GPUs for Medical Image Registration

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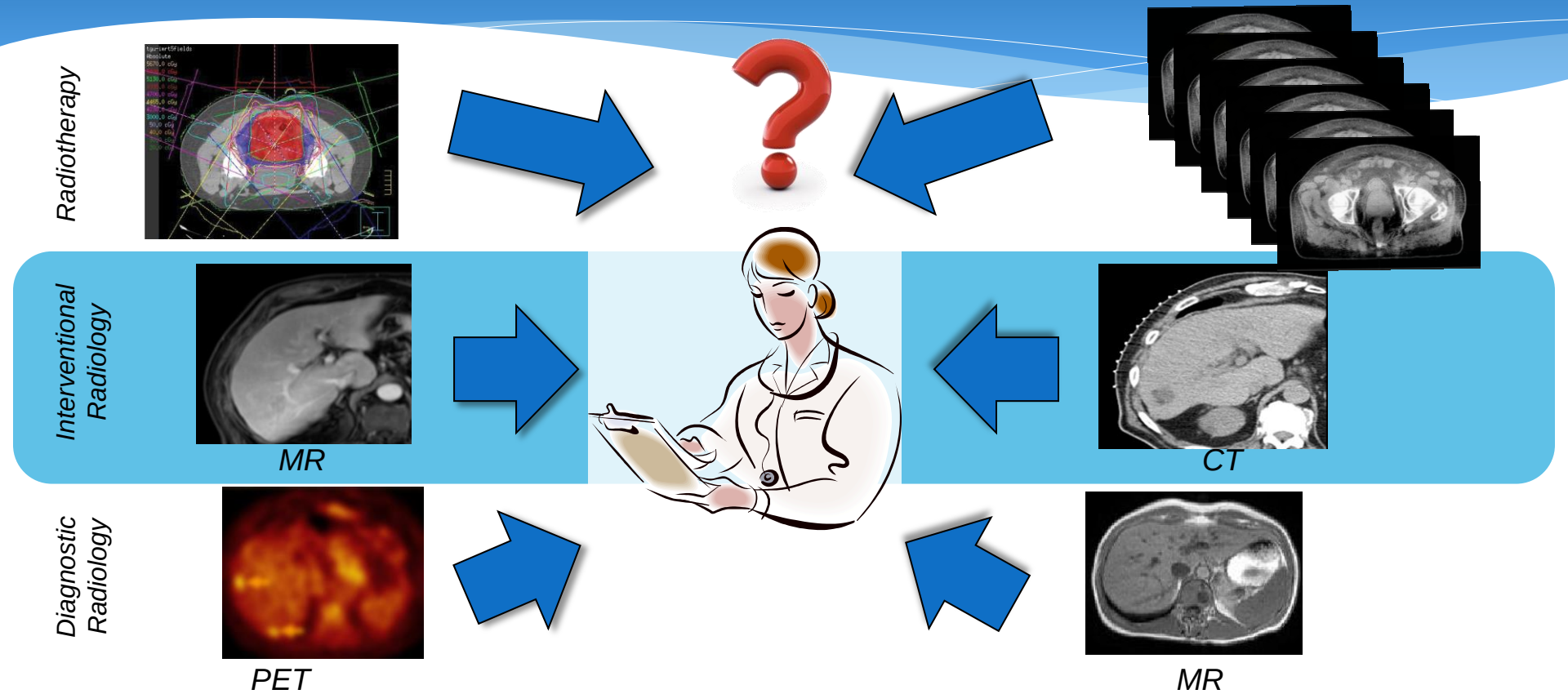
IGI Technologies

