Alejandro Rodríguez Aguilera

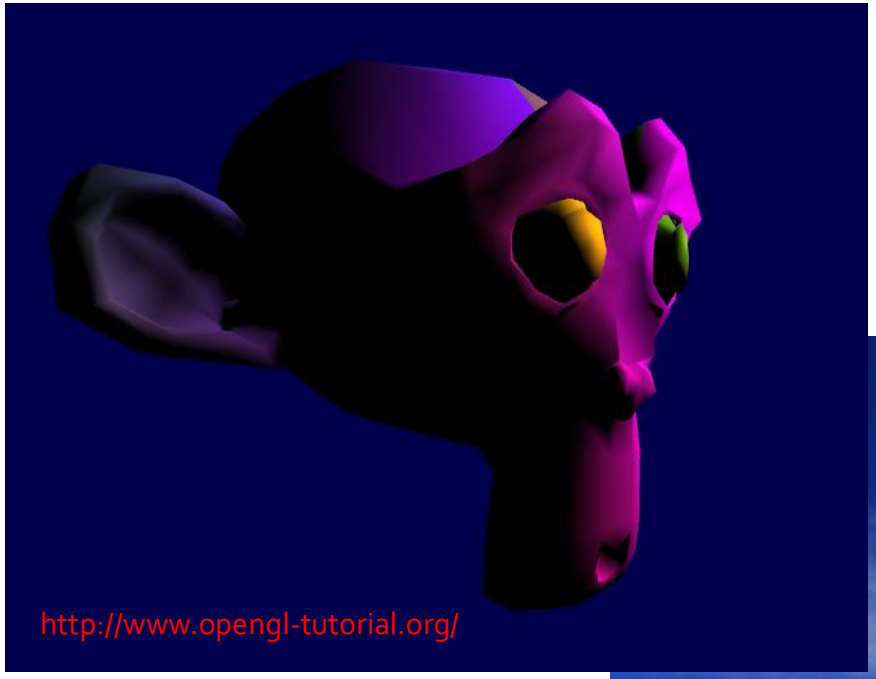
Visualización y Simulación Médica con GPGPU

Visualización y Simulación Médica con GPGPU

- Grupo de Investigación en Informática Gráfica (GIIG)
  - Lenguajes y Sistemas Informáticos

