GPU Panel for Medicine

Computing on GPUs for Biomedical Science and Clinical Practice

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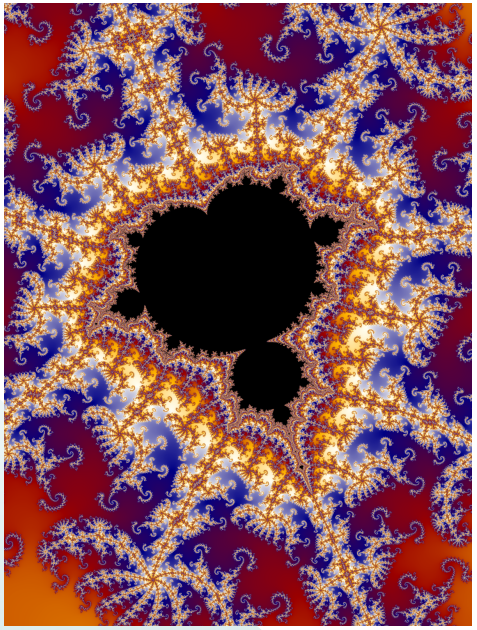
Early GPU(like) computing

1984 – CPU – 2 hours

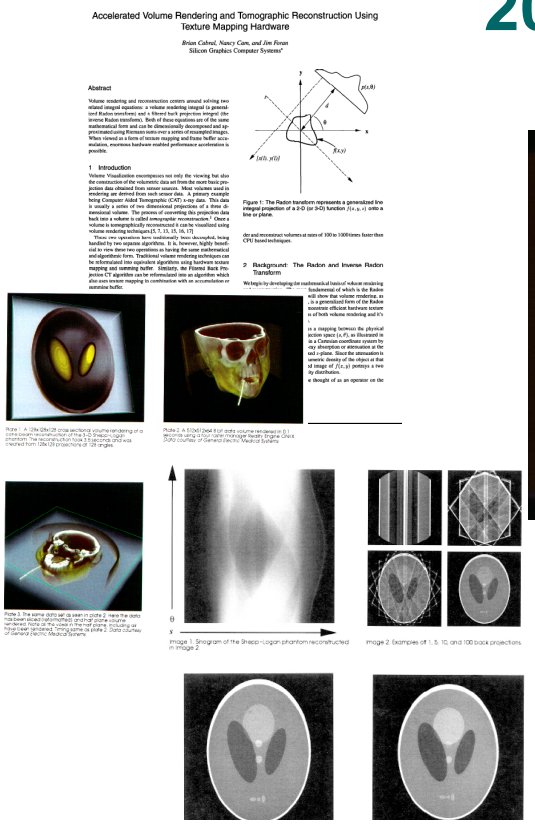


1986 – PxPl4 – 30 msec

Reconstruction and Rendering

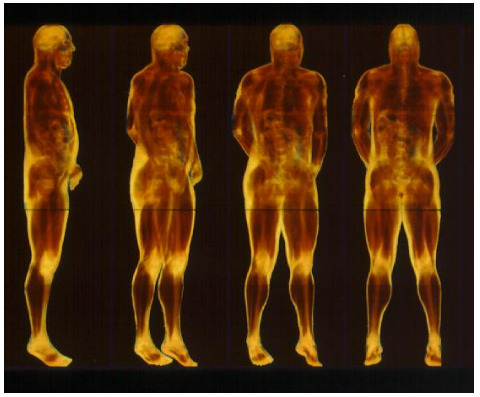
1994 Cabral, Cam, Foran

1. Introduction
2. Background – The Radon and Inverse Radon Transform
    - 2.1. Orthographic volume rendering and the generalized Radon Transform
    - 2.2. Fan beam reconstruction
3. Three Dimensional reconstruction and rendering
    - 3.1 Cone Beam Reconstruction
    - 3.2. Perspective Volume Rendering using the Generalized Radon Transform
4. Computational complexity
    - 4.1. FTT and filtering complexity
    - 4.2. Back projection and Radon transform complexity
5. A texture map based reconstruction algorithm
6. Texture mapped volume rendering
7. Performance results
8. Future directions and conclusions
9. Acknowledgements


Accelerated Volume Rendering and Tomographic Reconstruction Using Texture Mapping Hardware

