L10 Feb 29, Segmentation

1) Download Moodle/Week 7/GL01_6_ $28_{k}(650,650,100)_{uint16.h5}(85MB)$ 2) Download Moodle/Week 7/GL01_6_ $38_{k}(650,650,100)_{uint16.h5}(85MB)$ Note: Both *.h5 files are also on the HPC server in /project/lbutler/data_materials/basalt/

3) Download Moodle/Week 7/Pgm9_Segmentation_v2.nb

Philosophy

As yet, the human eye is better at detecting patterns in 2D images than Avizo, Mathematica, or ImageJ.

The conversion of gray scale volumes into segmented volumes is a common, challenging problem.



Volcanic basalts: (a) 28 keV and (b) 38 keV

Filename: GL01_5_28k_{650,650,515}_uint16.bin (one of six datasets: 3 samples and two X-ray energies) volume = {650, 650, 515} pixel size = 5.67 µm, file size = 0.44 GB X-ray tomography Advanced Photon Source 13-BM

- GL-01-5: Mid-Atlantic Ridge, Basalt glass 417D 29-4-33, Pillow margin, sea water deposit, about 100 Myr old
- GL-01-6: Columbia River Basalt, Basalt glass DSTW 78-226G, Pillow margin, fresh water deposit, about 100 Myr old
- GL-01-7: Columbia River, Basalt glass "Frenchman Springs Mbr", Pillow margin, fresh water deposit, about 15 Myr old



GL01_5_28k_{650,650,515}_uint16.bin



row





Volcanic basalts: (a) 28 keV and (b) 38 keV

1. Do segmentations of the 28 and 38 keV yield about the same mineral proportions? Can you develop a procedure to merge the segmentations?

2. One phase appears more needle-like in GL01-06. Can this characteristic be quantified and compared with the other samples?



GL01_6_28k_{650,650,515}_uint16.bin



Preliminary result

This is the result of segmentation into three mineral phases. Both the 28 keV and 38 keV data sets are used. One segmentation flaw remains at about z=200.

Note: The pixel size is temporarily set to 1 micron. This setting allows fast conversion of x,y,z coordinates into {row,column,slice} indices. The real pixel size is 5.67 microns.



 $z/\mu m$

Philosophy - Segmentation

A tip from woodworking - the best procedure for prefect sanding.

Avizo: Strengths for 3D segmentation:

- 3D operators
- GUI workflow

Mathematica: Strengths/weaknesses for 3D segmentation

- Only 2D operators
- Can parallelize
- New operators, like total variational filtering



Mathematics: Need more reconstruction and 3D image analysis MA

Jan 9-12, 2006 in Minnesota http://www.ima.umn.edu



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Application

- Audio/Video

- Calendar

IMA theme for Sept '08 - June '09 "Mathematics & Chemistry"

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Imaging, September 2005-June 2006

IMA Workshop:

3-D Image Acquisition and Analysis **Algorithms**

January 9-12, 2006

Organizers:

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Schee	dule Pa	articipants	Registration	Feedback
	Dining Guide			Maps

Schedule and list of participants are not yet available.

New mathematics and algorithms are needed for 3-D image acquisition and analysis. The 3-D images come from many disciplines: biomedicine, geology, chemistry, and microfabrication. The mathematics is wide-ranging and includes at least tomography and inverse problems, wavelets, PDE, and conformal mapping. The depth of the problem and the extent of the mathematics argues for multiple, long-duration collaborations that are fostered by a workshop series.