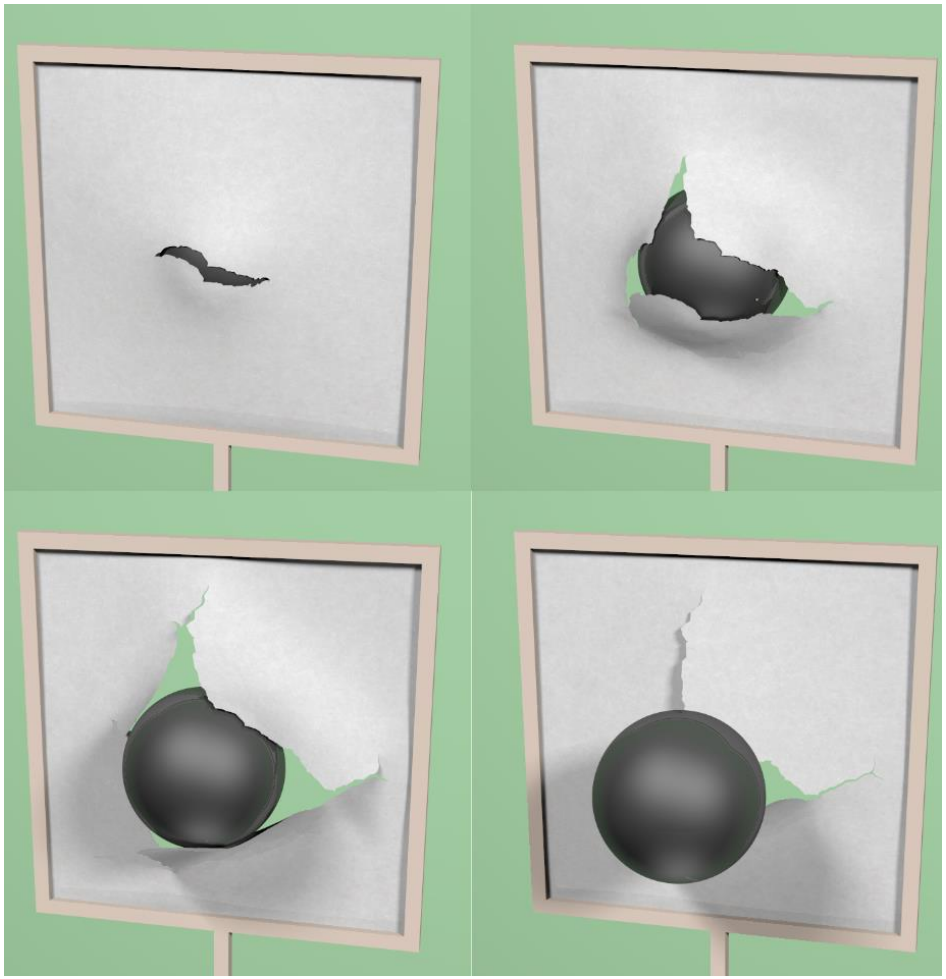
- alejandrora@ugr.es

Informática Gráfica



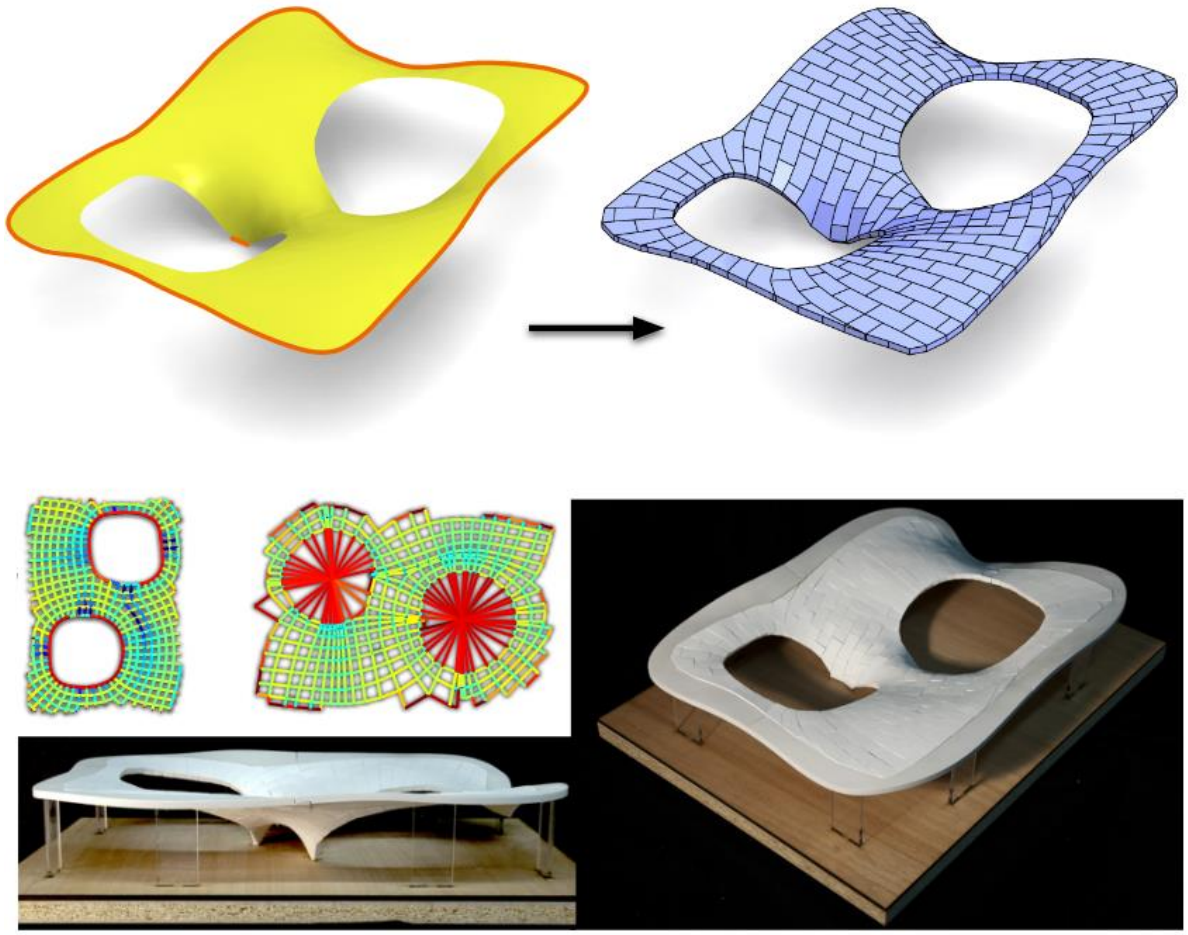
Informática Gráfica Ahora

Informática Gráfica Ahora



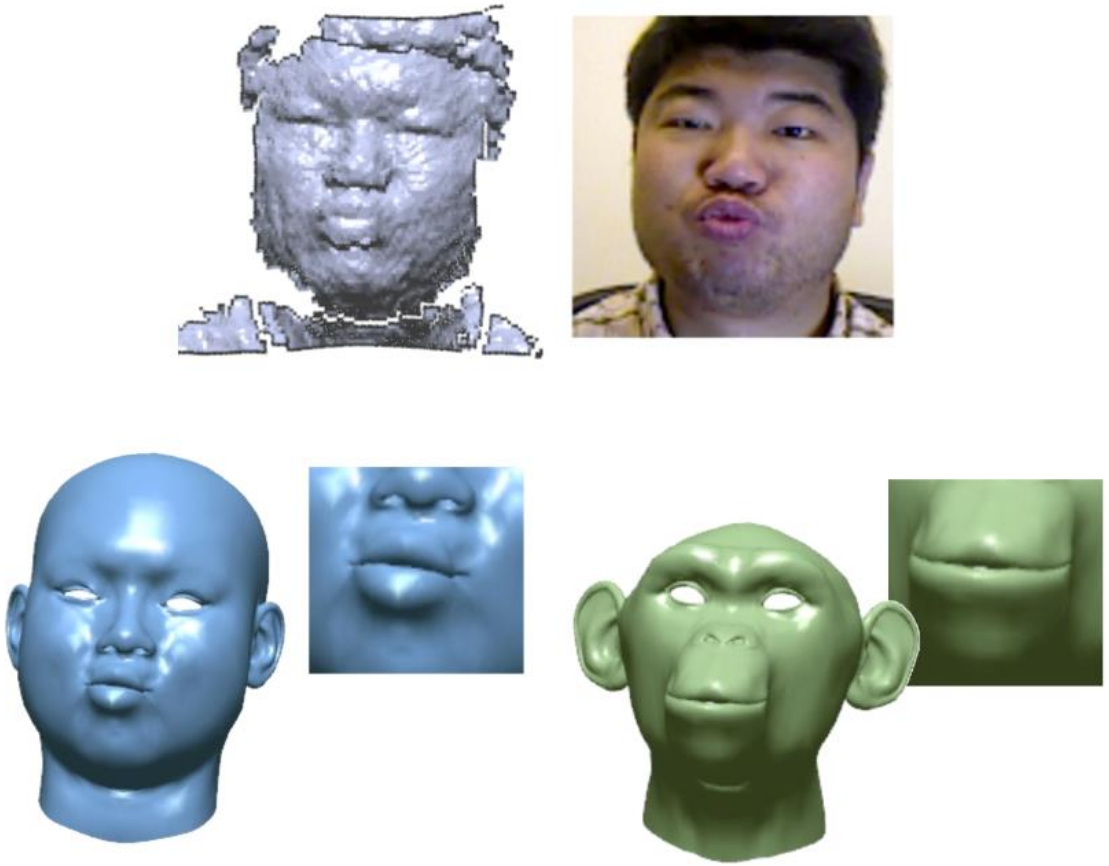
SIGGRAPH 2013

Informática Gráfica Ahora



SIGGRAPH 2013

