

Layered Solid Texture Synthesis from a Single 2D Exemplar

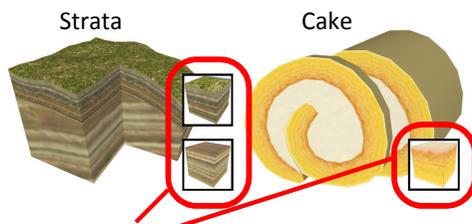
Kenshi Takayama¹, Takeo Igarashi^{1, 2}

¹The University of Tokyo, ²JST/ERATO
kenshi@ui.is.s.u-tokyo.ac.jp

Motivation

Previous work:

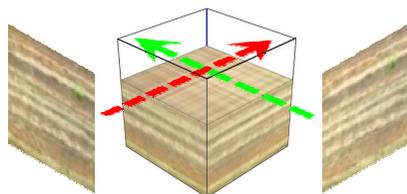
Layered solid textures used in lapped solid textures [2].



Q: How to create them?

Naïve method [2]:

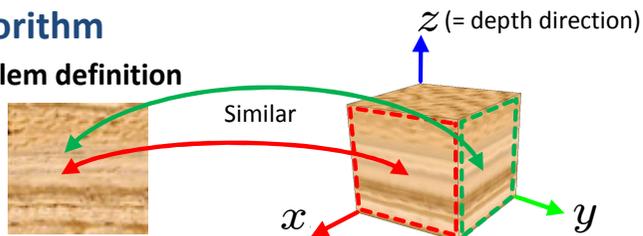
Sweeping a 2D exemplar from two orthogonal directions → “Cross-hatching” artifacts in the depth direction ☹️



Our proposal: An algorithm for synthesizing layered solid textures from single 2D exemplars.

Algorithm

Problem definition

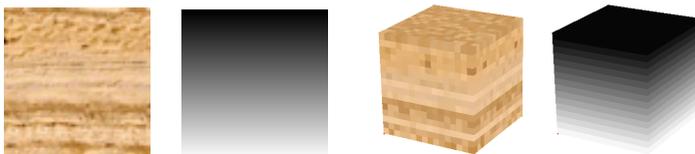


IN: 2D exemplar

OUT: solid texture

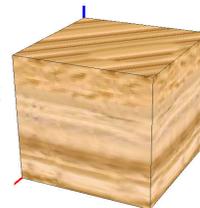
Basic idea: Extend Kopf et al.’s algorithm [1].

Extension 1: Add depth map to both 2D exemplar & 3D synthesis volume.

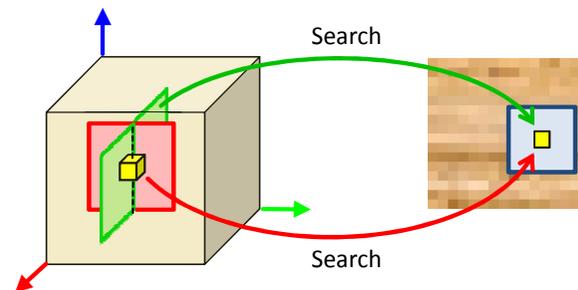


Extension 2: Perform two-pass synthesis process (search and optimization) only in x - and y -directions.

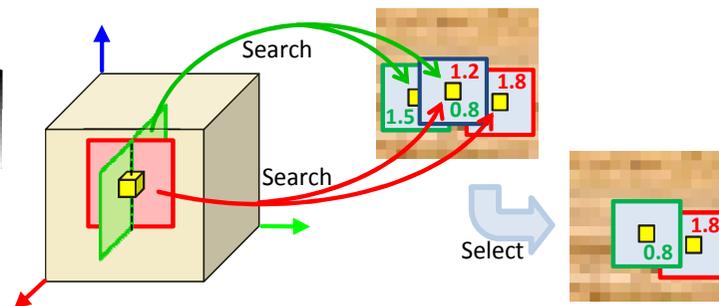
Problem of **sweeping artifact** with simple extensions only.



Cause of sweeping artifact: For each voxel, the two neighborhoods of the current synthesis volume corresponding to the x - and y -directions are very likely to best match with exactly the same neighborhood in the 2D exemplar.

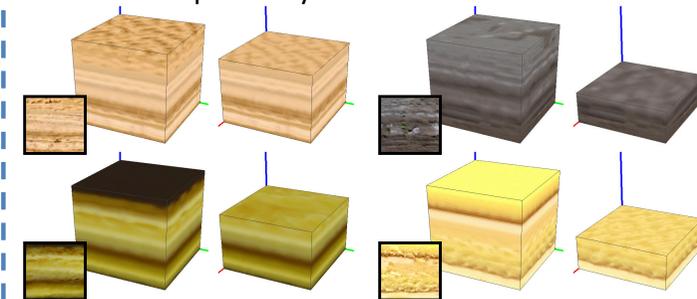


Solution to sweeping artifact: When searching neighborhoods, for each voxel, collect the two best matching neighborhoods in each of the x - and y -directions. If the first best matching neighborhoods in both of the two directions point to exactly the same location in the 2D exemplar, select one of the two according to the matching distances and assign that pixel as the best matching neighborhood for the selected direction. For the other direction, the second best matching neighborhood is chosen as the matching result.

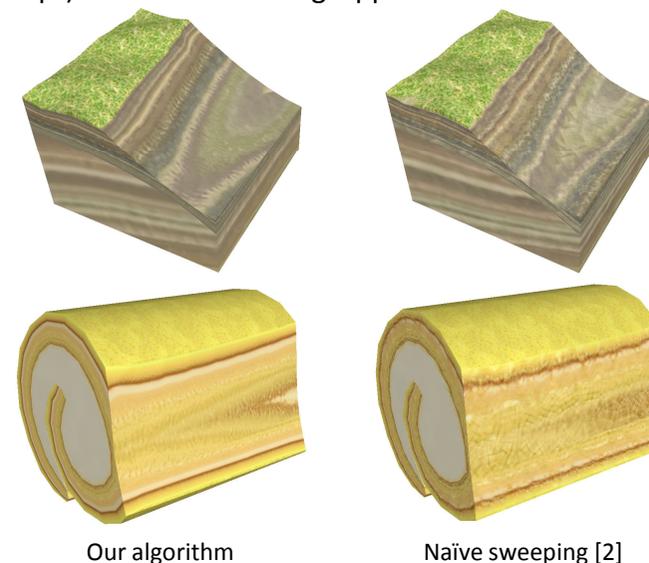


Results

Several examples of synthesized textures.



Applying layered textures (either synthesized or swept) to 3D models using lapped solid textures.



Discussion

- ☺️ “Cross-hatching” artifacts much reduced
- ☹️ Strong blur compared to 2D exemplar
- ☹️ Directionality in depth-axis cross sections

References

- [1] KOPF, J., FU, C.-W., COHEN-OR, D., DEUSSEN, O., LISCHINSKI, D., AND WONG, T.-T. Solid texture synthesis from 2d exemplars. *SIGGRAPH 2007*.
- [2] TAKAYAMA, K., OKABE, M., IJIRI, T., AND IGARASHI, T. Lapped solid textures: filling a model with anisotropic textures. *SIGGRAPH 2008*.