Brian Cabral, Nancy Cam, and Jim Foran
Silicon Graphics Computer Systems*

2009 – NLM VHP VolRen



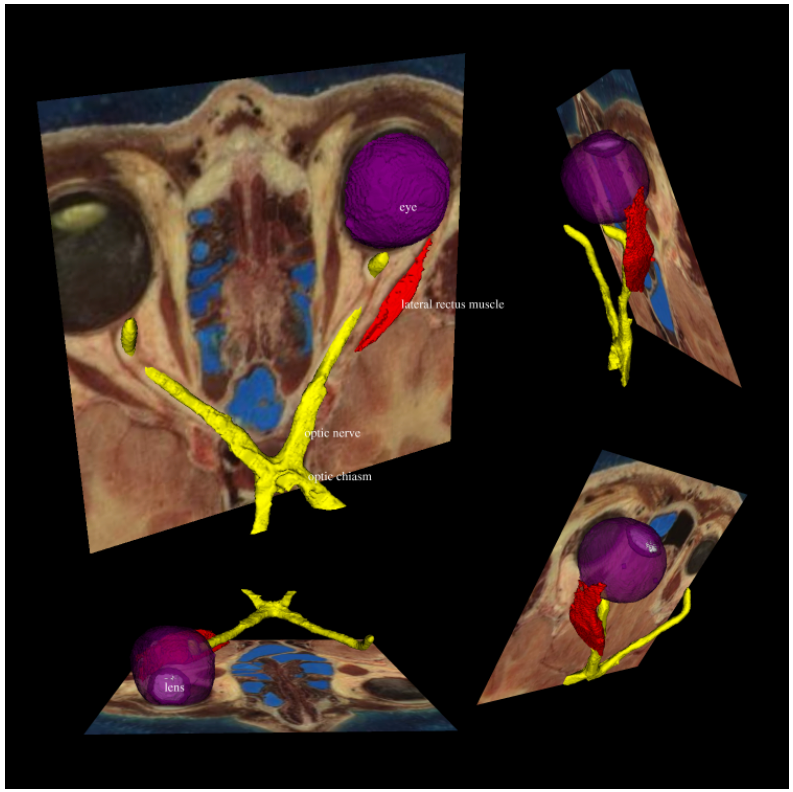
Insight Toolkit (ITK)

An open-source software toolkit for performing image analysis, registration, and segmentation

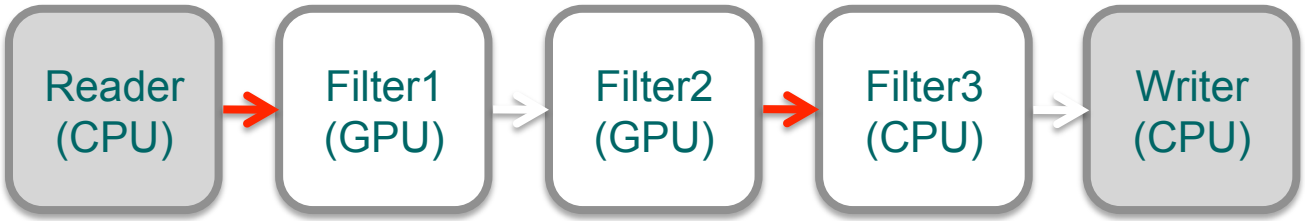
Collection of over 1500+ filters and algorithms for medical image processing

Examples:

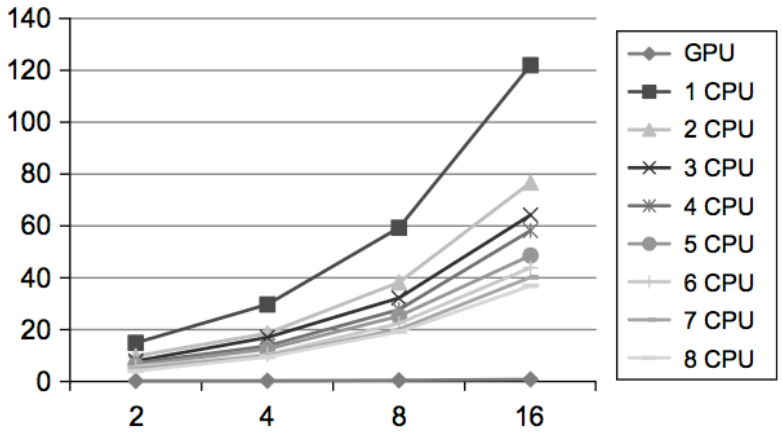
- Interactive watershed segmentation
- Viola-Wells: Mutual Information registration
- Osher-Sethian: Level set segmentation framework