Informática Gráfica Ahora

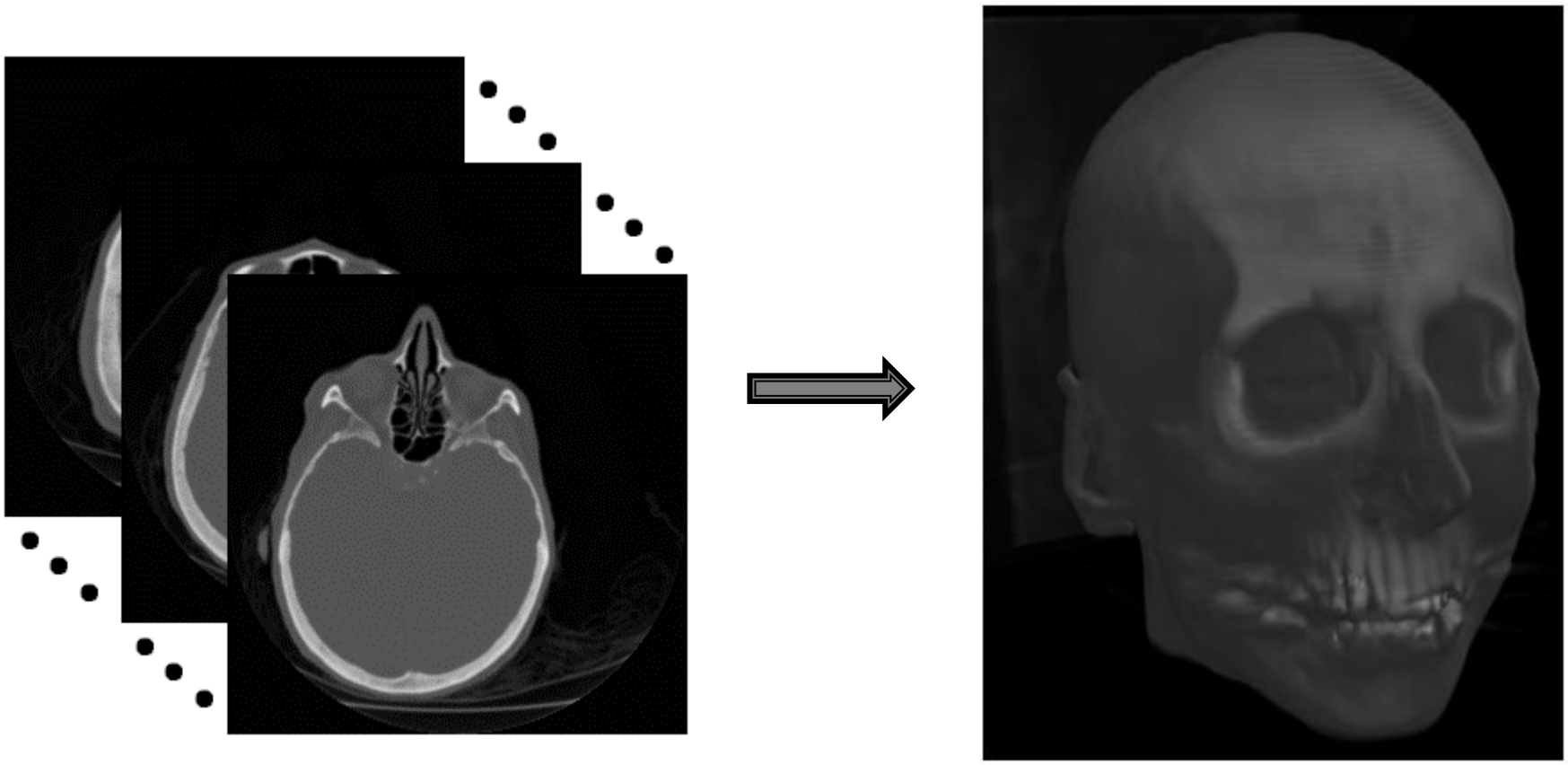


SIGGRAPH 2013

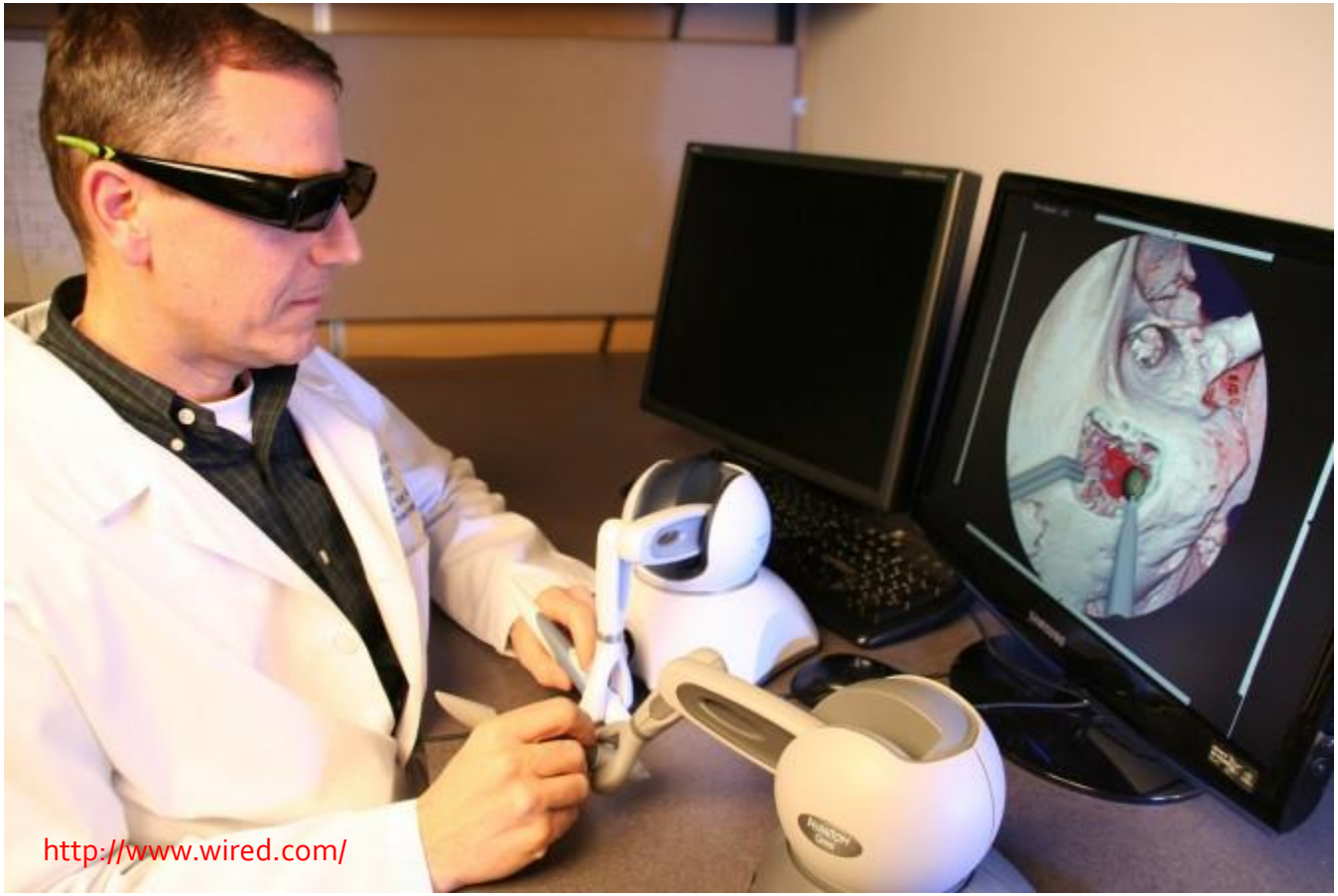
Informática Gráfica Ahora

SIGGRAPH 2013

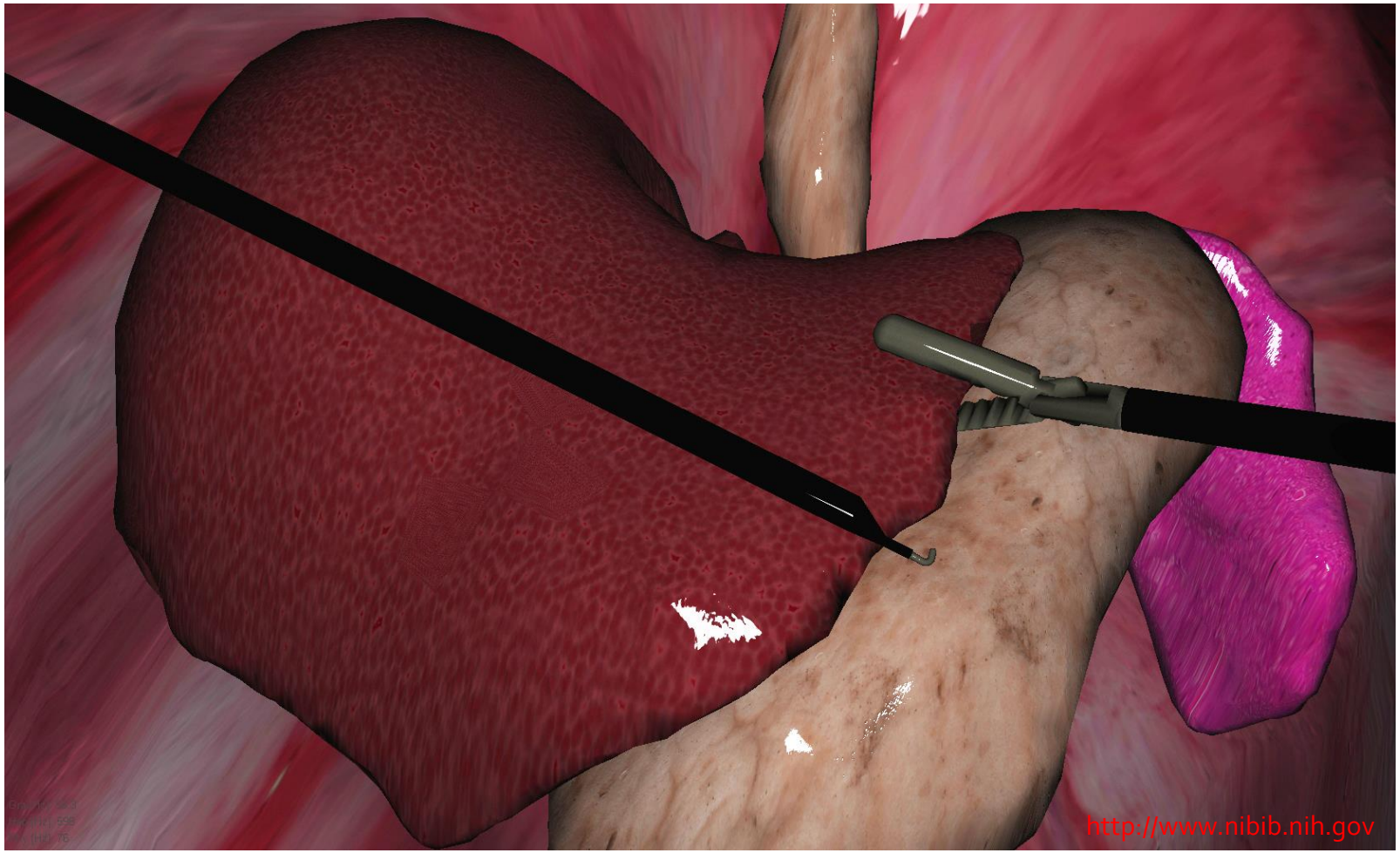
Visualización de volúmenes médicos



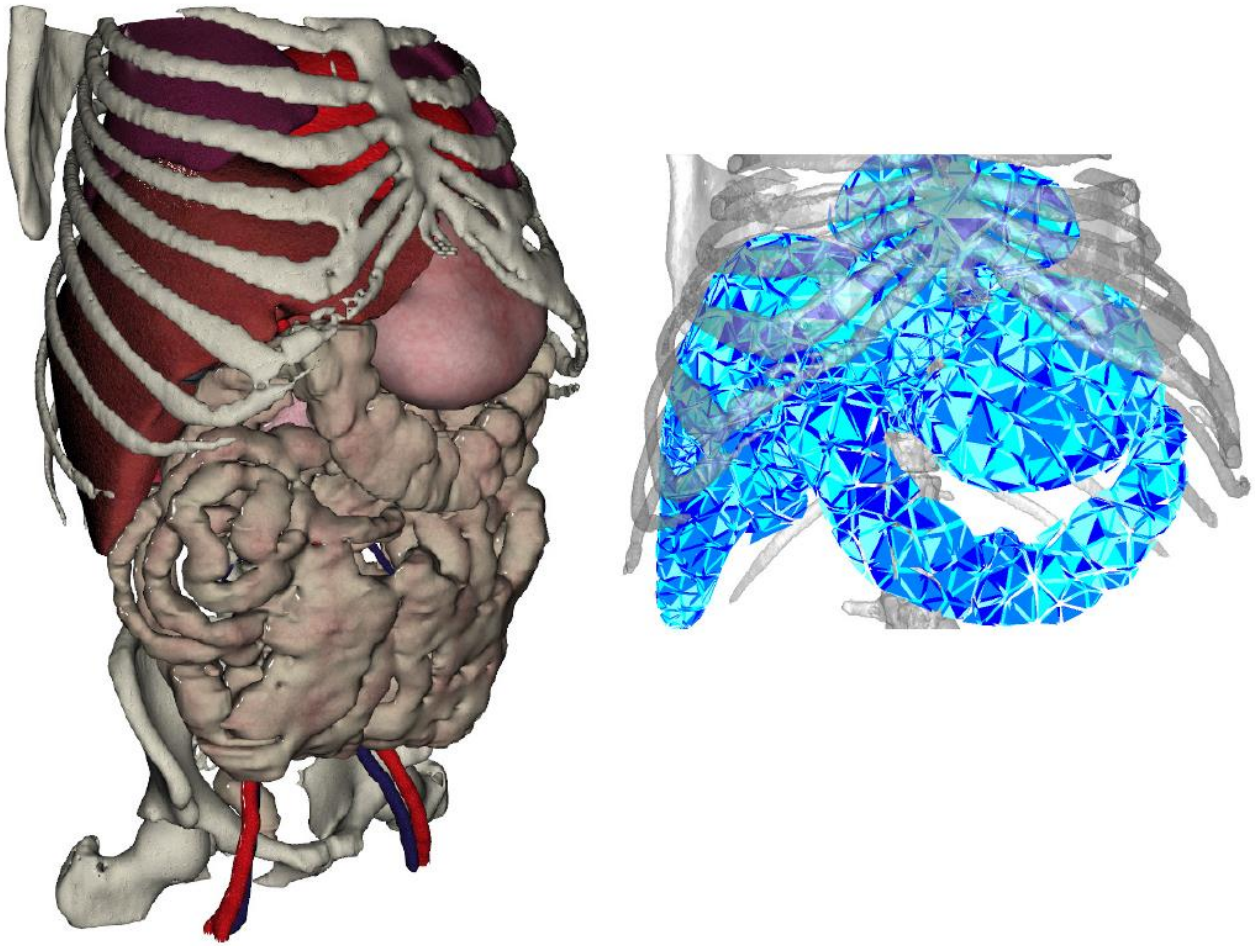
