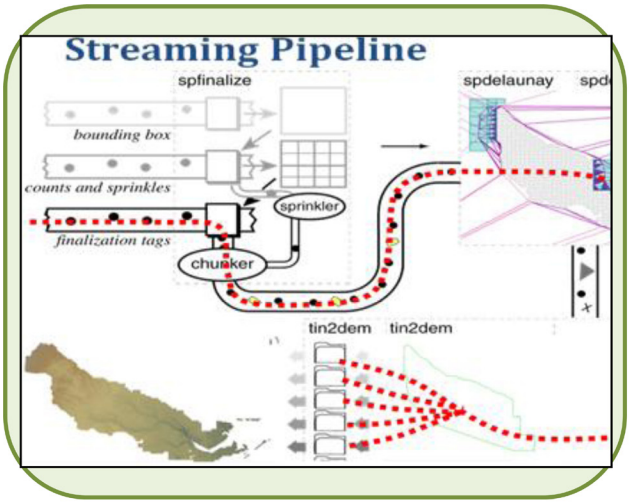
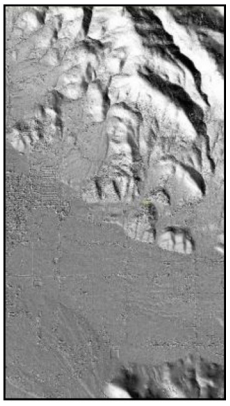
Terrain Modeling and Visualization

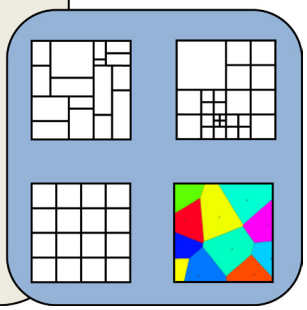
Department of Computer Science | University of North Carolina at Chapel Hill | March 2010





Streaming Mesh (.sma)

```
# Header
# nverts 5
# nfaces 4
# bb_min 0.3 0.1 0.2
# bb_max 1.4 1.1 1.2
# Body
v 0.3 1.1 0.2
v 0.4 0.4 0.5
v 1.4 0.8 1.2
v 0.9 0.5 0.7
f 2 4 1
v 1.0 0.1 1.1
f 4 5 4
f 3 5 4
f 2 1 3
...
```



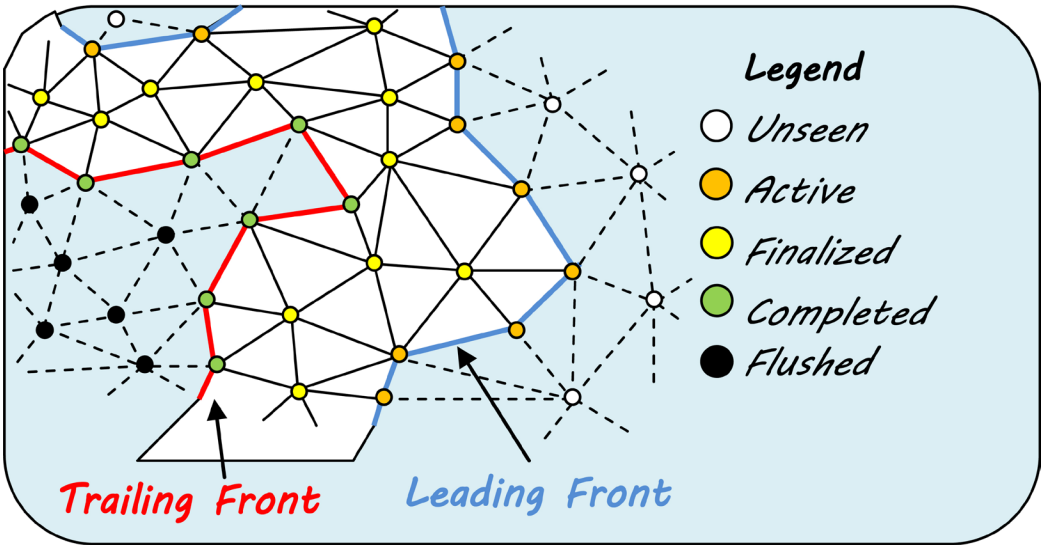
The Challenge

Given an immense data cloud of GIS terrain points, how do we extract meaningful structure from it? Our research group explores important operations on massive GIS terrain data sets: Classification, Comparison, Compression, Filtering, Grouping, Rasterization, Triangulation, and Visualization.

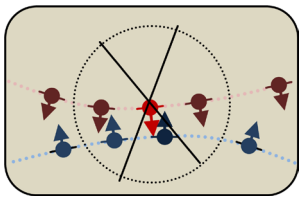
The Approach

We use 3 main concepts in guiding our research: Neighborhoods, Refinement and Streaming.

Neighborhoods: Points do not exist in isolation but are part of a larger neighborhood surrounding them. We use these local neighborhoods to extract structure about each point. Various spatial data structures



(grids, kd-trees, quad-trees, 1-rings, etc.) support different notions of neighborhoods.



Refinement: We construct order of out of chaos by improving initial structures found from point set neighborhoods. From measurements we compute in the initial neighborhoods we make coarse guesses about the underlying data, then refine these guesses into better estimates through filtering by various tests using the discovered structure.

Streaming: Spatial streaming documents spatial locality in a stream of geometric data, like points or triangles. Applications that process data via local neighborhoods can exploit this spatial locality to handle massive data sets with a small memory footprint, giving high performance. We have developed file formats, readers and writers that allow us to spatially stream both point and mesh data, and continue to add new tools for terrain modeling and visualization based on these concepts of neighborhoods, refinement, and streaming.

Current Project Members

Jack Snoeyink (Principal Investigator)
Shawn Brown, Graduate Research Assistant
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Other Collaborators

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Keywords

TMV; terrain modeling and visualization; GIS; computational geometry; streaming; pipelining; streaming points; streaming meshes; Delaunay triangulation; LIDAR; compression; filtering; compression

For More Information

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Apps	Conversion	Finalization	Delaunay	Compress	Simp.	Filters	Vis.
Tool Kits	Surface Fitting	Quad Edge	Octree	kd-Tree	Predicates		
Streams	Scanner	Parser	Point (SP)	Mesh (SM)	Ext (SX)	Wrappers	
Base	Data Types	3D primitives	Allocaters	Containers	GIS Convertors		
Platform	IEEE 754 Floating Point	Memory	Pipes	Files	I/O		

http://wwwx.cs.unc.edu/Research/compgeom/twiki/bin/view.cgi/TModeling/WebHome