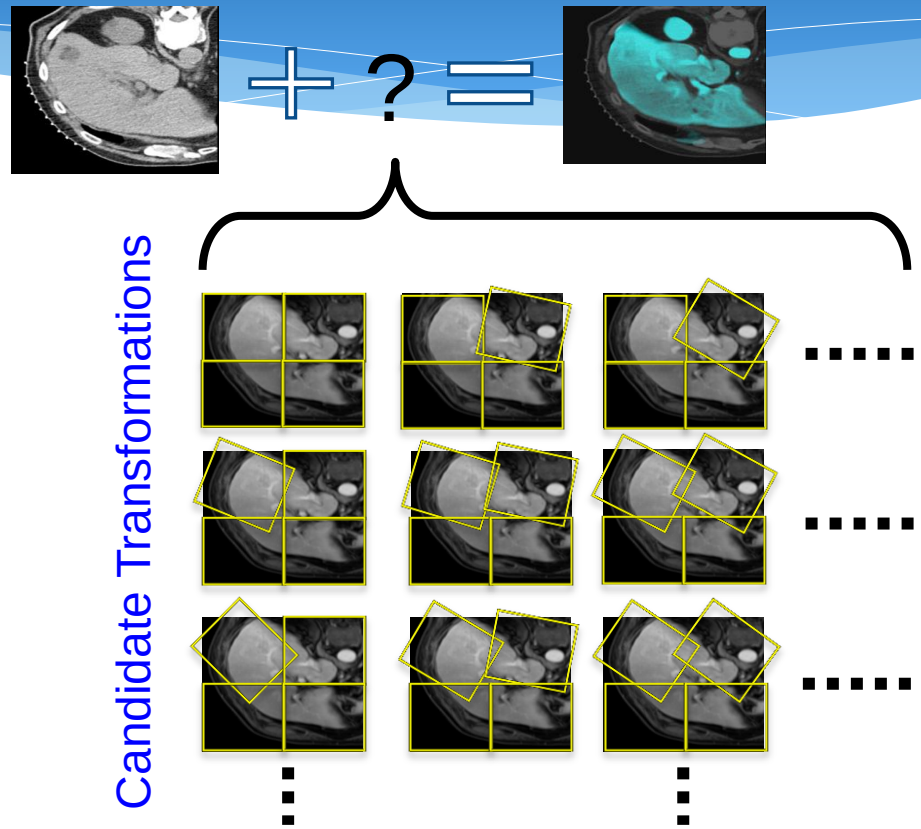
(1 of 12 Emerging Companies at 2014 GPU Tech Conference)

Misaligned images hinder precise, quantitative decision making

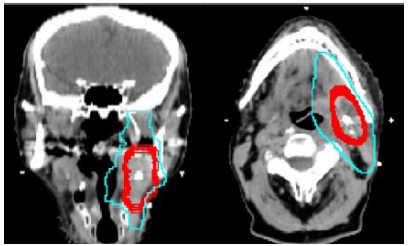


Nonrigid image registration is computationally difficult

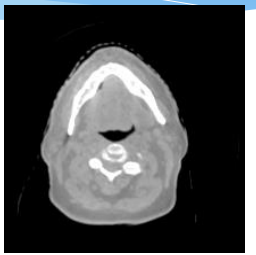
- Images are large and getting larger
- Arbitrary internal movement
  - *Over 10K Degrees of freedom*
- Multimodal registration requires special similarity metrics
  - *Mutual information* is complex to compute
- *To produce the proper result, hours are needed for registration*



Core Technology: Image Registration Acceleration Engine (IRAE)