Cirugía virtual



Cirugía virtual

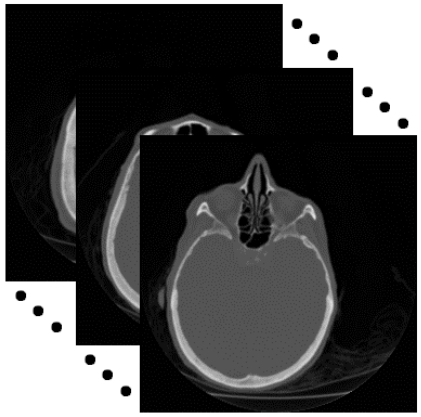


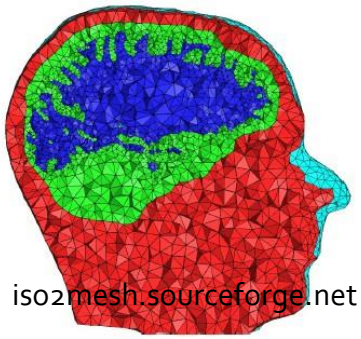
Simulación



GPU-based Real-Time Soft Tissue Deformation with Cutting and Haptic Feedback

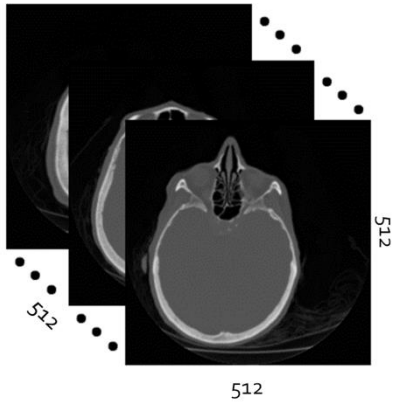
La Idea



