Fast and robust curve skeletonization for real-world elongated objects

Amy Tabb1 and Henry Medeiros2
1USDA-ARS-AFRS and 2Marquette University

Motivation

Curve skeletons are locally one-dimensional representations of three-dimensional structure, and there is a rich history of work on curve skeletons in various communities. In this work, we intend to use curve skeletons as an intermediate step between surface reconstruction and computing measurements of branches for automation applications in which the following are important:
- robustness to noise
- fast execution
such as in the automatic modeling of fruit trees in an orchard [5].

Approach

The method was evaluated on synthetic data with a known ground truth, and then artificial noise was added.

Synthetic experiments

Our method was compared to Thinning [4], PINK skel [2], PINK filter3d [1], and Jin et al. [3].

Method features and contributions

- An algorithm that operates on voxels
- A path-based algorithm for real-time computation of curve skeletons
- One parameter that represents noise level
- No additional pruning
- Time complexity $O(n^2)$ ($n =$ number of occupied voxels)
- Method can handle loops
- Source code provided

Qualitative results

Figure 1: Root mean squared error of the curve skeletons computed with our method.

Additional Information


References


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Contact Information

- Email: amy.tabb@ars.usda.gov
- Email: henry.medeiros@marquette.edu