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Cantor Hashing for Axially Decorrelated Perlin Noise Generation

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Abstract

Categories and Subject Descriptors (according to ACM CCS): I.3.3 [Computer Graphics]: Picture/Image Generation—Line and curve generation

1. Introduction

JP: Write about procedural noise, motivations and applications [ARZ05]

Discuss the axial correlation of Perlin noise, how better gradient overcomes this limitation. Briefly mention about other noise such as wavelet, Gabor, anisotropics etc..Cite the survey as well.

Discuss pairing functions-mention Cantor and Szudzik etc..What makes them a better hasg=hing function Not in detail. Somehow relate pairing functions to hashing.

Outline the contributions:
-Pairing functions for hashing -Probably a different noise function? -Computational improvements?

2. Related Work

ST: Survey would be a good reference for this section. Adopt the writing style of the survey. Use any recent reference as well. Try to classify the noise functions.

OS: References for Pairing functions

3. Cantor Hashing

3.1. Cantor Pairing

ST: Overview

3.2. Improved Perlin Noise

3.3. Algorithm

3.4. Implementation

4. Evaluation

[TODO:

]

4.1. Procedural Models

In order to analyze how reconstruction algorithms perform w.r.t. varying sampling density, we describe a simple sampling algorithm [OMW16] which creates an approximate ε-sampling on cubic Bézier curves.

First we sample the segments of the Bézier curve densely along its parametrization. Then we determine the normal n_i at each curve sample $s_i \in S$ as orthogonal to the edge connecting its neighbor samples on the curve. The largest empty disc at s_i can be established by s_i, n_i and querying each other curve sample $s_j \in \{S \setminus s_i\}$ by setting the disc center $c_j = s_i + tn_i, \|cs_i\| = \|cs_j\|$, which we solve and then add the c_j having the largest radius of all empty discs to the set of medial axis points M. After having sampled the medial axis, we can simply estimate the lfs for each s_i by locating its nearest neighbor in M and its distance. Note that this computation is not exact due to discretizing the original curve as well as floating point precision, however computing medial axis thus lfs exactly is a hard and expensive task [AAA*09], [ABE09], and since ε-sampling requires an upper bound on distance, but the curve is also discretized, the

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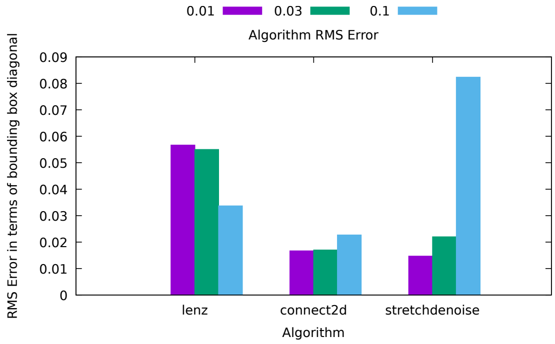

Figure 1: RMS Error of reconstructed curves from ground truth for the point sets used in Figure **??**, with the points perturbed with noise of $\delta = 0.01, 0.03$ and 0.1. (*run-noisy.sh*)

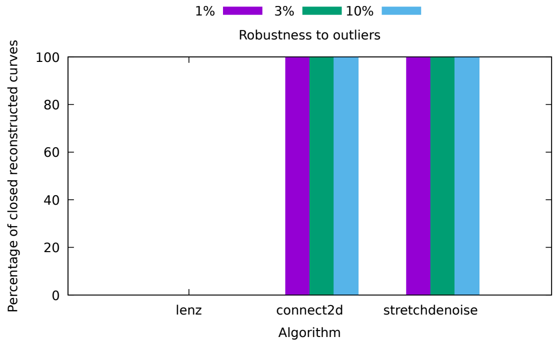

Figure 2: Percentage of closed reconstructed curves for the point sets used in Figure **??**, with a share of $1\%, 3\%$ and 10% outliers added. (*run-outliers.sh*)

chosen samples should be mostly within that bound. In order to sample the curve with a given ε, we now start with any curve sample s_i (or any on its boundary if the curve is open) and iterate over successive samples along the curve while $\|s_i, s_j\| / \mathrm{lfs} < \varepsilon$ and choose the last valid one as next point in our ε-sampling.

Since we have computed the lfs, we can further perturb samples in its terms to simulate feature size varying noise. We retain the sampling density by just moving each sample along their normal which was incidentally determined by the fitting of the empty discs.

4.2. Procedural Textures

[MTSM10]: `http://www.cs.unc.edu/~ravishm/robustPointVisibility_smi_10_files/data/DATA_version_2.zip` [Lee00]: data sets bottle and fish (with SO)

4.3. Evaluation Criteria

Amplitude Distribution

Periodograms

Power spectrum estimate

4.4. Comparative Study

4.5. Results

5. Conclusion

References

[AAA*09] Aichholzer O., Aigner W., Aurenhammer F., Hackl T., Jüttler B., Rabl M.: Medial axis computation for planar free-form shapes. *Computer-Aided Design 41*, 5 (2009), 339 – 349. Voronoi Diagrams and their Applications. 1

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