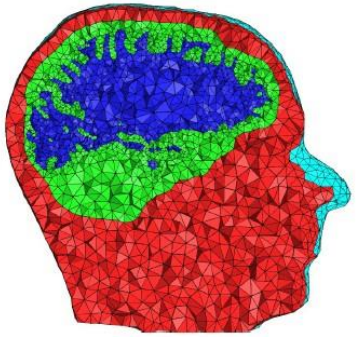


iso2mesh.sourceforge.net

La chicha



≈ 134M Elementos

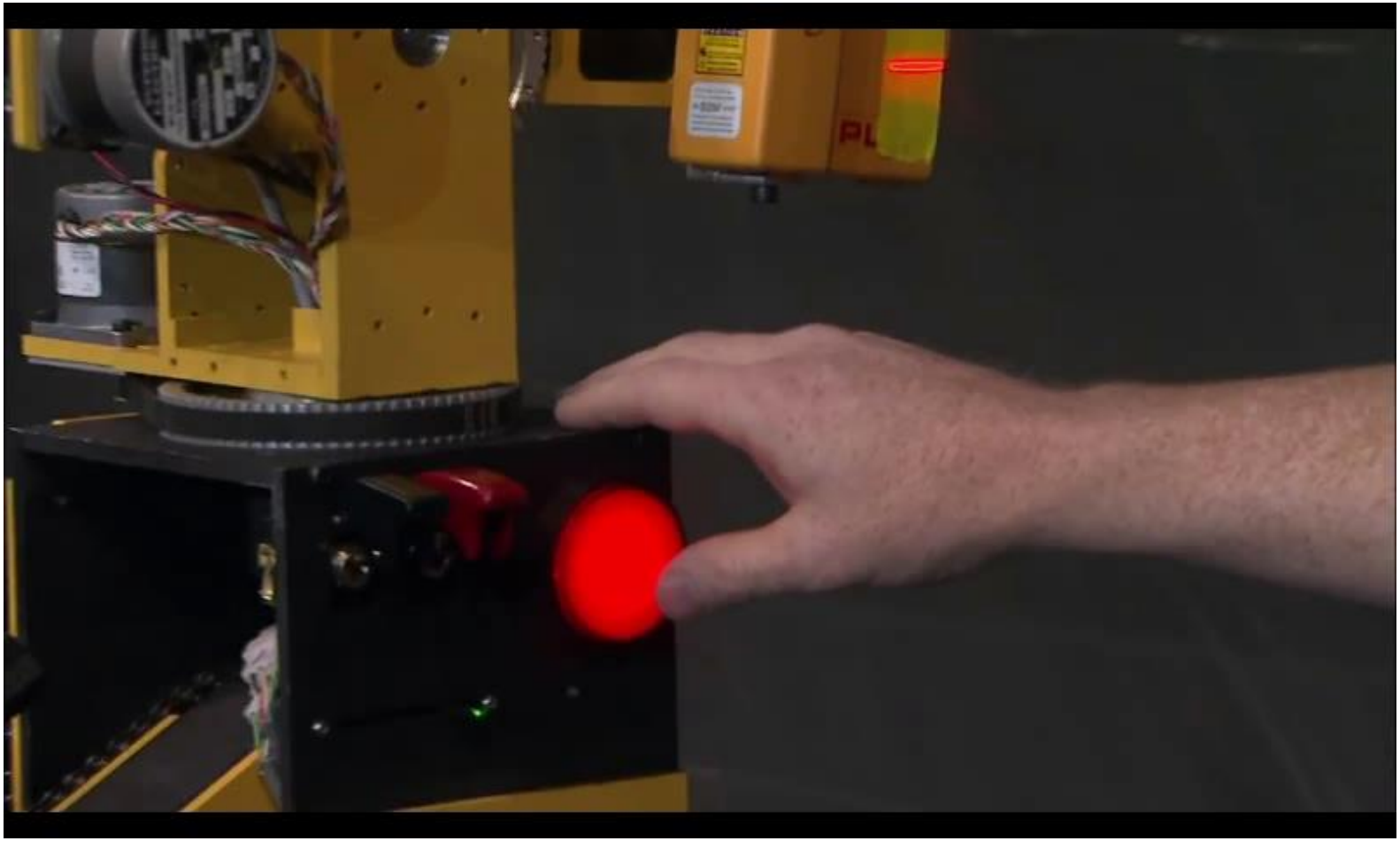


Interactividad

La solución: GPGPU

- General-Purpose Computing on Graphics Processing Units
- Lenguajes de propósito general
  - CUDA (Nvidia)
