Local Delaunay-based high fidelity surface reconstruction from 3D point sets. (English) 

Summary: In this paper, we introduce a feature preserving surface reconstruction algorithm to produce a high fidelity triangulated mesh from an input point set. The concept of local Delaunay triangulation is applied to speed up the reconstruction procedure and to preserve features. The proposed algorithm has running time complexity of $O(n \log n)$, where $n$ is the number of points. Additionally, the local Delaunay triangulation improves the memory efficiency of the proposed method compared to global Delaunay-based methods. We introduced the concept of minimum circum-radius triangle to select the prime-triangle in the local Delaunay mesh. Based on the local projection and minimum circum-radius, our triangle selection criteria ensures the output mesh will be free from non-manifold edges and fold-over triangles. On top of that, we have provided the theoretical correctness of the proposed algorithm with the assumption of $\epsilon$-sampling model. The experimental results show that the proposed method is capable of producing high fidelity meshes from large real-world non-uniform data. We also show the effectiveness of the proposed method compared to the state-of-the-art methods in terms of visual and quantitative analysis.

MSC: 
65D18 Numerical aspects of computer graphics, image analysis, and computational geometry

Keywords: 
surface reconstruction; local Delaunay triangulation; prime triangles

Software: 
SegMatch; Powercrust; CGAL

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References:

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