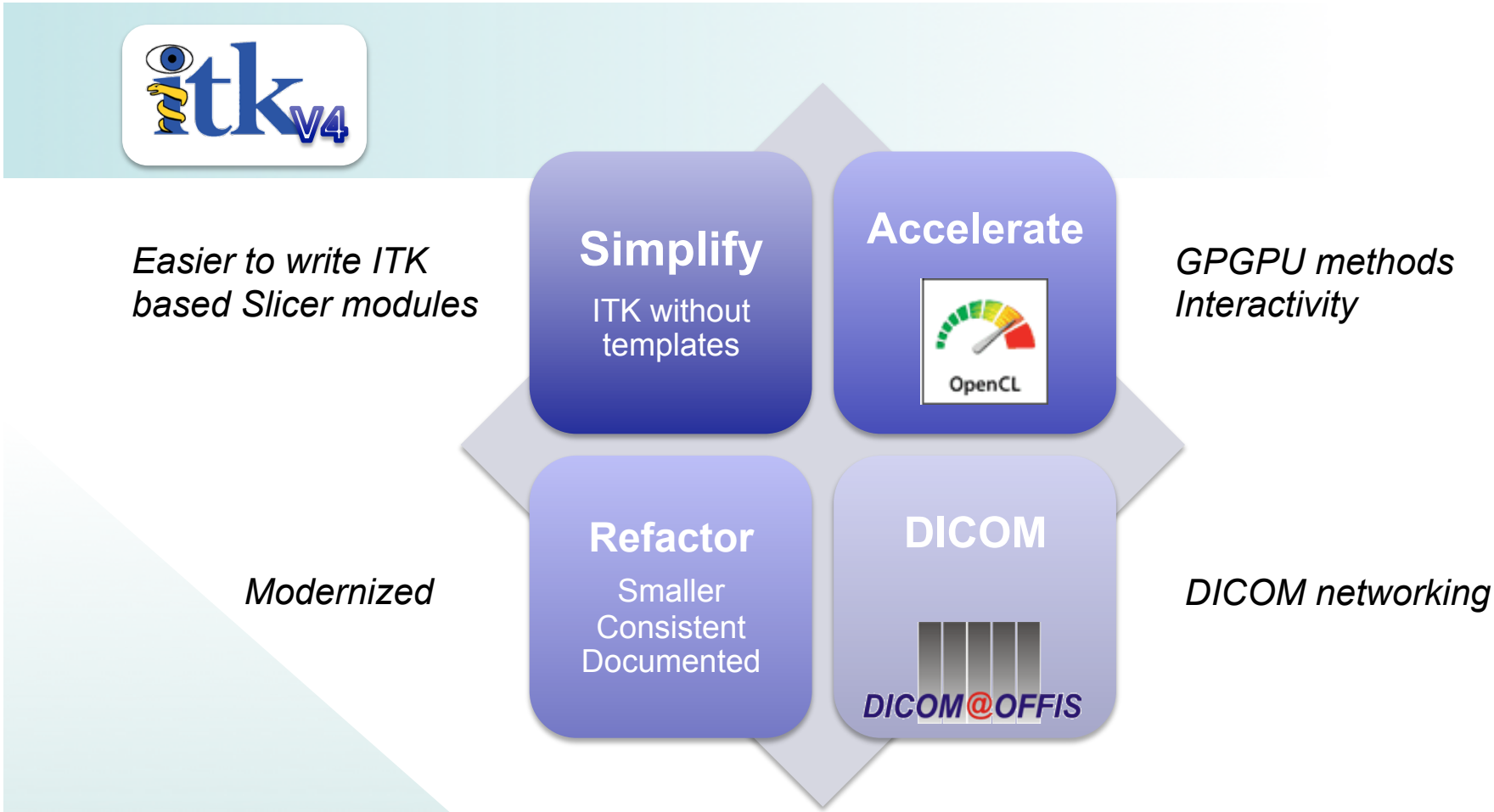
ITKv4: Accelerate



# iter	2	4	8	16
GPU	0.225	0.308	0.479	0.82
1 CPU	14.9	29.7	59.3	122
2 CPU	9.78	18.6	38.2	76.7
3 CPU	7.89	17	32.2	64.2
4 CPU	7.13	13.7	27.7	58.2
5 CPU	6.3	12.5	25.2	48.2
6 CPU	5.76	10.4	22.4	43.9
7 CPU	4.89	9.86	20.1	40.2
8 CPU	4.08	9.49	19.2	36.9
Speedup	18x	30.8x	40x	45x



- **Example**: Anisotropic Diffusion Filter
- One GPU was up to 45 times faster than 1-8 CPUs



ITK v4 is an ARRA funded contract from the National Library of Medicine