  - OpenCL (estándar abierto)

GPGPU



GPGPU

- Intel Core i5-3570 3.4 GHz
  - 4 cores
  - 188€
- Radeon R9 270X 2GB 1 GHz
  - 1280 cores
  - 179€

GPGPU

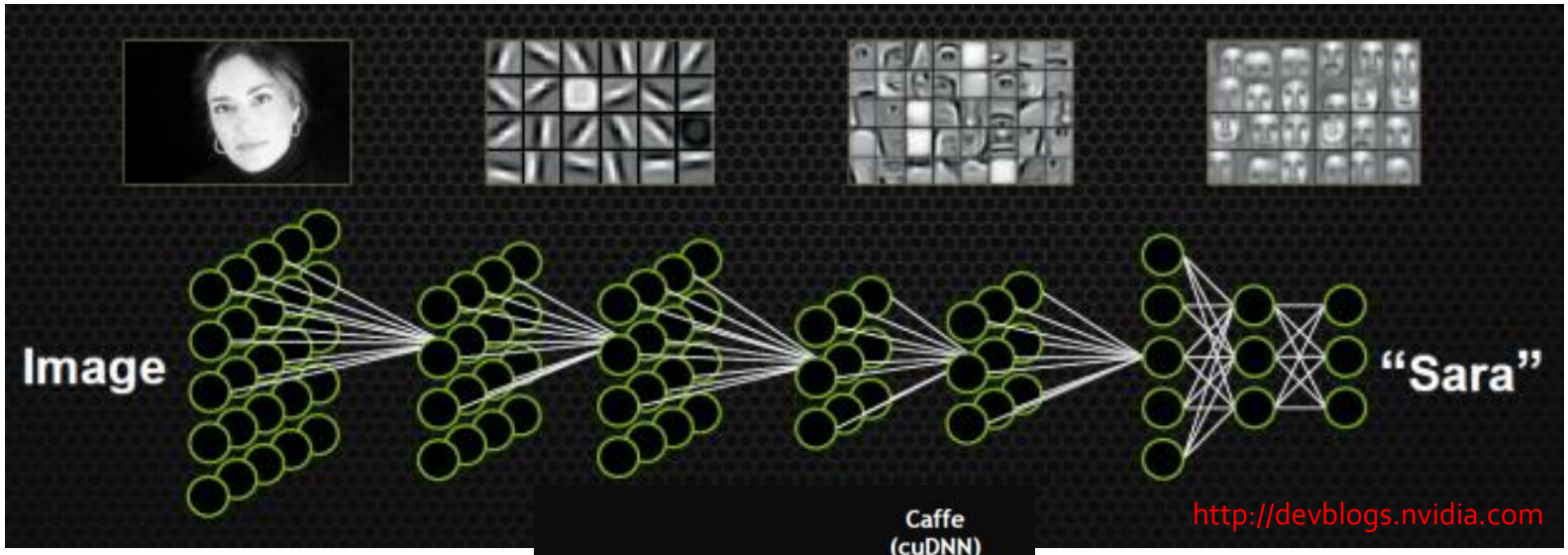
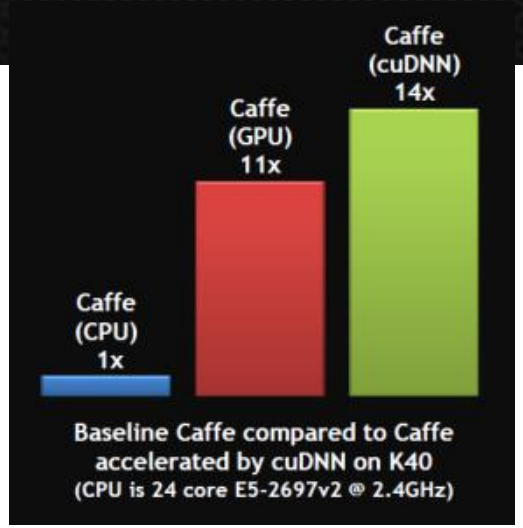
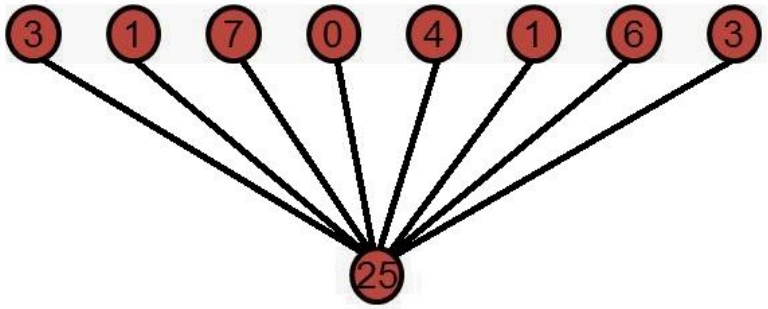


