



THE UNIVERSITY
of NORTH CAROLINA
at CHAPEL HILL



OpenPros: A Large-Scale Dataset for Limited View Prostate Ultrasound Computed Tomography

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Bottleneck in Prostate USCT

- **The Clinical Need:** Early detection of prostate cancer is critical, but standard transrectal ultrasound (TRUS) lacks sensitivity (30%-50%), and mpMRI is costly
- **The Promise:** Ultrasound computed tomography (USCT) offers a cost-effective, quantitative alternative
- **The Roadblock:** Anatomical constraints create a severely limited-angle acquisition environment, and there are currently no large-scale, anatomically precise datasets to train modern inversion models

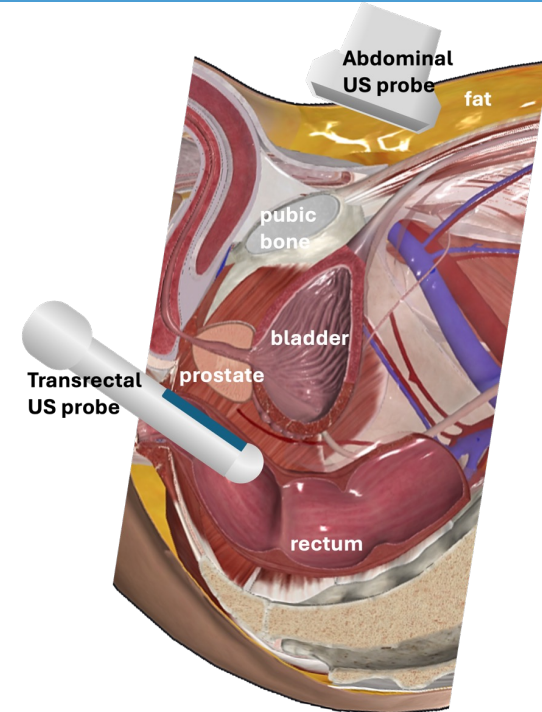


Figure 1. Anatomical structure and probe placement. Two probes-abdominal (on the body surface) and transrectal (in the rectum)-are used in our simulation. Image courtesy of Complete Anatomy.



Introducing OPENPROS

- OPENPROS is the first large-scale benchmark dataset explicitly designed for limited-angle prostate USCT
- Contains over **280,000 paired samples** of realistic 2D speed-of-sound (SOS) phantoms and full-waveform ultrasound data
- Highly realistic: Derived from 4 clinical MRI/CT scans and 62 expertly annotated ex vivo prostate specimens

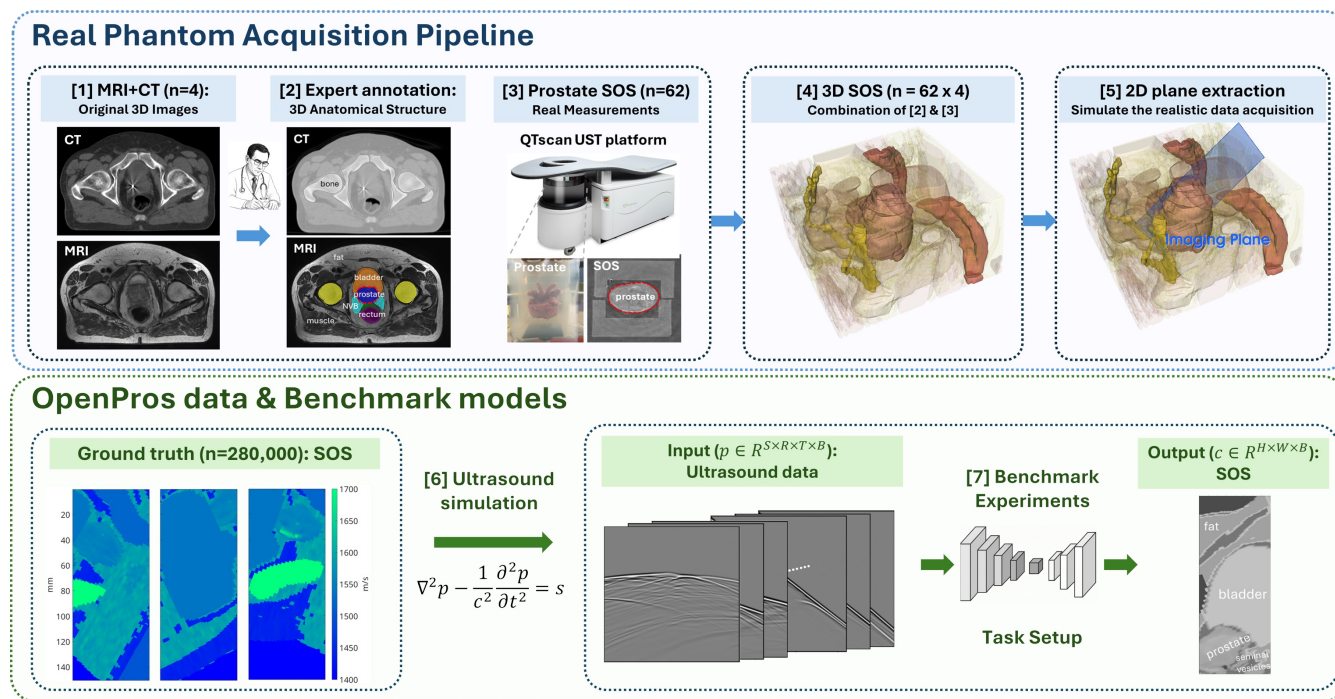


Figure 2. OPENPROS dataset creation and benchmarking pipeline.

