

Implementation of selected algorithms for processing of volumetric data

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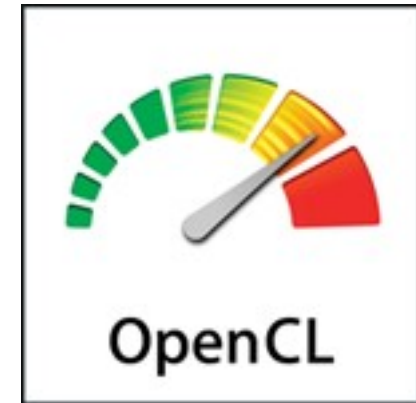
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Chapters of diploma thesis

- Introduction to OpenCL
- Processing of volumetric data by Slice streaming
- Testing implementation of separable 3D convolution in openCL and f3d
- Implementation of iterative filters in slice streaming of f3d

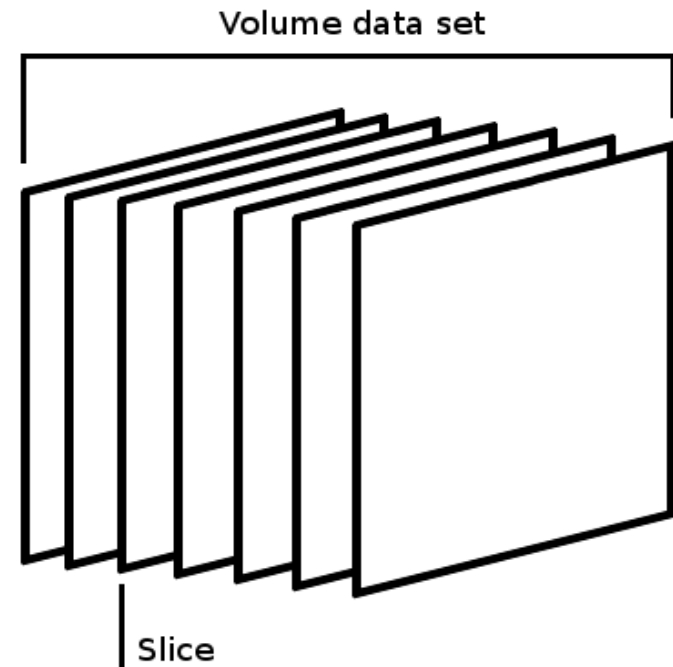
Introduction to OpenCL

- New technology
- framework
- cross-platforms CPU, GPU
- based on C99
- parallel computing



Processing of volumetric data by Slice streaming

- described in paper „Processing of Volumetric Data by Slice- and Process-Based Streaming“
- enhance using of main memory
- basic memory element - slice
- suited for point, local operations
- supports parallel computation



Testing implementation of separable 3D convolution in openCL and f3d

- gaussian blur
- testing on CPU, GPU
- comparission with CPU, CPU+SSE, GPU+OpenGL, GPU+CUDA

Implementation of iterative filters in slice streaming of f3d

- smoothing by anisotropic diffusion
- „Scale-space and edge detection using anisotropic diffusion“
- „Nonlinear filtering of magnetic resonance tomograms by geometry-driven diffusion“

Smoothing by diffusion equation

- smooth the noise
- blurs the edges
- heat conduction (diffusion equation)

$$I_t = c \cdot \Delta I = c \cdot (I_{xx} + I_{yy})$$

with the initial condition $I(x, y, 0) = I_0(x, y)$

Smoothing by anisotropic diffusion

- smooth the noise and sharp the edges
- intra-region smoothing vs. inter-region smoothing
- constant c is replaced with suitable $c(x, y, t)$

$$I_t = \operatorname{div}(c(x, y, t)\nabla I) = c(x, y, t)\Delta I + \nabla c \cdot \nabla I$$

- where $c(x, y, t) = g(\|E\|)$
- $E(x, y, t)$ estimates the location of the boundaries
- $g(\cdot)$ monotonically decreasing function

Effects of anisotropic diffusion



Discrete implementation of the AND

- Gerig's approach
- Li and Chen's approach
- Direct approach

References

- Perona P., Malik J. (1990) Scale-space and edge detection using anisotropic diffusion. IEEE Trans Pattern Anal Mach Intell 12:629-639
- Bajla I., Holländer I. (1997) Nonlinear filtering of magnetic resonance tomograms by geometry-driven diffusion. Machine Vision and Applications (1998) 10:243-255

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Thanks for your attention.