Image
"Sara"
http://devblogs.nvidia.com

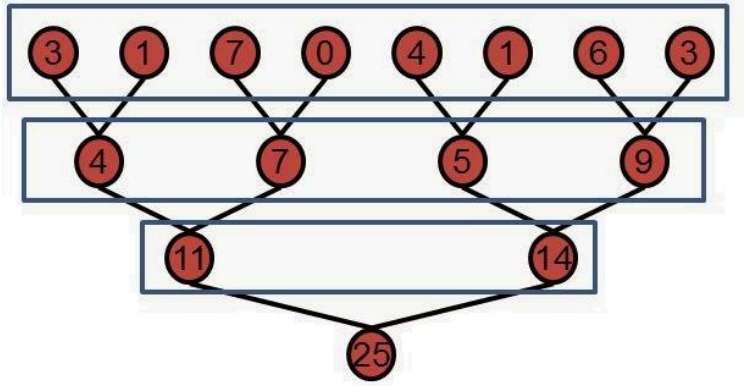

Caffe (CPU) 1x
Caffe (GPU) 11x
Caffe (cuDNN) 14x
Baseline Caffe compared to Caffe accelerated by cuDNN on K40
(CPU is 24 core E5-2697v2 @ 2.4GHz)

GPGPU

Reducción CPU

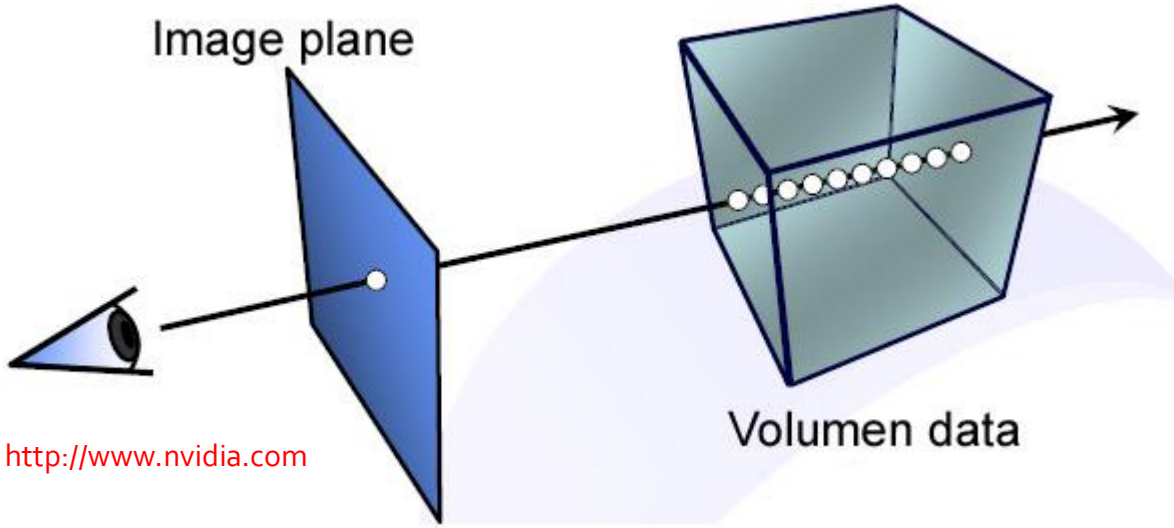


Reducción GPU

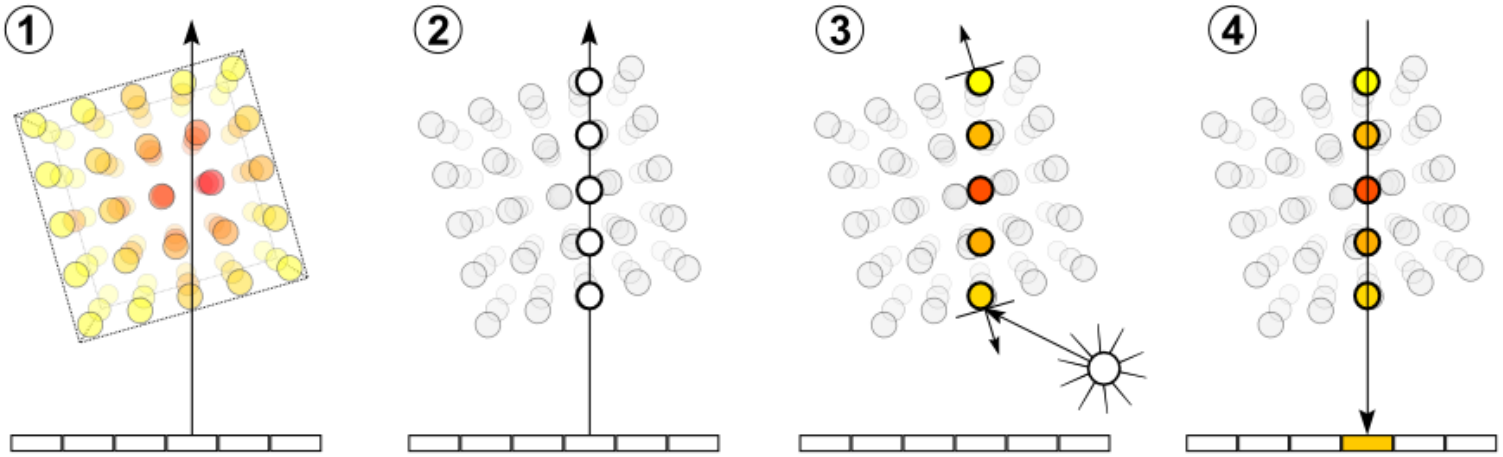


- 150M elementos
  - CPU -> 126 ms
  - GPU -> 4 ms (x31)

Nuestra Solución: Visualización Clásica en GPU (Ray casting)