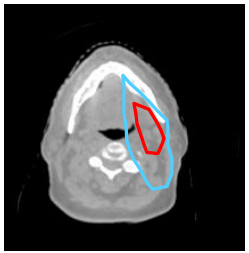


CT

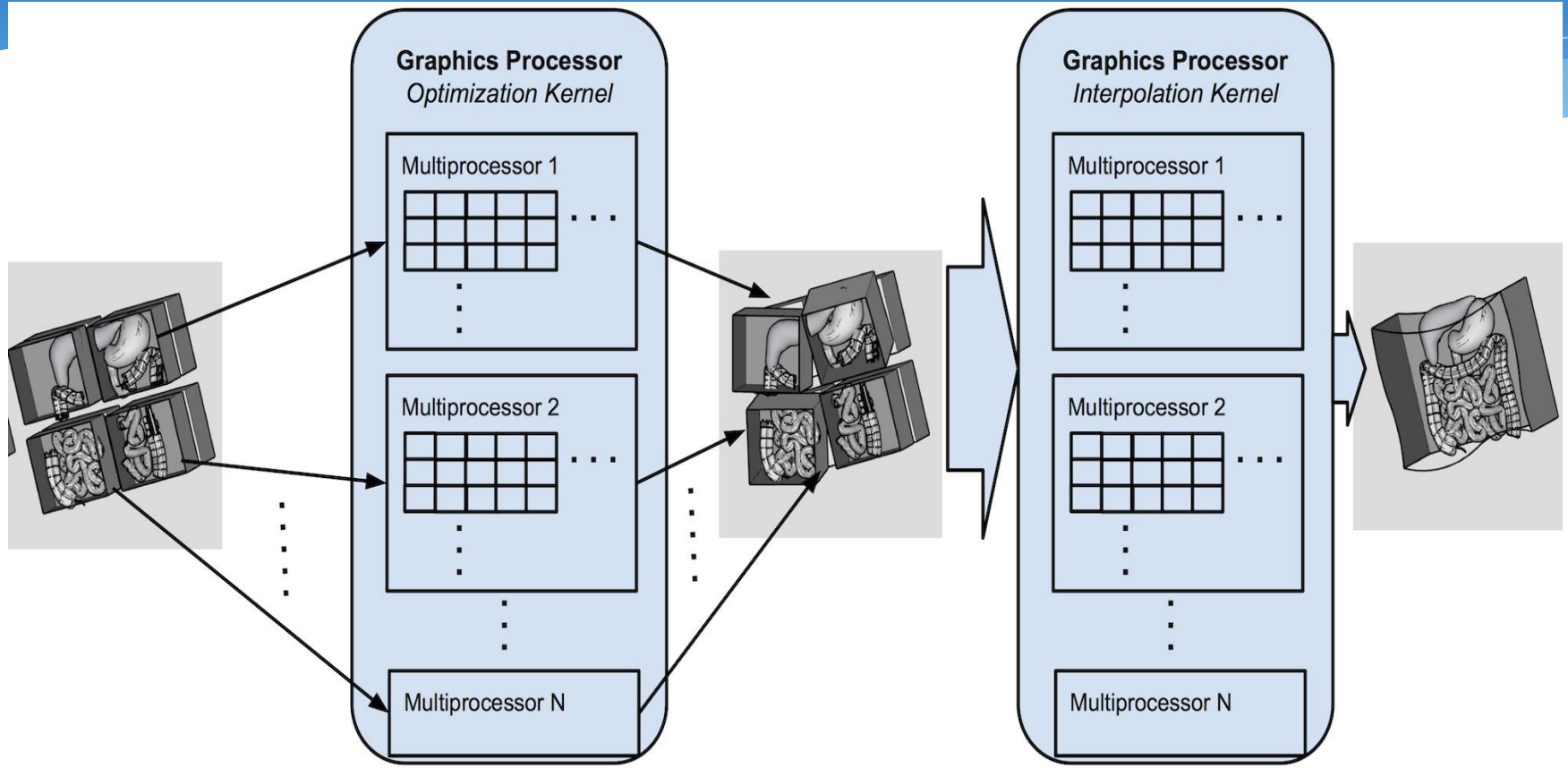


CBCT

Automatic
Fast
Accurate
Scalable



Algorithm & GPU Mapping

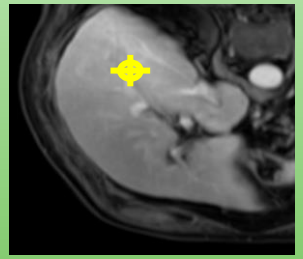


Interventional Radiology
(with Brigham & Women's)

Pre-treatment Workup

Planning MRI

Planning



Treatment Room

Treatment Room CT

Fully Automatic Registration

Needle Positioning

Benefit: *No manual steps required to bring target on to onboard image. Could save* ***over 5 minutes*** *of procedure time.*