Deep Learning vs. Physics-Based USCT

- **Massive Speedups:** Data-driven methods (InversionNet, ViT-Inversion) achieve near-instantaneous inference (milliseconds) vs. hours for physics-based methods
- **Superior Accuracy:** Learned models reduce Root Mean Squared Error (RMSE) by 5-6x compared to traditional baselines
- **Top Performer:** ViT-Inversion excels in global structural fidelity (SSIM ~ 0.99)

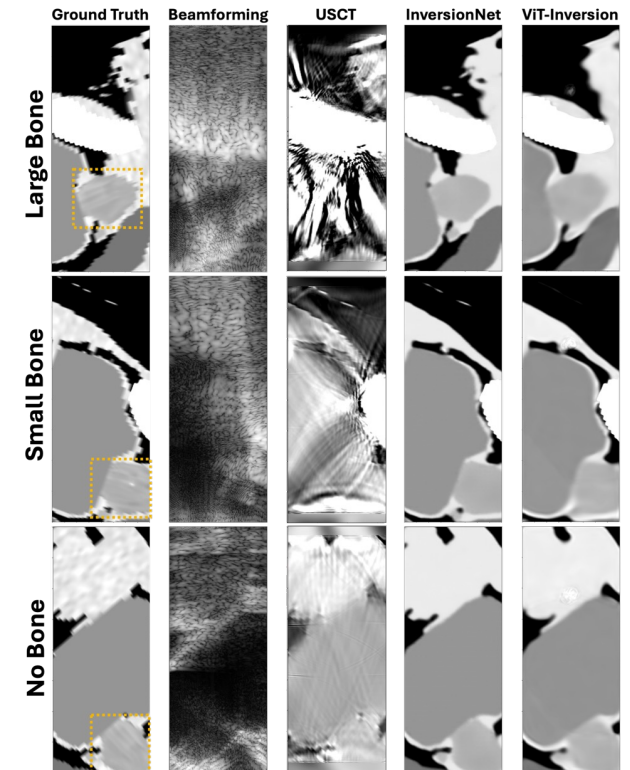


Figure 3. Benchmark results for limited-angle prostate USCT.



The Catch & The Open Challenge (Visit the Poster!)

- Despite massive improvements, current ML models smooth over fine internal structures and high-resolution boundaries
- Robust generalization across out-of-distribution (OOD) patient anatomies and measurement noise remains a barrier to clinical deployment
- **Visit our booth** to discuss physics-informed learning, foundation models, and the path to real-world deployment!

Website:

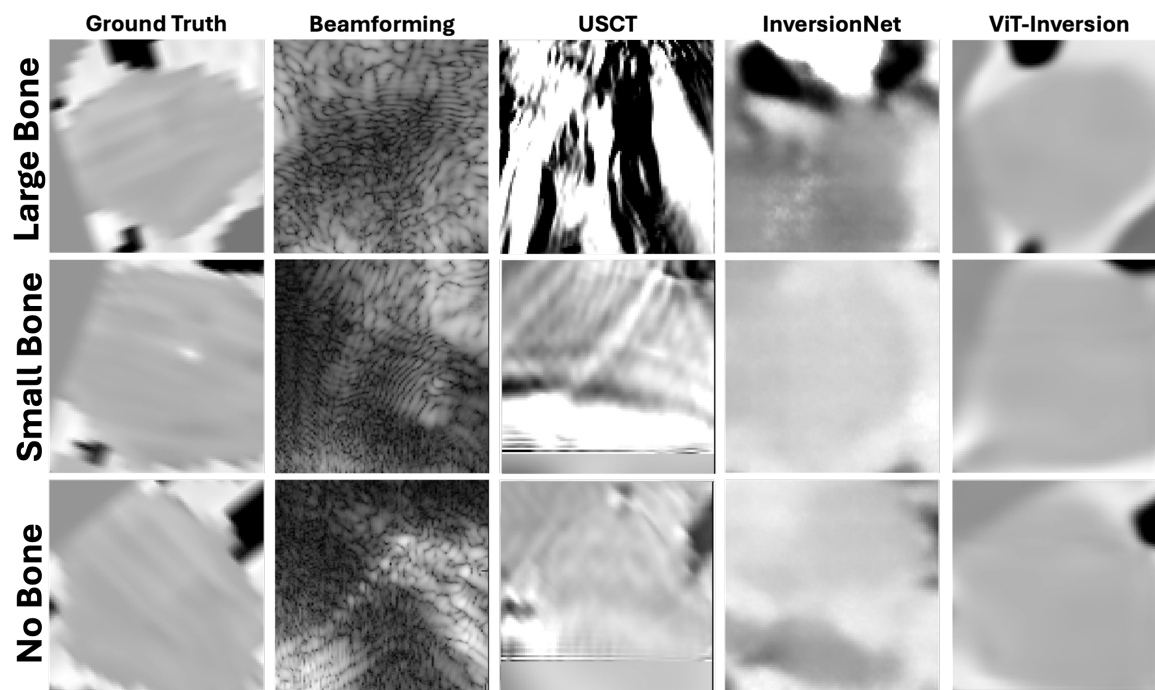


Figure 4. Zoom-in comparison of prostate regions.



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