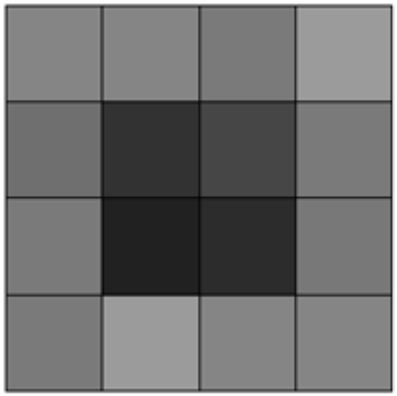


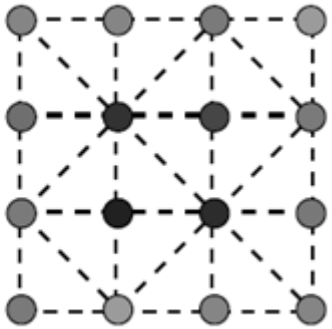
http://www.nvidia.com

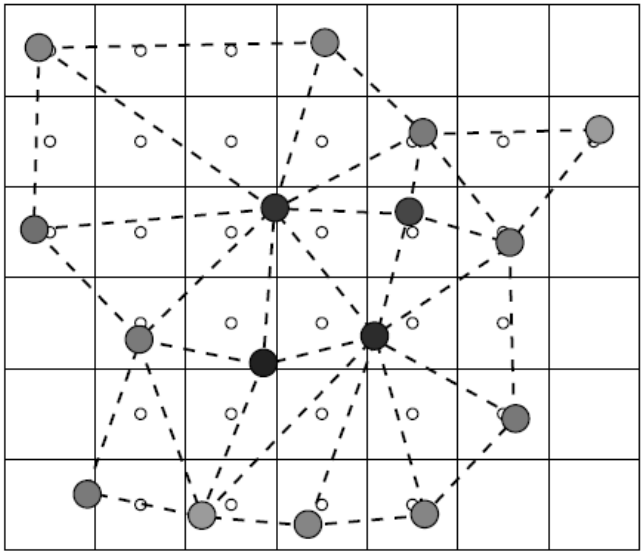


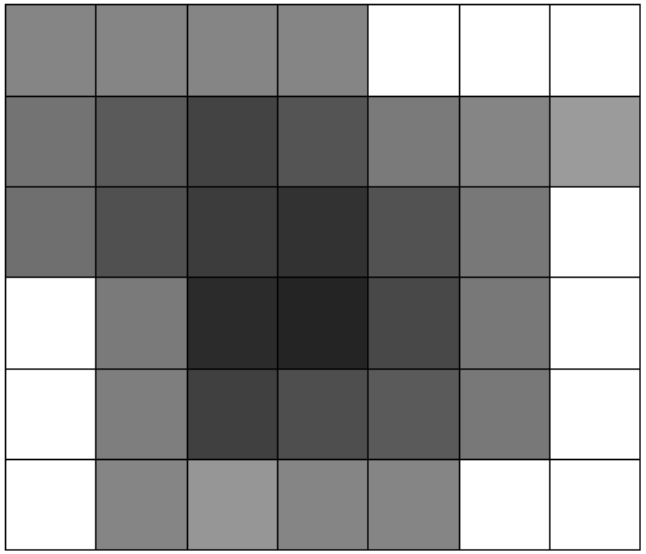
http://blog.micfort.org

Nuestra Solución: Generación "on-the-fly" del Cubo de datos



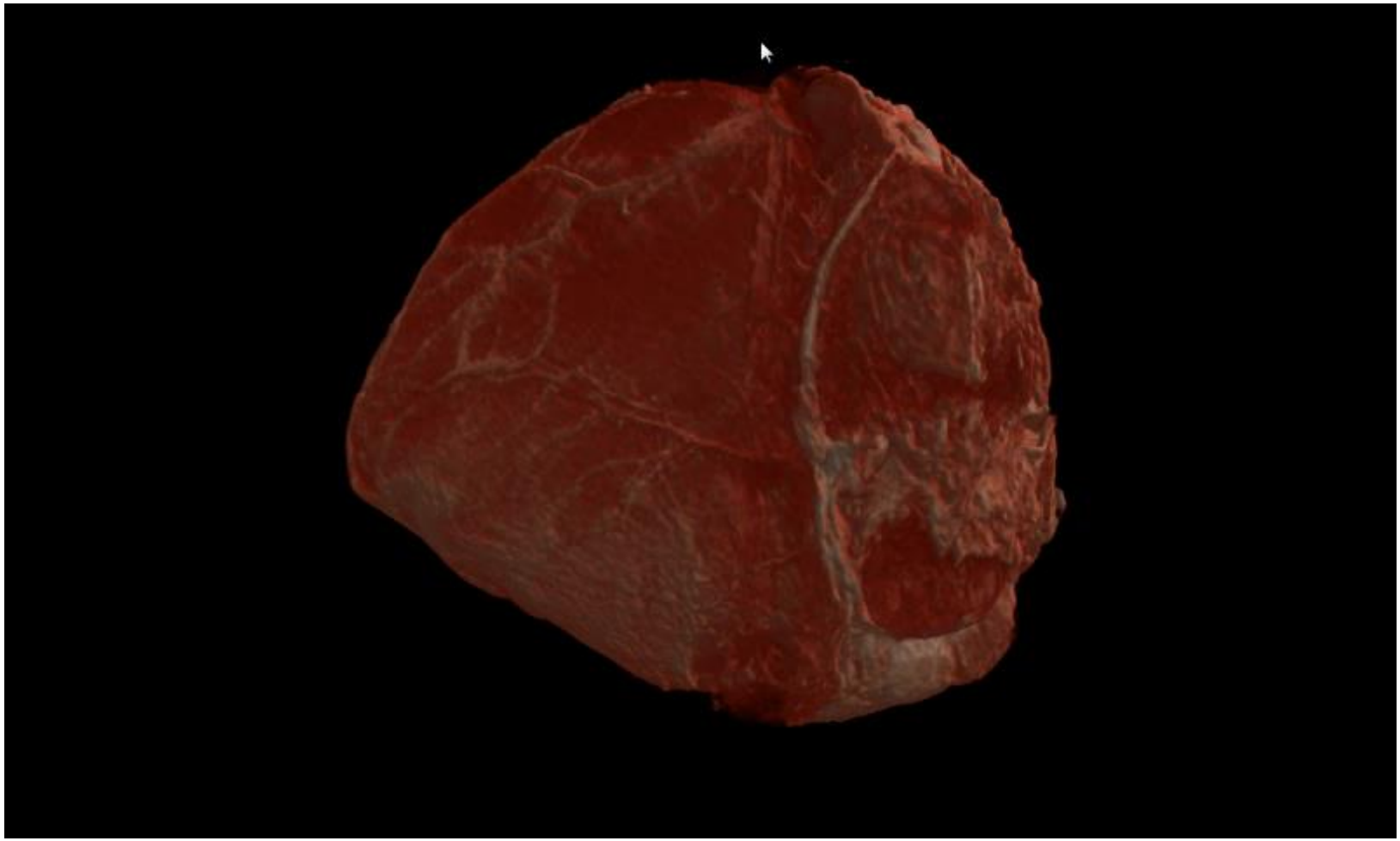






Resultados

Resultados



Más cosas

- Deformación realista
- Visualización compleja
- Interacción háptica
- Etc.

Resumiendo…

- Visualización de volúmenes
- Programación paralela (GPGPU con OpenCL)
- Simulación física
- Optimización de código
- Técnicas de interacción


¡Gracias!