High-speed Nonrigid Image Registration

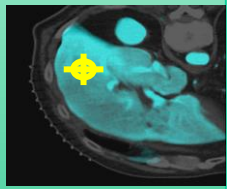
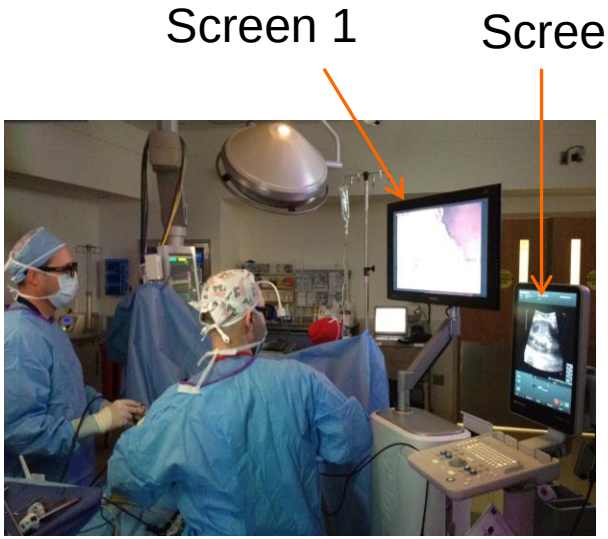
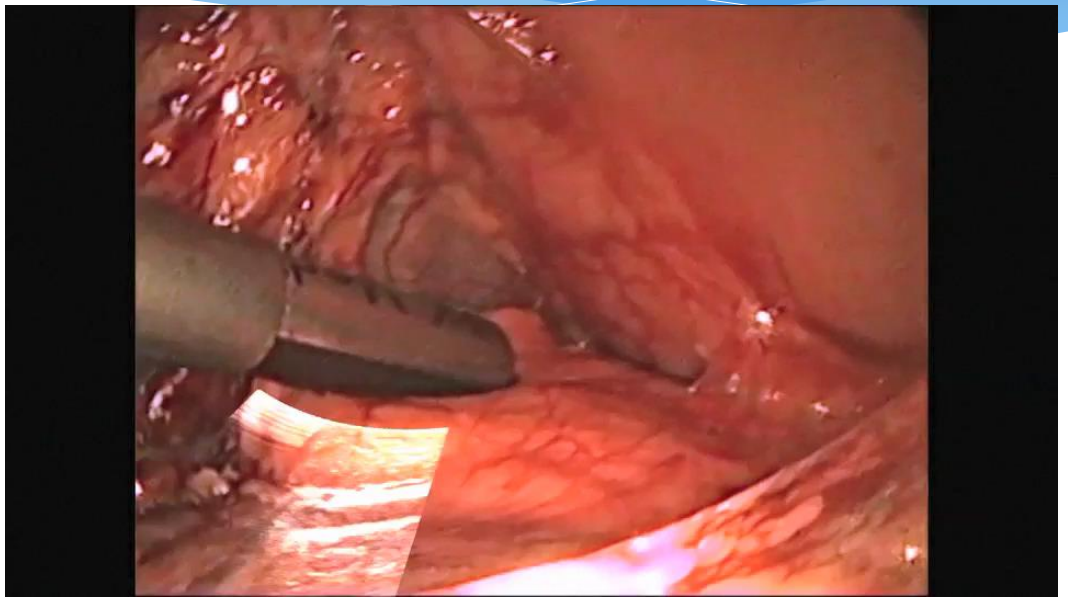


Image registration in the OR
(with Children's National)



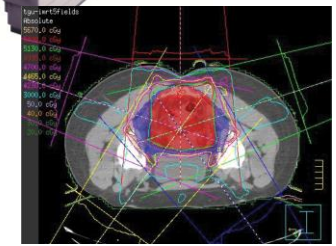


Augmented/Mixed Reality

GPUs make sense for medical image computing

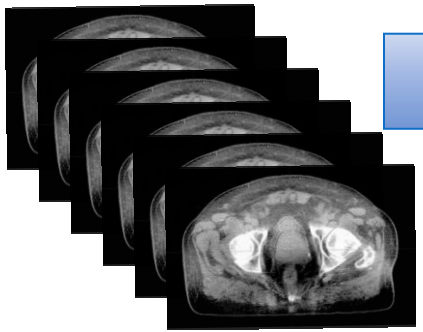
- Need for practical speed
- Natural parallelism (e.g., voxel-wise operations)
- Graphics-heavy, especially video-based minimally invasive surgery
- Other applications: image reconstruction, image segmentation, image denoising, radiation dose calculation, etc.

A typical radiotherapy patients has dozens of misaligned images taken



CT image acquired to plan treatment

Per visit CBCT to position the patient during every treatment



Treatment