Hey there,

Here is what's been going on in medical physics and related areas the last 24 hours. Here's what you folks might find interesting today.

TOP PICKS

Imaging Physics and Reconstruction

- Agentic Autoresearch for CT Reconstruction (Andreas Maier et al.)

This paper asks whether an LLM agent can autonomously implement, tune, and benchmark CT reconstruction methods -- and the answer is surprisingly yes. The agent independently worked through 26 methods on Mayo low-dose CT and a sparse-view breast task, using a shared differentiable fan-beam projector and a calibrated headroom metric against FBP. The most striking finding is that ideal-data leaderboards do not predict robustness: under realistic noise, the noiseless champion (a supervised denoiser) collapses while a learned primal-dual method rises to the top, an inversion that retraining on matched noise only partially corrects. This matters because it exposes a fundamental gap in how reconstruction benchmarks certify generality, and the agentic workflow itself could change how reconstruction research is conducted. **Andreas Maier** is among the authors.

- LoTA-N2N: Local Trace Adaptation for Zero-Shot Self-Supervised Image Denoising (Hu et al.)

The authors derive a parameter-independent constant and a trace interaction term that exactly characterizes the discrepancy between MSE-based self-supervised denoising objectives and supervised MSE. This formulation unifies paired-noise, blind-spot, weak-noise, re-corruption, and sub-image methods under one theoretical lens, and reveals that small global interaction can mask large positive and negative regional interactions through spatial cancellation. Their two-stage LoTA-N2N framework suppresses patch-wise interaction magnitude using frozen clean-sub-image proxies, and experiments on X-ray, confocal, and natural images show consistent gains under IID, spatially varying, and mixed noise. The mechanistic insight -- that local interaction control prevents spatial cancellation -- is a genuinely new design principle for self-supervised denoising without paired targets.

Radiotherapy and Hadron Therapy

- Circulating Lymphocytes Preservation in Lung Cancer SBRT with Ultra-Fast Proton Delivery Using Modularized Pin Ridge Filters (Bohannon et al.)

This study evaluates a patient-specific pin ridge filter (pRF) framework that enables ultra-fast proton delivery with a single beam energy, applied to lung SBRT. The key novelty is the combination of time-resolved blood dose accumulation with circulating lymphocyte (CL) survival modeling derived from in-vitro CD4/CD8 data, comparing conventional and FLASH dose rates against standard IMPT. The pRF plans reduced delivery time by up to 99.9% and irradiated blood volume per fraction by up to 81.3%, yielding statistically significant improvements in modeled CL survival. This is directly relevant to robust optimization under beam-delivery uncertainty and adaptive radiotherapy, as it quantifies immune-sparing tradeoffs that conventional planning tools do not capture.

Uncertainty Quantification

- Controllable Diversity in Normalization-Based Implicit Ensembles via Softmax-Temperature Modulation (Suteu and Serban)

The authors introduce sigma-N-Ens, an implicit ensemble that replicates only normalization layers and modulates a shared backbone through sigmoid-bounded scalers, treating each member

as a task in a multi-task architecture. The softmax-temperature regularizer traces the accuracy-calibration frontier, allowing controllable member diversity during training -- something no prior implicit ensemble could do. The paper frames the resulting epistemic uncertainty as "modulation uncertainty," explains why calibration holds under input corruption but weakens for OOD detection, and shows it matches deep ensembles at a fraction of parameter cost across ResNets and transformers. The theoretical treatment of why normalization-based sharing preserves calibration under distribution shift is the conceptual contribution here, not just the efficiency gains.

Until the next announcement!

P.S. In the most recent submission window: physics.med-ph: 6 papers cs.CV: 100 papers